Quantum Materials at the Nanoscale – Final Report

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QMN Cluster Research Goals

The central aim of the *Quantum Materials at the Nanoscale* (QMN) cluster was to understand and control collective behavior involving the interplay of spins, orbitals, and charges, which governs many scientifically interesting and technologically important phenomena in numerous complex materials. Because these phenomena involve various competing interactions, and influence properties on many different length and energy scales in complex materials, tackling this important area of study motivated a collaborative effort that combined the diverse capabilities of QMN cluster experimentalists, the essential theoretical analysis provided by QMN cluster theorists, and the outstanding facilities and staff of the FS-MRL.

OUTCOMES OF QMN CLUSTER ACTIVITIES

During the funding period 2007-2014, the DOE cluster grant for the *Quantum Materials at the Nanoscale* (QMN) cluster supported, at various times, 15 different faculty members (14 in Physics and 1 in Materials Science and Engineering), 7 postdoctoral research associates, and 57 physics and materials science PhD students. 41 of these PhD students have since graduated and have gone on to a variety of advanced technical positions at universities, industries, and national labs: 25 obtained postdoctoral positions at universities (14), industrial labs (2 at IBM), DOE national facilities (3 at Argonne National Laboratory, 1 at Brookhaven National Lab, 1 at Lawrence Berkeley National Lab, and 1 at Sandia National Lab), and other federal facilities (2 at NIST); 13 took various industrial positions, including positions at Intel (5), Quantum Design (1), Lasque Industries (1), Amazon (1), Bloomberg (1), and J.P. Morgan (1). Thus, the QMN grant provided the essential support for training a large number of technically advanced personnel who have now entered key national facilities, industries, and institutions.

Additionally, during the period 2007-2015, the QMN cluster produced 159 publications (see pages 14-23), including 23 papers published in *Physical Review Letters*; 16 papers in *Nature, Nature Physics, Nature Materials, or Nature Communications*; 4 papers in *Science*, and 8 papers in *Applied Physics Letters*.

Below, we provide some key highlights of the collaborative projects in which the QMN cluster members have been involved since 2007.

CLUSTER RESEARCH HIGHLIGHTS

1. <u>Highlight</u>: Tunable superconductivity in island arrays and nanowires

Superconducting transitions in low-dimensional systems exhibit a competition between long-range correlations, localization, disorder, quantum fluctuations, and Coulomb interactions.[1] While understanding the influence of these parameters is crucial for a variety of systems, from high temperature superconductors to superconducting qubits, the competing influences have often proven difficult to control. Work by **Mason**, **Goldbart**, **Van Harlingen** and **Bezryadin** demonstrated novel methods of tuning the parameters relevant to superconductivity in one- and two-dimensional systems.

Mason and **Goldbart** studied systems of mesoscopic superconducting islands placed on normal metal films (Fig. 1). They demonstrated that these systems can behave as disordered two-dimensional superconductors,[2,3] where the superconducting transitions can be tuned via island size, spacing, and configuration. They performed the first systematic measurements of the dependence of the superconducting transitions on island spacing (Fig. 1), and showed that mesoscopic island arrays deviate from predictions of standard proximity theory.[3,4] **Mason** and **Goldbart** also showed that the island systems seem to approach a quantum metallic state, a state previously thought to be precluded in 2D because of localization. The results were published in *Nature Physics*.[3]

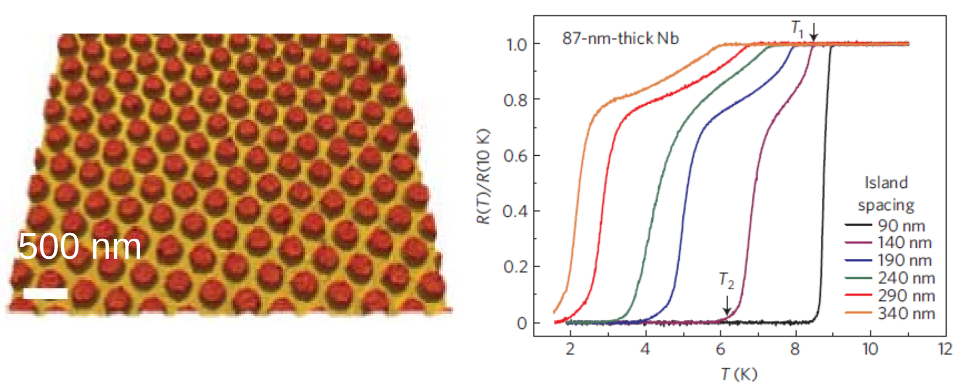


Figure 1. Left: AFM micrograph of arrays of 87-nm thick Nb islands (red) on 10-nm thick Au underlayer (yellow). Right: superconducting transitions in the island arrays, showing that the transitions of the islands (T_1) and the film (T_2) depend strongly on island spacing.[3]

Measurements of vortex dynamics in the island arrays were also performed in collaboration with **Van Harlingen** and **Budakian**. **Van Harlingen** previously measured vortex dynamics in superconductor-normal metal-superconductor arrays via magnetoresistance and scanning SQUID measurements.[5]

Similar measurements were performed as part of this grant to determine vortex behavior in the island systems, to look for novel behavior resulting from the smaller correlation length scales and the possibility of unusual lattice configurations (controlled via electron beam lithography).

Bezryadin similarly explored new methods of tuning superconductivity, but in one-dimensional nanowire systems. The tuning was achieved *in situ*, by applying high-voltage pulses to cause short-term Joule heating in the nanowire. Using this method,[6] it was possible to gradually and controllably transform an amorphous nanowire into a single-crystal nanowire. This procedure allowed the critical current and the critical temperature of the wire to be controlled while in the cryostat (Fig. 2).

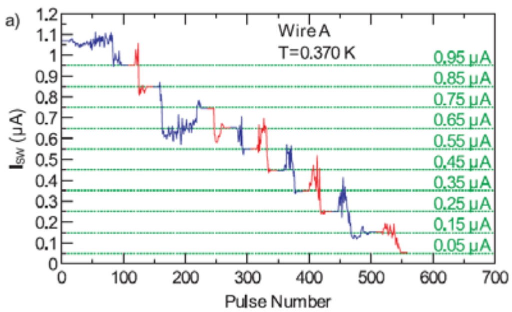


Figure 2. Precise *in situ* tuning of the critical current of a superconducting nanowire via the application of voltage pulses.[6] The horizontal lines mark desired values of the switching current.

By measuring the switching current dispersion, strong evidence of quantum phase slippage (QPS) was obtained. This follows from the fact that the dispersion remains constant at low temperatures while the switching current increases with cooling. Such behavior is in good agreement with the theory developed in collaboration with **Vakaryuk** (Argonne National Lab).[7] Changes in wire morphology, from amorphous to crystalline, do not cause qualitative changes of the QPS behavior, which eliminates the possibility that weak links or granularity are responsible for the observed QPS.[7]

2. Highlight: Interplay of superconductivity, magnetism, and spin-orbit coupling in topological insulator heterostructures

Coupling the boundaries of 2D or 3D topological insulators to ferromagnets or s-wave superconductors yields a variety of novel phenomena including fractional charge [8] and Majorana fermion bound states.[9] **Hughes** and **Vishveshwara** theoretically studied the effects of strong electron correlations in the 2D materials [10] and have proposed viable experiments in heterostructure devices in which fractional charge, the quantum Hall effect, or Majorana fermions can be realized.[11,12] **Hughes** and **Vishveshwara** predicted that a magnetic spin-density wave state can be induced on the edge of the quantum spin Hall effect in the presence of repulsive electron-electron interactions.[10] Interestingly, the spin-density wavevector can be tuned using a conventional gate, and a new type of measurable oscillation in the local magnetization *direction* would be induced near magnetic impurities or magnetic tips on the edge. For the case of attractive interactions, the edge would provide a novel means of hosting a Fulde-Ferrell-Larkin-Ovchinnikov phase characterized by an oscillatory SC order parameter whose characteristic wavevector can be tuned by an applied magnetic field.

Hughes and **Vishveshwara** also showed that a layered sandwich structure with a ferromagnet between two 3D topological insulators will produce an integer quantum Hall effect due to the appearance of chiral fermion modes on the lateral sides of the magnetic layer analogous to the chiral edge states found in 2DEG quantum Hall devices.[11] They showed that a quantum spin Hall device fabricated in an H-bar geometry with a deposited magnetic island (see Fig 3) will confine fractional charge at places where the H wraps around the magnet. For example, in Fig. 3 there would be e/4 fractional charges confined at the corners of the magnet indicated by the dark circles. These proposals have the tremendous advantage in that they only require a *single* magnetic layer/island unlike previous work which requires pairs of magnets that must both be manipulated in concert.[8,12] Additionally, **Hughes** showed that if new classes of bulk doped 3D topological insulators with electronic structures similar to bulk HgTe, or the class of ternary Heusler compounds (*e.g.*, ScPtBi) become superconducting, they can host vortex core Majorana modes over a very wide doping range.[13] This is desirable as a similar effect predicted for Cu-doped Bi_2Se_3 exists over only a very low, and narrow range of doping where the density of states is low.[14] This work offers insight into the design of new ternary Heusler compounds for which an optimal doping window and robust superconducting order can be achieved.

These theoretical studies were some of the initial results of a larger collaborative effort with **Eckstein**, **Greene, Mason**, and **Van Harlingen. Eckstein** worked on growing 2D quantum spin Hall devices, and 1D wires with strong-spin orbit coupling, while **Mason** and **Van Harlingen** developed fabrication and measurement techniques to consider the effects of magnetic and superconducting layers on topological insulators both for questions of fundamental physics and device applications. **Greene** made planar tunnel junctions for quasiparticle spectroscopy superconductor-topological insulator bilayers. Some of this work is described next in Highlight 3.

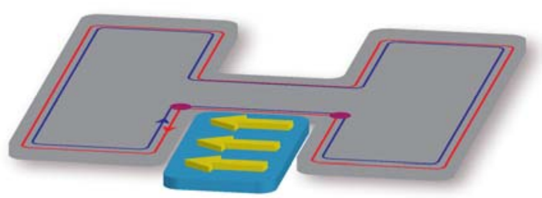


Figure 3: Two dimensional topological insulator/quantum spin Hall effect fabricated in a conventional H-bar geometry. Red and blue lines indicate counter-propagating helical edge states that feel the effects of the magnetic island (blue rectangle). The corners of the H-bar, marked by magenta circles, trap fractional charge e/4 on each corner.

3. <u>Highlight</u>: Superconducting proximity effect in large spin-orbit-coupled systems

Exotic quasiparticles, such as Majorana fermions, have been predicted to arise in topological superconducting materials.[9] These excitations have topological properties that make quantum states containing them more immune to decoherence, and this has led to interest in detecting them and measuring their properties.[15-19] A proposal for producing these quasiparticles is to start with a good topological material and a good superconductor and to combine them at an interface that strongly couples superconducting pair correlations into the topological conducting channels.

One proposed scheme calls for pairs to be introduced into a nanowire of a strong spin-orbit-coupled (SOC) material (e.g., InAs or InSb) that is coupled via a transparent contact to an s-wave superconductor (SC). Up to now, it has not been possible to measure just the contact resistance from a SC to a semiconductor like InAs using standard two terminal measurements. **Eckstein** invented a three terminal test structure that allows this to be done. By using a two chamber MBE system that allows UHV sample transfer, junctions with transmission probabilities greater than 70%, no chemical contamination, and crystalline interfaces were made. A typical plot of the temperature-dependent contact resistance is shown in Fig. 4. **Vishveshwara** modeled the junction using quasiclassical Green's functions to trace the superconducting correlations induced in InAs, and extracted from these transport and other measurements information on how the induced pair density varies away from the interface.

Junctions between Nb and topological materials like Bi_2Se_3 have also been predicted to produce Majorana modes.[8] **Greene** formed planar tunnel junctions to test this prediction. Cleaved single-crystal Bi_2Se_3 were coated *in situ* with a thin layer of Nb (~30 nm), then with a thin layer of Al

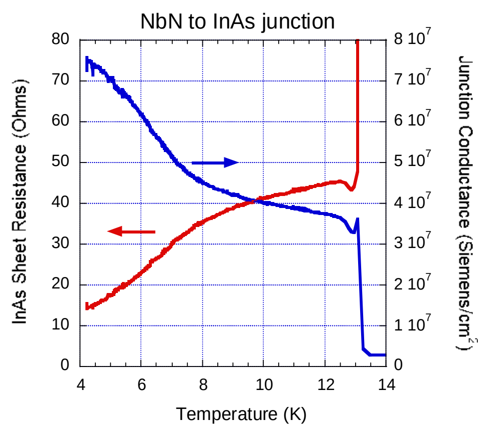


Figure 4. Typical plot showing how the contact resistance and the semiconductor sheet resistance changes below the critical temperature of the superconductor.

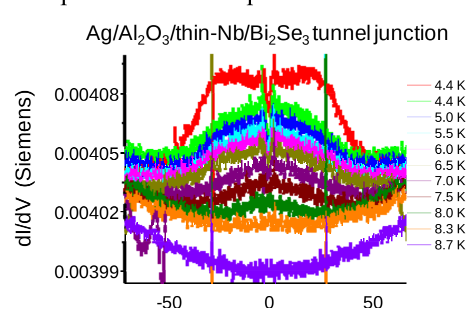


Figure 5. Temperature-dependence of tunneling conductance curves versus bias voltage for device described in text.

(~5 nm), which was allowed to oxidize to form the tunnel barrier. An Ag counter electrode was deposited *ex situ*. These tunneling data provided information about how the electronic structure of the Nb layer is modified by contact to the Bi_2Se_3 slab. Fig. 5 shows tunneling conductance curves versus bias voltage as a function of temperature. Above the critical temperature (T_c) of Nb, the conductance is parabolic. As the Nb becomes superconducting, an anomalous, broad (~ 90 mV) zero bias conductance peak arises, increasing in magnitude with decreasing temperature. Also, below the Nb critical temperature, a sharp dip (~1 mV) near zero bias in the tunnel conductance appears, which is likely due to the superconducting gap in the Nb layer. In junctions grown with sapphire—rather than Bi_2Se_3—substrates, only the Nb superconducting gap structure is observed in the junction conductance. The features that appear at large bias are not understood, but are directly attributable to the presence of the Bi_2O_3 slab below the thin Nb layer. Theoretical and experimental studies that attempt to identify the presence of Majorana fermions or topological superconductivity exist, but these results remain controversial.[15-19] **Vishveshwara** and **Hughes** continue to work on developing models to explain these tunneling data.

4. <u>Highlight</u>: Anomalous Noise in the Pseudogap Regime of $YBa_2Cu_3O_{7-\delta}$

Pseudogap physics in high-T_c superconductors may involve local breaking of various symmetries, including translation invariance, rotational symmetries and time-reversal [20-25]. Evidence for local electronic nematic [25] and static stripe order has been seen in studies of BSCCO [26,27], $La_{2-x}Ba_xCuO_4$ near x=1/8 [28], and $YBa_2Cu_3O_{7-\delta}$ (YBCO) [29-31]. Yet, key questions about the dynamics of local order in the pseudogap phase remain unsettled. Recently, **Van Harlingen** and **Fradkin** observed [20] an unusual noise component near and below about 250 K in the normal state of underdoped YBCO and Ca-YBCO films (Fig. 6 (a)). This noise regime, unlike the more typical noise above 250 K, has features expected of a symmetry-breaking collective electronic state, including large individual fluctuators, magnetic sensitivity, and aging effects. **Van Harlingen** and **Fradkin** present in [20] a possible interpretation of this behavior in terms of fluctuating charge nematic order [21,25]. Local charge nematic order on a square lattice has Ising symmetry, and couples to disorder as if it were a random symmetry breaking field [33], leading to characteristic noise and hysteretic behavior similar to what is observed in experiments [20,32]. The extra noise component in underdoped YBCO and Ca-doped YBCO films exhibits magnetic sensitivity, aging effects and large discrete fluctuators (Fig. 6 (b)), which are characteristic of noise from collective states in disordered systems [34]. Future mesoscopic thermodynamic measurements are planned to study the nature of the states associated with the large fluctuators, and noise symmetry measurements are planned to characterize their collective order.

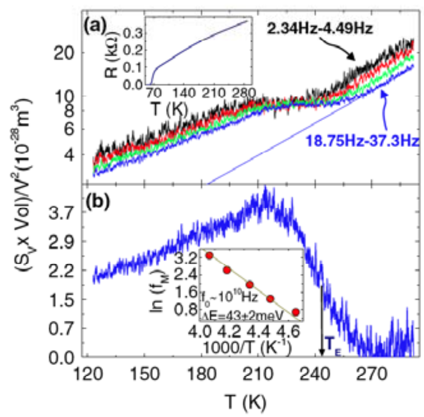


Fig. 6 (a). Noise power S_V in four consecutive octaves vs T smoothed over the range of 0.3 K for the T_c=58 K sample. Note a significant deviation of the noise power from high T extrapolation (solid line). Inset: Dependence of the resistance on temperature. (b) Excess noise after subtracting high-T part. The arrow marks $T_E(f)$. Inset: Dependence of T_E on meausreument frequency.[20]

5. <u>Highlight</u>: Imaging nanoscale magnetic stripe formation in Mn_3O_4

Strong coupling among the spin, lattice, and orbital degrees of freedom in magnetically frustrated materials [35] results in a variety of important phases and properties, including large magnetodielectric effects [36,37] and orbital-liquid or -glass ground states.[38,39] Little is known, however, about the microscopic magneto-structural changes that govern the phases and properties of frustrated materials. To study this, **Cooper** grew large single crystals of frustrated Mn_3O_4, which were measured by **Abbamonte** (X-ray) and **Cooper** (Raman) [40] to characterize the complex magnetostructural phases and magnetodielectric behavior in Mn_3O_4. These results—which relied on theoretical analysis by **Fradkin**—showed [40] that magneto-dielectric behavior in Mn_3O_4 is associated with field-induced tetragonal-to-orthorhombic distortions. More recent magnetic field-dependent X-ray diffraction measurements at the X21 beamline at Brookhaven NL by **Abbamonte**, **Cooper**, and **Nelson** confirmed that there is a field-tuned quantum ($T \sim 0$) phase transition to a frustrated tetragonal spin/orbital glass phase in Mn_3O_4 (Fig. 7 (b)). Ongoing studies are aimed at exploring the nature of the spin dynamics in this field-tuned frustrated phase. **Abbamonte, Budakian** and **Cooper** also investigated the pressure-tuned manipulation of the magnetostructural phases in Mn_3O_4 (Fig. 7 (c)), showing that pressure can be used to sensitively control the magnetic easy axis direction in this material [41]. Simultaneous *P*- and *H*-tuning also provides evidence for a tricritical point in the *PH* phase diagram of Mn_3O_4 [41], and future work is planned to explore whether a continuous quantum phase transition can be induced in this material with both *H* and *P*.

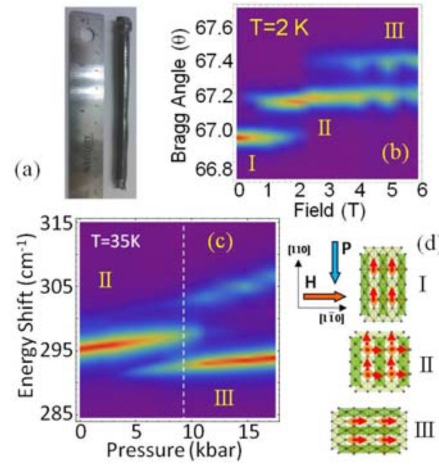


Fig. 7 (a) Single-crystal sample of spinel Mn_3O_4. (b) Field-dependent X-ray diffraction from Mn_3O_4 at T =2 K, showing field-induced structural changes—shown in (d)—with applied field. (c) Pressure dependent phonon spectrum of Mn_3O_4, showing pressure-induced rotation of the magnetic easy axis.[41]

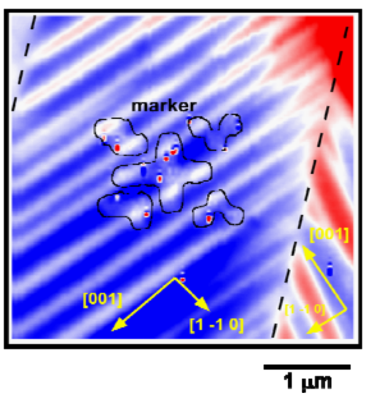


Fig. 8. MFM data taken after field cooling Mn_3O_4 at T = 25 K with a 0.15 T field applied parallel to the [110] axis. A periodic modulation of the spins (period ~ 100 nm) in the [1-10] direction is illustrated as alternating white and blue stripe regions, reflecting different resonant frequencies of the cantilever in the different regions.

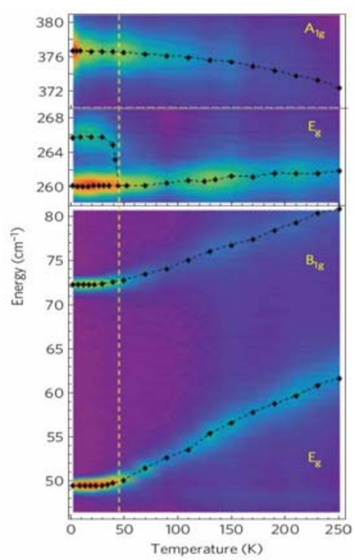
To image the nanometer-scale magnetic domains that develop through the various magnetostructural phases in Mn_3O_4, **Budakian** applied variable temperature cantilever magnetic force microscopy (MFM) to investigate the real space evolution of the high temperature incommensurate phase of Mn_3O_4 to the low temperature commensurate phase. Results indicate that, at low temperatures, the system phase separates into striped regions with a characteristic lengthscale of order 100 nm (Fig. 8). The stripes are visible for fields $\boldsymbol{H}\|[110]$ less than 2 T. In this field range, Raman spectroscopy measurements by **Cooper** and x-ray measurements by **Abbamonte** and **Nelson** (Brookhaven National Lab) indicated a coexistence between the high temperature (tetragonal) phase and the low temperature (orthorhombic) phase.[41] The local information provided by the MFM data has shown for the first time that the coexistence region is not a random distribution of these two structural phases, but instead consists of a periodic arrangement of spins in which the spatial modulations have a well-defined orientation with respect to the crystallographic directions. **Cooper**, **Budakian**, and **Fradkin** collaborated to understand the collective spin-lattice interactions that give rise to the periodic structures observed in the MFM data. An intriguing fundamental physics question here is whether the spatial modulation of the magnetization in the spin/orbital glass phase is influenced by a quantum-critical point.

6. Highlight: Two-stage orbital ordering in $KCuF_3$

Orbital degeneracy is a pervasive phenomenon that gives rise to a wide variety of exotic quantum phenomena in condensed matter physics. Usually imposed by a structural symmetry, orbital degeneracy provides a mechanism for subtle interactions to emerge and determines the dominant broken symmetries in a many-body system. While the orbital degree of freedom is best known for influencing the details of the colossal magnetoresistence (CMR) effect in manganites, it also underlies triplet *p*-wave superconductivity in Sr_2RuO_4, determines the form of spin fluctuation interactions in iron-based superconductors, and has even led to the observation of both stripe order and triplet superfluidity in optical lattices.[42]

The original and most widely used minimal model of orbital physics is the Kugel–Khomskii (KK) model, whose validity was first established through its explanation of the symmetry of orbital and magnetic order in $KCuF_3$.[43] Since then, the KK model has been applied to virtually all materials in which there is an active orbital degree of freedom.

In this study, which used both Raman scattering measurements by **Cooper** and X-ray scattering measurements by **Abbamonte,** we uncovered a previously unidentified structural phase transition in $KCuF_3$ that lies outside the scope of the KK model. This transition is evident in the splitting of Raman active phonon modes (Fig. 9 (upper left)), which occurs in below T_O = 50 K and involves rotations of the CuF_6 octahedra, which were found to be only quasi-ordered and exhibit glassy hysteresis.[44] This transition was found to be closely tied to the existence of Néel spin order below T_N = 39 K.



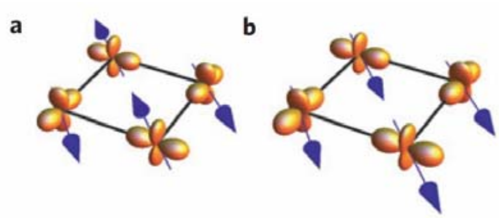


Fig. 9 (left) Evidence for a previously unobserved structural phase transition in $KCuF_3$, which can be observed as an anomalous softening and splitting of several Raman-active phonon modes. The existence of this phase transition implies the existence of direct orbital-orbital exchange, the inclusion of which imply a different orbital ground and excited states than reported previously (right). We argue that the orbital configuration b is slightly lower in energy.[44]

To explain this observation, **Goldbart** and postdoctoral associate Siddhartha Lal proposed a revised form of the KK model that includes a new, direct orbital exchange term. This term, proposed originally by Mostovoy,[45] is driven by a combination of electron–electron interactions and ligand distortions. Its effect is to create a near degeneracy between spin/orbital configurations (Fig. 9 (right)) that dynamically frustrates the spin subsystem, but is lifted at low temperature by orbital–lattice interactions, explaining the existence of the second structural transition and several other mysterious phenomena, including anomalous softening of certain phonon modes observed in Raman (Fig. 9 (lower left)). These results, which were published in *Nature Physics*,[44] suggest that direct orbital exchange may be crucial for the physics of many orbitally active materials, including manganites, ruthenates and the iron pnictides.

A further implication of our new model is that the occupations of the nearly degenerate orbital states should be extremely sensitive to temperature and pressure. Pressure-dependent Raman measurements by **Cooper** and **Abbamonte** showed that applied pressures above P^*~7 kbar reverses the low temperature structural transition in $KCuF_3$, and causes a concomitant development of a pressure-induced fluctuational response near T~0 K, suggesting the onset of quantum fluctuations between different orbital configurations.[46]

7. <u>Highlight</u>: Fundamental studies of electronic correlations and phase coherence using graphene

Andreev bound states (ABS), due to Andreev reflection in confined regions, carry the supercurrent in SNS junctions and have been proposed as the basis of qubits [47]. Work of **Hughes** and **Mason**—reported in *Nature Physics* [48]—succeeded in determining the spectra of individual Andreev bound states (ABS) that formed in a graphene quantum dot. For the experiments, **Mason** fabricated narrow superconducting tunnel probes on top of exfoliated graphene flakes. Aluminum oxide nanoparticles, deposited between the graphene and the superconducting probes, formed quantum dots connected to the graphene and proximity-coupled to the superconducting leads. The interplay of the resulting Andreev reflections with Coulomb charging effects gave rise to low-energy ABS, which appeared as subgap conductance peaks in the tunneling measurements (Fig. 10a). The ABS have a striking gate-voltage dependence, which was explained by **Hughes** both phenomenologically and via a microscopic Hamiltonian for ABS in a graphene quantum dot. Transport calculations based on this model demonstrated a remarkable correspondence with experiment (Fig. 10b).

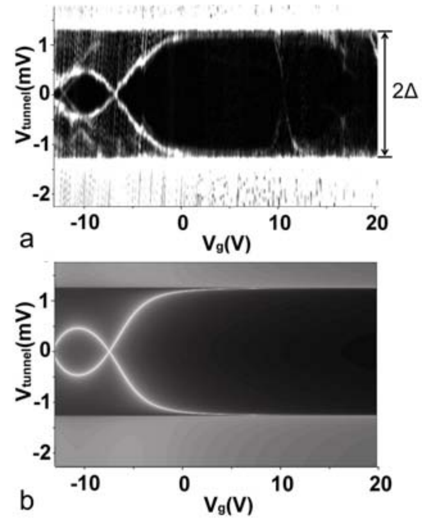


Fig. 10: (a) 2D map of tunneling differential conductance vs. backgate voltage and bias voltage for tunneling into single-layer graphene. White curves inside the superconducting gap (marked as 2Δ) are ABS. (b) Transport calculations for ABS in a quantum dot coupled to normal metal and superconducting leads.[48]

8. Highlight: Measuring fractional vortices in Sr_2RuO_4

Most known superconductors are characterized by the spin-singlet pairing of the electrons that constitute the superconducting flow. An exception is Sr_2RuO_4 (SRO), which—much like superfluid ^{3}He—may be a spin-triplet *p*-wave superfluid. Superconductivity of this type may support remarkable vortex excitations that carry half a unit of magnetic flux (half quantum vortices, or HQVs) and provide topologically-protected states for quantum computation [49,50]. HQVs have not been observed in large samples of SRO, but may be more stable (and thus observable) in mesoscopic samples.[51] Following a suggestion by **Leggett**, **Budakian** fabricated micron-sized, ring-shape structures from high-quality samples of SRO (from Y. Maeno, Kyoto U.) using the focused ion-beam capabilities at the MRL Central Facilities. They made ultra-sensitive cantilever magnetometry measurements on these SRO rings (Fig. 11 (left)) and discovered vortex states exhibiting a magnetic response consistent with the presence of HQVs (Fig. 11 (right)). **Leggett** and **Goldbart** played an essential role in interpreting these measurements, which were published in *Science* [52] and featured in a Search and Discovery article in *Physics Today*.[53] These results demonstrated the efficacy of **Budakian's** MFM techniques in probing unconventional superconductivity, which will be exploited to probe unusual superconducting phases in the current proposal.

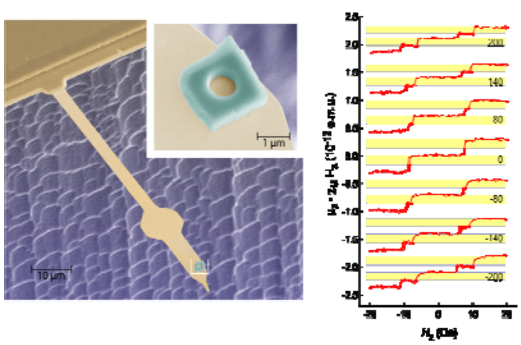


Fig. 11: (left) False color image of an SRO nanocrystal ring attached to the tip of a cantilever. (right) Magnetic response of SRO particle showing the evolution of the half-integer state with in-plane field. The linear Meissner response has been subtracted from the data.

Motivated by **Budakian's** experiments, **Vishveshwara** proposed a two-path vortex interferometry experiment based on the Aharonov-Casher effect [54] for detecting the non-Abelian nature of the fractional vortices observed in SRO. The effect is based on observing vortex interference patterns upon enclosing a finite charge of externally controllable magnitude within the interference path. **Vishveshwara** predicts that when the interfering vortices enclose an odd number of identical vortices in their path, the interference pattern disappears only for non-Abelian vortices. This proposal will be implemented using **Van Harlingen's** extensive expertise in nanofabrication and measurement of mesoscopic devices, and **Budakian's** expertise in fabricating nanometer-scale SRO samples.

In preliminary measurements, **Budakian** created an SRO rf-SQUID by fabricating a single weak-link junction into a ring-shaped SRO particle (see Fig. 12). To interpret the behavior of Josephson currents in these devices, **Leggett** is working with **Budakian** to model the current-phase relationship of spin-triplet Josephson junctions. Ongoing theoretical work by **Vishveshwara** is aimed at estimating the magnitude of the Majorana quasiparticle contribution to the Josephson currents and estimating the temperature dependence of this effect.

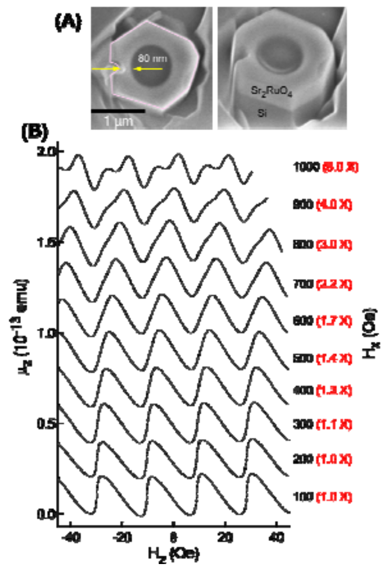


Fig. 12 (A) Image of an SRO nanocrystal ring with an 80-nm wide weak-link constriction. (B) Cantilever magnetometry data showing the evolution of the Josephson currents taken by varying the flux through the ring at a fixed value of the field applied parallel to the ring face.[52]

9. __Highlight__: Measurement of the effective fine structure constant of graphene

Electrons in graphene behave like massless Dirac fermions, permitting phenomena with parallels in high-energy physics to be studied in a solid-state setting. Several authors have argued that the electrons in graphene should form a strongly correlated electron system, and might form any of a variety of exotic ground states, such as an excitonic insulator [55] or a nearly perfect fluid that exhibits electronic turbulence.[56] Surprisingly, such effects have not been observed in transport experiments;[57] at low temperatures, graphene behaves as a simple semimetal. The reason for this has been a mystery.

In most materials, the effect that most directly influences the strength of correlations is screening. To investigate how screening influences the strength of interactions in graphene, **Abbamonte** performed inelastic x-ray scattering experiments on single crystals of graphite at Sector 9 at the Advanced Photon Source (APS). Using new reconstruction algorithms developed in collaboration with **Fradkin** and postdoc Bruno Uchoa, **Abbamonte** was able to image the dynamical screening of charge in a freestanding graphene sheet (Fig. 13). They found that the polarizability of graphene is approximately 3.5 times larger than expected from past estimates based on the random phase approximation.[58] This enhanced screening is a consequence of excitonic effects in transitions between the π and π^* bands, which dominate screening at long distances and low energies. **Abbamonte** and **Fradkin** argued, further, that the strength of Coulomb interactions is characterized by a scale-dependent, effective fine-structure constant, $\alpha_g^*(\mathbf{k},\omega) = e^2/\hbar v_F \varepsilon(\mathbf{k},\omega)$, which approaches the value 0.14 ± 0.092 ~ 1/7 at low energies and large distances. This value is substantially smaller than past estimates and suggests that graphene is more weakly interacting than previously believed. This study—which recently appeared in *Science* [59]—is significant because it demonstrates that a two-dimensional system can exhibit strong dielectric screening over finite distances, provided its excitation spectrum is gapless. These results have implications for all two-dimensional Dirac systems, including transition metal dichalcogenides, copper-oxide superconductors with nodal quasiparticles, and surface states in topological insulators.

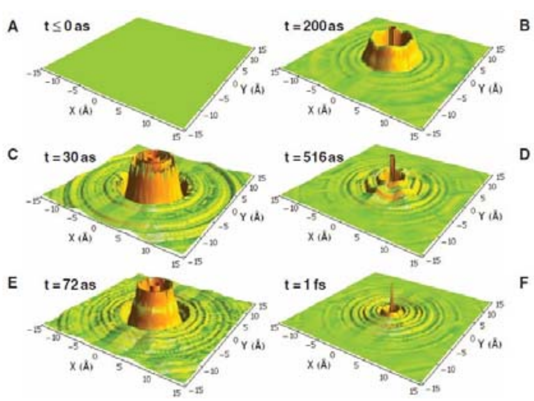


Fig. 13 Snapshots of the dynamical electronic screening in graphene, reconstructed from inelastic x-ray scattering experiments. These images were produced with a spatial resolution of 0.53 Å and a time resolution of 10.3 attoseconds.[58]

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1. E. Berg, **E. Fradkin**, E.-A. Kim, S. Kivelson, V. Oganesyan, **J.M. Tranquada**, and S. Zhang, "Dynamical layer decoupling in a stripe-ordered high T_c superconductor", *Physical Review Letters* **99**, 127003 (2007).
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145. Q.L. Meng, **S. Vishveshwara**, and **T.L. Hughes**, "Spin-transfer torque and electric current in helical edge states in quantum spin Hall devices," *Physical Review B* **90**, 205403 (2014).
146. **T.L. Hughes**, H. Yao, and X.L. Qi, "Majorana zero modes in dislocations of Sr_2RuO_4," *Physical Review B* **90**, 235123 (2014).
147. Y.-T. Hsu, M.H. Fischer, **T.L. Hughes**, K. Park, and E.A. Kim, "Effects of surface-bulk hybridization in three-dimensional topological metals," *Physical Review B* **89**, 205438 (2014).

148. M.F. Lapa and **T.L. Hughes**, "Swimming at low Reynolds number in fluids with odd, or Hall, viscosity," *Physical Review E* **89**, 043019 (2014).

149. K. Kumar, K. Sun, and **E. Fradkin**, "Chern-Simons theory of magnetization plateaus of the spin-1/2 quantum XXZ Heisenberg model on the kagome lattice," *Physical Review B* **90**, 174409 (2014).

150. R. Soto-Garrido and **E. Fradkin**, "Pair-density-wave superconducting states and electronic liquid-crystal phases," *Physical Review B* **89**, 165126 (2014).

151. S. Smadici, G. Logvenov, I. Bozovic, and **P. Abbamonte**, "Sequence of hole resonances in complex oxide heterostructures," *Journal of Physics-Condensed Matter* **26**, 155302 (2014).

152. A.D.K Finck, C. Kurter, Y.S. Hor, **D.J. Van Harlingen**, "Phase coherence and Andreev reflection in topological insulator devices, "*Physical Review X* **4**, 041022 (2014).

<u>2015</u>

153. S.L. Gleason, Y. Gim, T. Byrum, A. Kogar, **P. Abbamonte, E. Fradkin, G.J. MacDougall, D.J. Van Harlingen,** X. Zhu, C. Petrovic, and **S.L. Cooper,** "Structural contributions to the pressure-tuned charge density-wave to superconductor transition in $ZrTe_3$: Raman scattering studies," *Physical Review B* **91**, 155124 (2015).

154. S. Cho, B. Dellabetta, R. Zhong, J. Schneeloch, T. Liu, G. Gu, M.J. Gilbert, and **N. Mason**, "Aharonov-Bohm oscillations in a quasi-ballistic three-dimensional topological insulator nanowire," *Nature Communications* **6**, 7634 (2015).

155. A. Belkin, M. Belkin, V. Vakaryuk, S. Khlebnikov, and **A. Bezryadin**, "Formation of quantum phase slip pairs in superconducting nanowires," *Physical Review X* **5**, 021023 (2015).

156. S. Hegde, V. Shivamoggi, **S. Vishveshwara**, and D. Sen, "Quench dynamics and parity blocking in Majorana wires," *New Journal of Physics* **17**, 053036 (2015).

157. K. Sun, K. Kumar, and **E. Fradkin**, "Discretized Abelian Chern-Simons gauge theory on arbitrary graphs," *Physical Review B* **92**, 115148 (2015).

158. K. Kumar, K. Sun, and **E. Fradkin**, "Chiral spin liquids on the kagome lattice," *Physical Review B* **92**, 094433 (2015).

159. C. Kurter, A.D.K. Finck, Y.S. Hor, **D.J. Van Harlingen**, "Evidence for an anomalous current-phase relation in topological insulator Josephson junctions," *Nature Communications* **6**, 7130 (2015).

PATENTS (2007-2013)

Alexey Bezryadin

- Nanowire structures and electrical devices, United States Patent 7749922 B2, Inventors: **Alexey Bezryadin** and Mikas Remeika, More info: http://www.freepatentsonline.com/7749922.html

CLUSTER AWARDS AND HONORS (2007-2013)

PETER ABBAMONTE

- Two of the group's 2008 publications, both supported by the DOE Quantum Cluster, were selected as "Editor's Suggestions" by the editors of *Physical Review B*.
- Arnold O. Beckman Fellow, Center for Advanced Study (2008-2009).
- Xerox Award for Faculty Research (2010)

ALEXEY BEZRYADIN

- Arnold O. Beckman Award (2008)

Raffi Budakian

- University of Illinois Center for Advanced Study Fellow (2010)
- The publication (J. Jang et al., *Science*, **331** 186-188 (2011)) was chosen as the subject of a Search and Discovery article in *Physics Today,* 17-18 (March 2011).

S. LANCE COOPER

- The Cooper group's work on field-dependent manipulation of structural and conducting properties in layered ruthenates written up in "News and Views", *Nature Materials* (December, 2007).
- Grad student Harini Barath received for her thesis work the Mavis Memorial Award from the College of Engineering at the University of Illinois (2008).
- Two of the group's 2008 publications, both supported by the DOE Quantum Cluster, were selected as "Editor's Suggestions" by the editors of *Physical Review B*.
- Graduate student Minjung Kim received 2009 Mavis Memorial Award from College of Engineering for her thesis research, which was supported by the DOE Quantum Cluster.
- Graduate student Minjung Kim received the 2011 John Bardeen Award, which recognizes outstanding thesis work by a graduate student in condensed matter physics.

JAMES N. ECKSTEIN

- Bernd T. Matthias Prize (2012)

EDUARDO FRADKIN

- Two of the group's 2008 publications, both supported by the DOE Quantum Cluster, were selected as "Editor's Suggestions" by the editors of *Physical Review B*.
- Elected Fellow of the American Academy of Arts and Sciences (2009).
- César Milstein Research Award, Ministry of Science and technology, Argentina (August 2007 and June 2011)
- Elected to the National Academy of Sciences (2013)

PAUL GOLDBART

- Fellow, Institute of Physics, U.K. (2008)
- Xiaoming Mao, Goldbart's Graduate Student, was the recipient of the 2008 John Bardeen Award, which recognizes outstanding work by a graduate student in condensed matter physics or the physics of electronic devices
- The Goldbart group's work on the crystallization of atoms and light was written up in "News and Views", *Nature Physics* (November, 2009).

LAURA GREENE

- Fellow, Institute of Physics, U.K. (2007)
- Editor-In-Chief, *Reports on the Progress in Physics*, Institute of Physics, U.K. (2007)
- Member, National Academy of Science (Inducted 2007)
- Undergraduate thesis student, Zhen Wah Tan won: a) the Robert E. Hetrick Outstanding Senior Thesis Award for 2009; b) the 2009 Ernst M. Lyman Prize for the outstanding senior in physics; and c) the Bronze Tablet for sustained academic achievement for an undergraduate at UIUC.

- Undergraduate research student, Anne Glaudell, won the 2009 Laura B. Eisenstein Award for exceptional women physics students.
- Undergraduate REU student, Alison Pawlicki (FSU, Summer 09 REU Student) was awarded the Lannutti Award for Undergraduate Research at FSU, a Lynn Shannon Proctor award for Achievement in Physics by a minority student, and was inducted into Sigma Pi Sigma National Physics Honor Society.
- Center for Advanced Study Professor, University of Illinois at Urbana-Champaign (2009)
- Visiting Professor, University of California at Irvine (November, 2009)
- John S. Guggenheim Foundation Fellowship (2009-2010)
- Visiting Fellow Commoner, Trinity College, Cambridge University, UK (Lent term 2010)

TAYLOR L. HUGHES

- Alfred P. Sloan Fellow (2013)

ANTHONY LEGGETT

- American Physical Society Outstanding Referee Program award recipient (2008)
- Distinguished Service Medallion, University of Illinois (2009)
- Membership of Indian National Science Academy (October, 2010)

GREGORY MACDOUGALL

- NSF Career Award (2014)

LANE W. MARTIN

- Dean's Award for Excellence in Research (formerly Xerox Award), College of Engineering, University of Illinois (Feb. 2013)
- National Science Foundation CAREER Award (Aug. 2012)
- Army Research Office Young Investigator Program (YIP) Award Winner (Oct. 2010)
- Anoop Damodaran, Martin's graduate student partially supported by DOE QMN cluster, received the 2014 Outstanding Graduate Student Award in the College of Engineering, University of Illinois (Nov. 2013)

NADYA MASON

- National Science Foundation, CAREER Award (2007-2012)
- *Diverse Magazine*, Emerging Scholar, (2008)
- Woodrow Wilson Career Enhancement Fellow (2008-2009)
- Denice Denton Emerging Leader Award (2009)
- APS Maria Goeppert Mayer Award (2012)
- Kavli Fellow, NAS (2011)
- Center for Advanced Study Fellow, University of Illinois, Urbana, IL (2011-2012)
- Dean's Award for Excellence in Research, UIUC (2013)

SMITHA VISHVESHWARA

- National Science Foundation CAREER Award (2007-present)
- Visiting Scientist, Indian Institute of Science, Bangalore, India (2008-2009)
- Associate, Center for Advanced Studies, UIUC (2009)

- National Science Foundation American Competitiveness and Innovation Fellows (2010)
- Simons Fellowship in Theoretical Physics, Simons Foundation (2011)
- Center for Advanced Studies Fellowship, University of Illinois, Urbana, IL (2010)
- American Competitiveness and Innovation Fellowship, National Science Foundation (2010)

CLUSTER INVITED TALKS (2007-2013)
PETER ABBAMONTE

1. Science Advisory Committee Review of the Advanced Photon Source, Argonne National Laboratory, "Imaging electron motion in condensed matter with attosecond time resolution", Argonne, IL (September, 2007).
2. Physics Department, CM/AMO Seminar, University of Michigan, "Imaging electron motion with attosecond time resolution ", Ann Arbor, MI (September, 2007).
3. DOE Contractor Meeting, "Spontaneous vs. engineered electronic order in transition metal oxides", Warrenton, VA (October, 2007).
4. Experimentalist of the Week, Kavli Institute for Theoretical Physics, Santa Barbara, CA (Nov. 13, 2007).
5. Condensed Matter Seminar, University of Texas, "Electronic reconstruction at transition metal oxide interfaces", Austin, TX (December, 2007).
6. Aspen Center for Physics, Aspen, CO (February 4, 2008).
7. NSLS II Planning Workshop, Brookhaven National Laboratory, "Dynamical reconstruction of the valence exciton in LiF", Upton, NY (February, 2008).
8. Workshop on Inelastic Scattering at NSLS-II, Brookhaven National Laboratory, "Real-time imaging of exciton structure with causality-inverted inelastic x-ray scattering", Brookhaven National Laboratory, Upton, NY (February 8, 2008).
9. DARPA Correlated Electronic Oxides Workshop, Arlington, VA (February 13, 2008).
10. Argonne National Laboratory, Advanced Photon Source, IXS Interest Group Seminar, "Dynamical reconstruction of the valence exciton in LiF", Argonne, IL (March, 2008).
11. Workshop on Inelastic X-Ray Scattering, APS Users Week, Argonne National Laboratory, "Dynamical reconstruction of the exciton in LiF with inelastic x-ray scattering", Argonne, IL (May, 2008).
12. Workshop on Emergent States at Interfaces of Complex Oxides, APS Users Week, Argonne National Laboratory, "Nonlocal screening in La_2CuO_4– $La_{2-x}Sr_xCuO_4$ superlattices", Argonne, IL (May, 2008).
13. Workshop on Nanoscale Phenomena Near Phase Transitions, APS Users Week, Argonne National Laboratory, Argonne, IL (May, 2008).
14. Strongly Correlated Electron Workshop on Oxide Heterostructures, Oak Ridge National Laboratory, Oak Ridge, TN (June, 2008).
15. LEES 2008, "Interface charge tunneling in La2CuO4-La1.64SrO.36CuO4 superlattices", Whistler, British Columbia, (July, 2008).
16. San Domenico Monastry, 6th International Conference of the Stripes Series, Stripes 2008, "Unusual valence band order in Zn-doped La_{2-x}SrxCuO_4", Erice, Sicily (July, 2008).
17. Institute of Scientific Studies, *ECRYS 2008*, Cargese, France (August, 2008 declined).

18. Ringberg Workshop on High Temperature Superconductivity, Rottach-Egern, Germany (November, 2008 declined).
19. ISAQM 2008, Tokyo, Japan (November, 2008 declined).
20. 53rd Conference on Magnetism and Magnetic Materials, "Emergence of a Fermi resonance with ferromagnetism at the LaMnO3-SrMnO3 interface", Austin, TX (November, 2008).
21. Paul Scherrer Institute, Workshop on `Crazy' Ideas for a Soft X-ray Free Electron Laser, "RIXS in the time-domain", Villingen, Switzerland (February, 2009).
22. Conference, Critical Issues Related to Higher Temperature Superconductors, Kavli Institute for Theoretical Physics, "Interface charge accumulation in $La_{2-x}Sr_xCuO_4$ heterostructures: insights from resonant x-ray scattering", Santa Barbara, CA (June, 2009).
23. 8th Asian-Pacific Workshop, Tokyo, Japan, July 5 - 7, 2009 (declined).
24. Resonant Scattering Workshop, SLAC, Stanford University, Menlo Park, CA (August, 2009).
25. Telluride Workshop on Competing Interactions and Colossal Responses in Transition Metal Compounds, "Evidence for a structural phase transition at the Neel temperature in orbitally ordered $KCuF_3$", Telluride, CO (August, 2009).
26. Villa Conference on Complex Oxide Heterostructures, St. Thomas, US Virgin Islands (September, 2009).
27. Center for Nanoscale Materials, Users Meeting, Argonne National Laboratory, Argonne, IL (October, 2009).
28. NSLS Friday Seminar, Brookhaven National Laboratory, Upton, NY (November, 2009).
29. Colloquium, Max Planck Institute for Complex Systems, "Why isn't graphene a strongly correlated electron system?" Dresden, Germany (November 2009).
30. Condensed Matter Seminar, IFW, University of Dresden, "Charge accumulation at La_2CuO_4-$La_{2-x}Sr_xCuO_4$ interfaces observed with resonant soft x-ray scattering", Dresden, Germany (November, 2009).
31. Kavli Institute for Theoretical Physics Conference, Materials by Design: Understanding and Controlling the Electronic Properties of Novel Correlated Electron Systems, Santa Barbara, CA (February, 2010).
32. Lorentz Institute, Workshop on Novel Electronic Phases appearing at Interfaces, University of Leiden, The Netherlands, (April, 2010).
33. Nobel Symposium on Graphene, Stockholm, Sweden (May, 2010).
34. 9th International Conference on Spectroscopies in Novel Superconductors (SNS2010), Shangai, China (May, 2010).
35. KITP Conference on Materials by Design: Understanding and Controlling the Electronic Properties of Novel Correlated Electron Systems, "A Fermi resonance at the $LaMnO_3$-$SrMnO_3$ interface observed with resonant soft x-ray scattering," Santa Barbara, CA (February, 2010).
36. Workshop on Condensed Matter and Materials Science for a Next Generation Soft X-ray FEL, "Inelastic x-ray scattering as a decoherence phenomenon," Berkeley, CA (March, 2010).

37. Workshop on Novel Electronic Phases Appearing at Interfaces, "A Fermi resonance at the $LaMnO_3$-$SrMnO_3$ interface observed with resonant soft x-ray scattering," Lorentz Institute, University of Leiden, The Netherlands (April, 2010).
38. Nobel Symposium on Graphene, "The effective fine structure constant of graphene," Stockholm, Sweden (May, 2010).
39. Summer school on X-ray and neutron scattering, "Inelastic x-ray scattering," Argonne, IL (June, 2010).
40. KITP Conference, X-Ray Science in the 21st Century, "The effective fine structure constant of graphene," Santa Barbara, CA (September, 2010).
41. International Conference on Raman Spectroscopy, "The effective fine structure constant of graphene," Boston, MA (September, 2010)
42. LASSP Seminar, Cornell University, "The effective fine structure constant of graphene," Ithaca, NY (September, 2010).
43. IXS 2010, "The effective fine structure constant of graphene," Grenoble, France (October, 2010).
44. Colloquium, Jefferson National Accelerator Laboratory, "The effective fine structure constant of graphene," (November, 2010).
45. CM Seminar, Physics Dept., University of Texas, "The effective fine structure constant of graphene," Austin, TX (November, 2010).
46. Colloquium, DESY, "The effective fine structure constant of graphene," Hamburg, Germany (February, 2011).
47. CM Seminar, Ohio State University, "The effective fine structure constant of graphene," Columbus, OH, (March, 2011).
48. Special CM Seminar, Ohio State University, "A Fermi resonance at the $LaMnO_3$-$SrMnO_3$ interface observed with resonant soft x-ray scattering," Columbus, OH (March, 2011).
49. Physics Colloquium, Northeastern University, "The effective fine structure constant of graphene," Boston, MA (April, 2011).
50. CM Seminar, Stanford University / SLAC, "The effective fine structure constant of graphene," Menlo Park, CA (May, 2011).
51. Materials Science Centre, University of Groningen, "The effective fine structure constant of graphene," The Netherlands (June, 2011).
52. Colloquium, Center for Free Electron Science, DESY, "The effective fine structure constant of graphene," Hamburg (June, 2011)
53. SLS Seminar, Paul Scherer Institut, "The effective fine structure constant of graphene," Villigen Switzerland (June , 2011).
54. CM Seminar, University of Geneva, "The effective fine structure constant of graphene," Geneva, Switzerland (June, 2011).
55. Summer School on Complex Oxide Heterostructures, "Resonant x-ray scattering demystified," Vancouver, B.C. (September, 2011).
56. Colloquium, University of Iowa, "Attosecond imaging with x-rays," Iowa City, IA (September, 2011).

57. New Paradigms for Low-Dimensional Electronic Materials, Aspen Center for Physics, “A Fermi resonance at the $LaMnO_3$-$SrMnO_3$ interface observed with resonant soft x-ray scattering,” (February, 2012).
58. Invited talk, March APS Meeting, “The effective fine structure constant of graphene,” Boston, MA (February, 2012).
59. Memorial Symposium for P. M. Platzman, “Attosecond imaging with x-rays,” Chicago, IL (May, 2012).
60. Virginia FEL Workshop, James Madison University, “Attosecond imaging with x-rays,” Harrisonburg, VA (May, 2012).
61. Gordon Conference on Correlated Electron Systems, “The effective fine structure constant of graphene,” South Hadley, MA (June, 2012).
62. Symposium on Frontiers in X-Ray Science, CFEL, “Attosecond imaging with standing wave inelastic x-ray scattering,” Hamburg, Germany (October, 2012).
63. Director’s Colloquium, Advanced Photon Source, “Attosecond imaging with standing wave inelastic x-ray scattering,” Argonne, IL (November, 2012).

ALEXEY BEZRYADIN

1. March Meeting of the American Physical Society, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Denver, CO (March, 2007).
2. Colloquium, Northern Illinois University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", DeKalb, IL (April, 2007).
3. Condensed Matter Seminar, University of Wisconsin at Madison, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Madison, WI (April, 2007).
4. Center for Nanoscale Materials Workshop, Argonne National Laboratory, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Argonne, IL (May, 2007).
5. Solid State Seminar, Yale University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", New Haven, CT (September, 2007).
6. Buffalo University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Buffalo, NY (November, 2007).
7. Condensed Matter Seminar, Princeton University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Princeton, NY (November, 2007).
8. Condensed Matter Theory Seminar, Harvard University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Cambridge, MA (December, 2007).
9. Columbus Conductor-Insulator Quantum Phase Transitions Workshop, "Fluctuations and superconductor-insulator transition in thin superconducting wires", (January, 2008).
10. *Invited Talk*, Conductor-Insulator Quantum Phase Transitions Workshop, “Understanding dichotomy is thin superconducting nanowires”, Columbus, OH (January, 2008).
11. Colloquium, Bowling Green University, "Fluctuations and superconductor-insulator transition in thin superconducting wires", Bowling Greene, WI (March, 2008).

12. *Invited Talk*, Workshop, Superconductivity and Superfluidity in Finite Systems, “Macroscopic quantum tunneling in superconducting nanowires”, Madison, WI (May, 2008).
13. *Invited Talk*, Workshop, Superconductivity: From Collective Modes to Quantum Phase Transitions, “SIT and MQT in 1D”, Minneapolis, MN (May, 2009).
14. Department of Physics, Condensed Matter Theory Seminar, Pennsylvania State University, “Superconductor-insulator transition and macroscopic quantum tunneling 9MQT) in thin superconducting wires”, University Park, PA (October, 2009).
15. Nanoscience Seminar, “MQT at High Bias Current,” Grenoble, France (May 2010).
16. Bernard Pannetier Symposium, “Double-Nanowire Superconducting Devices,” Grenoble, France (May 2010).
17. Condensed Matter Seminar, ISSP, “MQT in Nanowires at Currents Approaching the Depairing Current,” Chernogolovka, Russia (June 2010).
18. Condensed Matter Seminar, FIAN, “Quantum Phase Slips in Nanowires at Currents Approaching the Depairing Current,” Moscow, Russia (July 2010).
19. Correlated Phenomena in Low-Dimensional Systems Workshop, “Quantum Phase Slips in Nanowires at Currents Approaching the Depairing Current,” Dresden, Germany (July 2010).
20. Aspen Summer School of Physics, “Quantum Phase Slips in Nanowires – New Evidence,” Aspen, CO (August 2010).
21. DARPA workshop, “Simple Model of Maximum Entropy Production Rate,” Los Angeles, CA (February 2010).
22. Disordered Systems: From Condensed-Matter Physics to Ultracold Atomic Gases, Cargese Summer School, “The Search for Macroscopic Quantum Tunneling in Superconducting Nanowires,” Corsica, France (June 2011).
23. ONR Workshop on Graphene, “Dispersion of the Critical Current in Graphene Junctions,” Monterey, CA (December 2011).
24. University of Illinois at Chicago, “Quantum Fluctuations in Superconducting Nanowires,” Chicago, IL (March 2012).
25. Graphene 2012 International Conference, “Dispersion of the Critical Current in Graphene Junctions,” Brussels, Belgium (April 2012).
26. Condensed Matter Seminar, Johns Hopkins University, “Observations of Quantum Phase Slips at High Bias Currents,” Baltimore, MD (May 2012).
27. Argonne MTI Nonconventional Insulators Workshop 2012, Argonne, IL (November 2012).
28. Arcachon, France, *The 11th International Symposium on Functional π-electron systems (Fπ-11)*, “Skewness and kurtosis of the graphene superconducting junction and nanowires” (June 2013).
29. Varenna, Italy, International Conference: Disorder in Condensed Matter and Ultracold Atoms, “Quantutative analysis of quantum phase slips in disordered superconducting wires” (June 2013)
30. Chernogolovka, Russia, Joint Seminar, “Superconductivity and quantum phenomena in superconducting wires” (June 2013).

31. Argonne National Laboratory, Workshop: Coherent Hybrid Structures on the Mesoscale, "Quantum tunneling and cotunneling between macroscopically distinct states in superconducting nanostructures" (October 2013).
32. Physics Colloquium, Drexel University, "Quantum tunneling between macroscopically distinct states in superconducting nanostructures" (October 2013).
33. Condensed Matter Seminar, University of Minnesota, "Quantum tunneling and cotunneling between macroscopically distinct states in superconducting nanostructures" (November 2013).
34. Condensed Matter Seminar, Rutgers University, "Quantum tunneling and co-tunneling between macroscopically distinct states in superconducting nanostructures" (November 2013).

RAFFI BUDAKIAN

1. Northwestern University, Condensed Matter Seminar, "Single spring imaging using magnetic resonance force microscopy", Evanston, IL (February, 2007).
2. ICMT Workshop on Topological Phases in Condensed Matter – UIUC, University of Illinois at Urbana-Champaign, "Search for chiral domains in mesoscopic Sr_2RuO_4 samples using ultra-sensitive torque magnetometry", Urbana, IL (October, 2008).
3. Department of Physics, Condensed Matter Seminar, University of Illinois at Urbana-Champaign, "Photon-mediated magnetic cooling of a micromechanical oscillator", Urbana, IL (November, 2008).
4. US Department of Energy, Office of Basic Energy Sciences Division (Contractors Meeting), "Investigating magnetic order in mesoscopic superconductors using cantilever torque magnetometry", Warrenton, VA (2008).
5. ICMT Workshop on Topological Phases in Condensed Matter, "Investigating magnetic order in mesoscopic superconductors using cantilever torque magnetometry"", Urbana, IL (2008).
6. Microsoft Station-Q Workshop on Topo"", Santa Barbara, CA (2009).
7. Department of Physics, Condensed Matter Seminar, Ohio State University, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Columbus, OH (2009).
8. Department of Physics, Condensed Matter Seminar, Cornell University, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Ithaca, NY (2009).
9. Kavli Workshop on Routes to Three Dimensional Molecular Imaging, "Ultrasensitive force detection using nanowire mechanical resonators", Ithaca, NY (2009).
10. University of Illinois at Urbana-Champaign, Workshop on Quantum Materials at the Nanoscale, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Urbana, IL (2009).
11. Condensed Matter Seminar, Stanford University, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Palo Alto, CA (2010).
12. Condensed Matter Seminar, California Institute of Technology, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Pasadena, CA (2010).
13. American Physical Society March Meeting, "Observation of fractional fluxoid states in mesoscopic rings of Sr_2RuO_4", Portland, OR (2010).

14. Gordon Research Conference on Mechanical Systems in the Quantum Regime, “"Using silicon nanowire resonators for force detected molecular imaging”, Galveston, TX (2010).
15. Condensed Matter Seminar, Stanford University, “Observation of Fractional Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Palo Alto, CA (January, 2010).
16. Condensed Matter Seminar, California Institute of Technology, “Observation of Fractional Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Pasadena, CA (January, 2010).
17. Condensed Matter Seminar, University of California at Los Angeles, “Observation of Fractional Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Los Angeles, CA (January, 2010).
18. Condensed Matter Seminar, University of Chicago, “Observation of Fractional Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Chicago, IL (January, 2010).
19. American Physical Society March Meeting, “Observation of Fractional Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Portland, OR (March, 2010).
20. Condensed Matter Seminar, Massachusetts Institute of Technology, “Evidence for Half-Integer Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Cambridge, MA (October, 2010).
21. Condensed Matter Seminar, Yale University, “Evidence for Half-Integer Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” New Haven, CT (October, 2010).
22. Condensed Matter Seminar, Harvard University, “Evidence for Half-Integer Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Cambridge, MA (October, 2010).
23. Condensed Matter Seminar, University of Illinois, “Evidence for Half-Integer Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” Urbana, IL (October, 2010).
24. Condensed Matter Seminar, Purdue University, “Evidence for Half-Integer Fluxoid States in Mesoscopic Rings of Sr_2RuO_4,” La Fayette, IN (February, 2011).
25. Condensed Matter Seminar, University of Toronto, “Probing the Physics of the Fractional Vortex State in Novel Superconductors,” Toronto, Ontario, Canada (March, 2011).
26. Department of Physics, Colloquium, McMaster University, “Probing the Physics of the Fractional Vortex State in Novel Superconductors,” (March, 2011).
27. Department of Physics, Colloquium, University of Iowa, “Probing the Physics of the Fractional Vortex State in Sr_2RuO_4,” Iowa City, IA (April, 2011).
28. Department of Physics, Colloquium, University of Waterloo, “Probing the Physics of the Fractional Vortex State in Novel Superconductors,” Waterloo, Ontario, Canada (March, 2011).
29. Gordon Research Conference on Superconductivity, “Probing the Physics of the Fractional Vortex State in Sr_2RuO_4,” Waterville Valley, NH (June, 2011).
30. International Workshop for Young Researchers on Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, “Probing the Physics of the Fractional Vortex State in Sr_2RuO_4,” Laforet Biwako, Shiga, Japan (June, 2011).
31. Physics Driven by Spin-orbital Coupling in Transition Metal Compounds, “Probing the Physics of the Fractional Vortex State in Sr_2RuO_4,” Beijing, China (June, 2011).
32. International Conference on Novel Superconductivity, “Probing the Physics of the Fractional Vortex State in Sr_2RuO_4,” Tainan, Taiwan (August, 2011).

33. 26th International Conference on Low Temperature Physics, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Beijing, China (August, 2011).
34. New Frontiers of Low Temperature Physics, International Conference on Ultra Low Temperature Physics, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Daejeon, Korea (August, 2011).
35. Department of Physics, Colloquium, Indiana University, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Bloomington, IN (February, 2012).
36. Topological Quantum Phenomena in Condensed Matter with Broken Symmetries, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Nagoya, Japan (June, 2012).
37. Eidgenössische Technische Hochschule Zürich Condensed Matter Seminar, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Zürich, Switzerland (August, 2012).
38. Materials and Mechanisms of Superconductivity Conference, "Probing the Physics of the Fractional Vortex State in Sr_2RuO_4," Washington, D.C. (August 2012).

S. LANCE COOPER

1. American Physical Society March Meeting, "Exploring competing interactions in the hexaborides with field- and pressure-tuned optical spectroscopy", Denver, CO (March, 2007).
2. Max Planck Institute, 6th Annual Workshop on Orbital Physics and Novel Phenomena in Transition Metal Oxides, "Field- and pressure-tuned optical spectroscopy of quantum phase transitions in transition metal oxides", Stuttgart, Germany (October, 2007).
3. Department of Physics, Condensed Matter Seminar, Rice University, "Quantum melting of the charge density wave state in *1T*-$TiSe_2$ and Cu_xTiSe_2", Houston, TX (March, 2008).
4. American Chemical Society Meeting, Focused Session on Multiferroics, "Raman spectroscopic studies of the magnetic-field- and temperature-dependent phases of $TbMnO_3$", New Orleans, LA (April, 2008).
5. 2nd Workshop on Novel Electronic Materials, "Field- and pressure-tuned spectroscopic studies of phase competition in multiferroics", Lexington, KY (May, 2008).
6. Department of Physics, Condensed Matter Seminar, Princeton University, "Quantum melting of the charge density wave state in 1T-$TiSe_2$ and Cu_xTiSe_2", Princeton, NJ (May, 2008).
7. 2nd Workshop on Novel Electronic Materials, "Field- and pressure-tuned spectroscopic studies of phase competition in multiferroics", Lexington, KY (May, 2008).
8. Colloquium, University of Tennessee, "Field- and pressure-tuned spectroscopic studies of phase competition in multiferroics and other spin-lattice coupled materials", Knoxville, TN (September, 2008).
9. Colloquium, Washington State University, "Field- and pressure-tuned spectroscopic studies of phase competition in multiferroics and other spin-lattice coupled materials", Pullman, WA (December, 2008).
10. Seminar given by group member Harini Barath, University of Waterloo, "Exploring quantum phase transitions in strongly correlated materials using optical spectroscopy", Waterloo, Ontario (April, 2009).

11. Seminar given by group member Harini Barath, Brookhaven National Laboratory, "Exploring quantum phase transitions in strongly correlated materials using optical spectroscopy", Upton, New York (August, 2009).
12. Seminar given by group member Harini Barath, University of Toronto, "Exploring quantum phase transitions in strongly correlated materials using optical spectroscopy", Toronto, Ontario (October, 2009).
13. Seminar given by group member Harini Barath, Johns Hopkins University, "Exploring quantum phase transitions in strongly correlated materials using optical spectroscopy", Baltimore, Maryland (October, 2009).
14. Condensed Matter Seminar, The Ohio State University, "Field- and Pressure-Tuned Spectroscopic Studies of Quantum Phase Transitions in Correlated Materials," Columbus, Ohio (February, 2010).
15. Condensed Matter Seminar, University of Illinois, "Tuning Orbital and Spin Frustration in Strongly Correlated Materials," Urbana, Illinois (October, 2010).
16. Colloquium, Illinois State University, "Tuning Orbital and Spin Frustration in Strongly Correlated Materials," Bloomington, Illinois (March, 2011).
17. Seminar, Materials Research Laboratory, University of Illinois, "Pressure- and Field-Tuning Exotic Phases in Correlated Materials," Urbana, Illinois (March, 2011).
18. ICMT Workshop on Large Fluctuations and Collective Phenomena in Disordered Materials, "Tuning Orbital and Spin Frustration in Strongly Correlated Materials," Urbana, Illinois (May, 2011).
19. 3rd International Workshop on Novel Electronic Materials, "Tuning Orbital and Spin Frustration in Strongly Correlated Materials," Wuhan, China (June, 2011; unable to attend, talk given by grad student Minjung Kim).
20. Symposium on Physics Driven by Spin-Orbit Coupling, "Tuning Orbital and Spin Frustration in Strongly Correlated Materials," Beijing, China (June, 2011; unable to attend, talk given by grad student Minjung Kim).
21. Colloquium, University of South Florida, "Pressure- and Field-Tuned Frustration of Spin/Orbital Order in Strongly Correlated Materials," Tampa, Florida (September, 2012).
22. Colloquium, University of Florida, "Pressure- and Field-Tuned Frustration of Spin/Orbital Order in Strongly Correlated Materials," Gainesville, Florida (September, 2012).
23. Workshop on Enhanced Functionalities in 5d Transition Metal Compounds From Large Spin-Orbit Coupling, "Pressure-Tuning the Phases of Transition Metal Dichalcogenides," Telluride, Colorado (July, 2013).
24. International Workshop on Pressure and Strain Effects in Correlated Electron Materials, "Pressure-Tuning Frustration in Magnetically Frustrated Materials," Max Planck Institute for the Physics of Correlated Systems, Dresden, Germany (October 6-10, 2014).

JAMES ECKSTEIN

1. Department of Physics, Condensed Matter Seminar, Rutgers University, "How does the superconducting proximity effect really work?" Piscataway, NJ (September, 2007).

2. Department of Physics, Condensed Matter Seminar, University of Illinois at Urbana-Champaign, "How does the superconducting proximity effect really work?", Urbana, IL (February, 2008).
3. Department of Physics, Seminar, Chicago State University, "From atoms to crystals: Making and thinking about solids", Chicago, IL (February, 2008).
4. Department of Physics, Condensed Matter Seminar, Ohio State University, "What really happens in the superconducting proximity effect?" Columbus, OH (February, 2008).
5. University of Illinois at Urbana-Champaign, "How does the proximity effect really work?" Urbana, IL (February, 2008).
6. Chicago State University, "From atoms to crystals", Chicago, IL (February, 2008).
7. Ohio State University, "How does the proximity effect really work?" Columbus, OH (February, 2008).
8. University of Missouri, "New electronic structure at oxide interfaces", Columbia, MO (April, 2008).
9. Argonne National Laboratory, "New electronic structure at oxide interfaces", Argonne, IL (May, 2008).
10. Oak Ridge National Laboratory, "New electronic structure at oxide interfaces", Oak Ridge, TN (June, 2008).
11. EU Workshop, "New phases at oxide interfaces", Switzerland (April, 2009).
12. Ameland Summer School, "Quantum transport at interfaces", Ameland, Netherlands (June, 2009).
13. Department of Energy Synthesis and Processing Meeting, "How perfect should each digitally synthesized molecular layer be?" Warrenton, VA (October, 2009).
14. Materials by Design, University of California, Kavli Institute for Theoretical Physics, "New Collective and Single Particle Phenomena at Oxide Interfaces and Digital Superlattices," Santa Barbara, CA (February, 2010).
15. Condensed Matter Seminar, Florida State University and NHMFL, "Transport Between Superconductors Coupled to Quantum Hall Edge Modes," Tallahassee, FL (April, 2010).
16. Coherence in Superconducting Qubits, "Atomic Layer Control of Josephson Junction Trilayer Epitaxy and Chemistry," San Diego, CA (April, 2010).
17. Complex Oxide Interface Workshop, University of Virginia, "How Superconductivity in Cuprates is Modified by Interfaces," Charlottesville, VA (August, 2010).
18. Department of Physics, Colloquium, University of Illinois, "Superconducting Qubits have Materials Problems: Can We Solve Them?," Urbana, IL (September, 2010).
19. Condensed Matter Seminar, University of Science and Technology in China, "Quantum Hall to Superconductor Junctions," Hefei, China (October, 2010).
20. Department of Physics, Colloquium, Iowa State University, "Quantum Hall to Superconductor Junctions," Ames, IA (October, 2010).
21. American Physical Society March Meeting, "New Optical Absorption Bands in Atomic Layer Superlattices," Dallas, TX (March, 2011).
22. Physics and Chemistry of Semiconductor Interfaces-39, "Superconducting Proximity Effect into Semiconductors," Santa Fe, NM (January, 2012).

23. Argonne MSD Seminar, Argonne National Laboratory, Materials Science Division, "How Superconductors Misbehave at Interfaces," Chicago, IL (May, 2012).
24. Workshop on Oxide Interfaces, Chinese Academy of Sciences, "How Superconductors Misbehave at Interfaces," Beijing, China (June, 2012).
25. DARPA Workshop on Correlated Quantum Materials, "Engineering Correlated Oxide Films and Heterostructures," Arlington, VA (November, 2012).
26. Workshop on Oxide Interfaces, Chinese Academy of Sciences, "How Superconductors Misbehave at Interfaces," Beijing, China (June, 2012).
27. Workshop on Emerging Areas of Ceramics Research, National Science Foundation, "Atomic Layer by Layer Synthesis of Artificial Materials and Device Heterostructures," Arlington, VA (March 2012).
28. Materials and Mechanisms of Superconductivity Conference, Matthias Lecture, "Atomic Layer by Layer Synthesis of Superconducting Films," Washington, DC (August 2012).
29. Workshop on Unconventional Superconductivity, Shanghai Center for Complex Physics, Shanghai Jiao Tong University, "Atomic Layer by Layer Synthesis of High Temperature Superconductors: New Materials and Devices," Shanghai, China (May 2013).
30. Physics of Emergent Correlated Materials, Telluride Science Research Center, How the Superconducting Prosimity Effect Changes the Electrodynamis of InAs Right at the Interface," Telluride, CO (June 2013).
31. Condensed Matter Theory Group Seminar, Alba Nova Campus of Nordita, KTH, and University of Stockholm, "Atomic Layer by Layer Synthesis of High Temperature Superconductors," Stockholm, Sweden (October 2013).
32. Colloquium, Department of Physics, Notre Dame University, "Atomic Layer by Layer Engineering of Complex Oxide Heterostructures," Notre Dame, IN (November 2013).

EDUARDO FRADKIN

1. Institute for Pure and Applied Mathematics (IPAM), Topological Quantum Computing Workshop, University of California, Los Angeles, "Entanglement entropy at two dimensional quantum critical points: Can you hear the shape of Schrödinger's cat?" Los Angeles, CA (February-March, 2007).
2. 2007 March Meeting of the American Physical Society, "How optimal inhomogeneity produces high temperature superconductivity", Denver, CO (March, 2007).
3. Condensed Matter Seminar, National High Magnetic Field Laboratory, "The role of charge order in the mechanism of high temperature superconductivity"", Tallahassee, FL (April, 2007).
4. Workshop WK1, Intermediate Energy Science at the Advanced Photon Source, Argonne National Laboratory, "The role of charge order in the mechanism of high temperature superconductivity", Chicago IL (May, 2007).
5. Perimeter Institute, Workshop, When Matter Meets Information: Entangling the Frontiers of Condensed Matter and Quantum Information Science, University of Waterloo, "Entanglement entropy at two dimensional quantum critical points: can you hear the shape of Schrödinger's cat?" Canada (June, 2007).

6. Rudolf Peierls Centre for Theoretical Physics, Condensed Matter Theory Seminar, Oxford University, “The role of charge order in the mechanism of high temperature superconductivity”", Oxford, United Kingdom (July, 2007).
7. STATPHYS 23 Satellite Meeting, Statistical Field Theory of Quantum Devices, “Entanglement entropy at two dimensional quantum critical points: Can you hear the shape of Schrödinger's cat?”" Perugia, Italy (July, 2007).
8. Theory Seminar Instituto de Física Balseiro, S. C. de Bariloche, “Fases Topológicas y Entropía Topológica en Materia Condensada Cuántica” (Spanish), “Topological phases and topological entropy in quantum condensed matter”, Argentina (August, 2007).
9. Condensed Matter Seminar, Instituto de Física Balseiro, S. C. de Bariloche, "Orden de carga y el mecanismo de superconductividad de alta temperatura crítica (Spanish), “Charge order and the mechanism of high temperature superconductivity”, Argentina (August, 2007).
10. Department of Physics, Condensed Matter Seminar University of California, San Diego, “The role of charge order in the mechanism of high temperature superconductivity”, San Diego, CA (November, 2007).
11. Department of Physics, Condensed Matter Seminar, University of California, Berkeley, “The role of charge order in the mechanism of high temperature superconductivity”, Berkeley, CA (November, 2007).
12. Station Q Seminar, Microsoft Corporation and University of California Santa Barbara, “Topological entanglement entropy in Chern-Simons theories and quantum hall fluids”, Santa Barbara, CA (November, 2007).
13. Department of Physics, Stanford Institute for Theoretical Physics Seminar, Stanford University, “Entanglement entropy at two dimensional quantum critical points and 2D topological fluids: Can you hear the shape of Schrödinger's cat?”" Stanford, CA (December, 2007).
14. Department of Physics, Condensed Matter Seminar, California Institute of Technology, “The role of charge order in the mechanism of high temperature superconductivity”, Pasadena, CA (December, 2007).
15. Department of Physics Seminar, Yale University, “Entanglement entropy at two dimensional quantum critical points and 2D topological fluids: Can you hear the shape of Schrödinger's cat?” New Haven, CT (February, 2008).
16. Princeton Center for Theoretical Physics Seminar, Princeton University, “Entanglement entropy at 2D quantum critical points, topological fluids and Chern-Simons theories”, Princeton, NJ (February, 2008).
17. Condensed Matter Seminar, Oak Ridge National Laboratory, “The role of charge order in the mechanism of high temperature superconductivity”, Oak Ridge, TN (March, 2008).
18. *Invited talk*, March Meeting of the American Physical Society, “Dynamical layer decoupling in a stripe-ordered high T_c superconductor”, New Orleans, LA (March, 2008).
19. Kavli Institute for Theoretical Physics, Director’s Blackboard Seminar, University of California, Santa Barbara, “Can you hear the shape of Schrödinger’s cat?” Santa Barbara, CA (April, 2008).

20. Rudolf Peierls Centre for Theoretical Physics, Seminar, University of Oxford, “Topological entanglement entropy in Chern-Simons theory and quantum Hall systems”, Oxford, United Kingdom (May 28, 2008).
21. Institute for Theoretical Physics, Seminar, University of Amsterdam, “Entanglement entropy at 2D quantum critical points, topological fluids and Chern-Simons theories”, Amsterdam, Netherlands (June, 2008).
22. *Invited Speaker*, International Symposium on Topological Aspects of Solid State Physics, Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto, Japan (June, 2008).
23. *Invited Participant and Speaker*, Workshop on Quantum Computation with Topological Phases of Matter, Banff International Research Station, Banff, Canada (July, 2008).
24. *Invited Speaker*, 6th International Conference of the series on Stripes and High T_c Superconductivity, Stripes08, “The role of charge order in the mechanism of high temperature superconductivity”, Erice, Sicily, Italy (July-August, 2008).
25. *Invited Speaker*, 25th International Conference in Low Temperature Physics “LT25”, “Entanglement entropy at 2D quantum critical points, topological fluids and quantum Hall systems”, Amsterdam, Netherlands (August, 2008).
26. *Invited Speaker*, Conference on Conformal Field Theory Approach to Quantum Hall Physics - Non-Abelian Statistics and Quantum Computing, “Entanglement entropy at 2D quantum critical points, topological fluids and quantum Hall systems”, Nordita, Stockholm, Sweden (August, 2008).
27. *Invited Speaker and Scientific Advisor*, Montauk Conference on Strong Fluctuations in Low Dimensional Systems, “Electronic liquid crystal phases and high Tc superconductivity”, Montauk, NY (September, 2008).
28. *Invited Speaker*, Exact Results in Low-Dimensional Quantum Systems: 2nd INSTANS Summer Conference, Galileo Galilei Institute for Theoretical Physics, Arcetri, Florence, Italy (September, 2008).
29. *Invited Speaker*, XIX Latin American Symposium on Solid State Physics (SLAFES XIX), Puerto Iguaz´u (Iguazú Falls), Argentina (October, 2008).
30. Department of Physics, Seminar, Indiana University, “The remarkable superconducting stripe phase of $La_{2-x}Ba_xCuO_4$ near $x = 1/8$”, Bloomington, IN (October, 2008).
31. Department of Physics, Colloquium, University of Illinois at Urbana-Champaign, “Can you hear the shape of Schrödinger’s cat?” Urbana IL (December, 2008).
32. Department of Physics, Seminar, Boston University, “Entanglement entropy at 2D quantum critical points and topological fluids”, Boston MA (April, 2009).
33. Department of Physics, Seminar, Harvard University, “The remarkable superconducting stripe phase of $La_{2-x}Ba_xCuO_4$ near $x = 1/8$”, Cambridge, MA (April 3, 2009).
34. Les Houches Summer School, series of lectures on Electronic Liquid Crystal Phases in Strongly Correlated Systems, “Modern theories of correlated electron systems”, Les Houches, France (May, 2009).
35. *Invited Speaker*, Topological Order: From Quantum Hall Systems to Magnetic Materials, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany (June-July, 2009).

36. Co-Organizer, Critical Issues Related to Higher Temperature Superconductors, Kavli Institute for Theoretical Physics, University of California, “How spin, charge and superconducting orders intertwine in the cuprates”, Santa Barbara (June, 2009).
37. Seminar, Instituto de Ciencias de Materials de Madrid, “The remarkable superconducting stripe phase of $La_{2-x}Ba_xCuO_4$ near $x = 1/8$”, Madrid, Spain (June, 2009).
38. *Invited Talk*, Quantum Criticality and the AdS/CFT Correspondence, Kavli Institute for Theoretical Physics, University of California, “Quantum dynamics of the Fermi surface and the breakdown of Fermi liquids”, Santa Barbara, CA (July 24, 2009).
39. Department of Physics, Seminar, University of Buenos Aires (Argentina), “How the spin, charge and superconducting orders intertwine in the cuprates”, Buenos Aires, Argentina (August 20, 2009).
40. Department of Physics, Seminar, University of La Plata (Argentina), “Entanglement entropy at 2D quantum critical points, topological fluids and quantum Hall fluids”, La Plata, Argentina (August 25, 2009).
41. *Invited Talk*, Quantum Materials at the Nanoscale Workshop, Materials Research Laboratory, University of Illinois at Urbana-Champaign, “How the spin, charge and superconducting orders intertwine in the cuprates”, Urbana, IL (September 25-26, 2009).
42. Department of Physics Seminar, Massachusetts Institute of Technology, “How the spin, charge , and superconducting orders intertwine in the cuprates”, Cambridge, MA, (October 9, 2009).
43. Department of Physics, Colloquium, University of Kentucky, “Can you hear the shape of Schrödinger's cat?” Lexington KY, (October 23, 2009).
44. Condensed Matter Physics Meets High Energy Physics Workshop, Institute for the Physics and Mathematics of the Universe (IPMU), University of Tokyo, “Quantum Entanglement and Quantum Criticality,” Kashiwa, Japan (February, 2010).
45. Department of Physics, Seminar, Princeton University, “Quantum Entanglement and Quantum Noise after a Quantum Quench,” Princeton NJ (April, 2010).
46. Colloquium, Yeshiva University, “Entanglement and Quantum Criticality: Can You Hear the Shape of Schrödinger's Cat?,” New York, NY (April, 2010).
47. *Invited Speaker*, Emergence and Entanglement Workshop, Perimeter Institute, “Quantum Entanglement and Quantum Criticality,” Waterloo, Ontario, Canada (May, 2010).
48. *Invited Speaker*, Quantum Information Concepts for Condensed Matter Problems Workshop, Max Planck Institute for the Physics of Complex Systems, “Entanglement and Noise after a Quantum Quench,” Dresden, Germany (June, 2010).
49. Seminar, The Rudolph Peierls Centre for Theoretical Physics, Oxford University, “Entanglement and Noise after a Quantum Quench,” Oxford, United Kingdom (June, 2010).
50. *Invited Lecturer*, The XII Giambiagi School, Low Dimensional Condensed Matter, Department of Physics, Faculty of Exact and Natural Sciences, University of Buenos Aires, “Topological Phases in Condensed Matter,” Buenos Aires, Argentina (July, 2010).
51. *Invited speaker*, International Workshop on Principles and Design of Strongly Correlated Electronic Systems, International Centre for Theoretical Physics, “How Charge, Spin and Superconducting Orders Intertwine in the Cuprates,” Trieste, Italy (August, 2010).

52. *Invited speaker*, International Workshop on Emergent Quantum States in Complex Correlated Matter, Max Planck Institute for the Physics of Complex Systems, "How Charge, Spin and Superconducting Orders Intertwine in the Cuprates," Dresden, Germany (August, 2010).
53. Seminar, The James Franck Institute, University of Chicago, "Entanglement and Quantum Criticality," Chicago, IL (October, 2010).
54. Department of Physics, Seminar, The Ohio State University, "How Charge, Spin and Superconducting Orders Intertwine in the Cuprates," Columbus, Ohio (November, 2010).
55. *Invited Participant*, Microsoft Station Q Winter Meeting, Santa Barbara CA (December 2010).
56. *Invited Participant*, "FradkinFest" Workshop, Stanford University, Stanford CA (December 2010).
57. *Invited speaker*, Aspen Winter Conference Materials and the Imagination, "Electronic Liquid Crystal Phases of Strongly Correlated Systems," Aspen, Colorado (January 2011).
58. *Invited speaker*, Aspen Winter Conference, "Strongly Correlated Systems and Gauge/Gravity Duality," Aspen, Colorado (February 2011).
59. *Invited participant*, "FreedmanFest" Workshop, Microsoft Station Q, Santa Barbara, CA (April 2011).
60. *Keynote speaker*, The 4 Corners Southwestern Ontario Condensed Matter Physics Workshop, Perimeter Institute, "Electronic Liquid Crystal Phases in Strongly Correlated Systems," Waterloo, Ontario, Canada (April, 2011).
61. Colloquium, Perimeter Institute, "Effective Field Theories of Fractional Quantum Hall Systems," Waterloo, Ontario, Canada (April, 2011).
62. *Invited Speaker*, Strongly Interacting Electrons in Low Dimensions: New Orders, Symmetries, and Excitations Workshop, Princeton Center for Theoretical Science, Princeton University, "The Dissipationless Viscosity of Topological Insulators," Princeton, NJ (September, 2011).
63. *Invited Talk*, Large Fluctuations and Collective Phenomena in Disordered Systems Workshop, Institute for Condensed Matter Theory, University of Illinois, "Electronic Liquid Crystal Phases in Strongly Correlated Systems," Urbana, IL (May, 2011).
64. *Invited speaker*, Black Hole Answers to Condensed Matter Questions Workshop, Lorenz Institute of the University of Leiden, Leiden, The Netherlands (June, 2011)
65. Department of Physics, Seminar, University of Buenos Aires. "Quantum Entanglement and Noise: is it Possible to Measure the Entanglement Entropy?," Buenos Aires, Argentina (in Spanish) (July, 2011).
66. *Co-Organizer*, Program on "Holographic Duality in Condensed Matter Physics," Kavli Institute for Theoretical Physics, University of California, Santa Barbara, CA (August-November 2011).
67. Department of Physics, Seminar, Cornell University, "Intertwined Orders in High Temperature Superconductors," Ithaca, NY (April 2012)
68. *Co-organizer* and *Invited Speaker*, Program and Workshop "Quantum Systems in and Out of Equilibrium", The Galileo Galilei Institute, "The Stability of the Quantum Lifshitz Model," Florence, Italy (May 2012).

69. *Invited Panelist*, 2012 Gordon Research Conference, Correlated Electronic Systems, Mount Holyoke, Massachusetts (June 2012).
70. Department of Physics, Seminar, University of Buenos Aires, "Intertwined Orders in High Temperature Superconductors," Buenos Aires, Argentina (in Spanish) (July 2012).
71. *Invited speaker*, Topological States of Matter: Insulators, Superconductors and Quantum Hall Liquids Program, "The Rényi Entropy and the Multifractal Spectrum of Systems Near the Localization Transition," Nordita, Stockholm (July-August, 2012).
72. Department of Physics, Condensed Matter Seminar, University of Illinois, "Intertwined Orders in High Temperature Superconductors," Urbana, IL (August, 2012).
73. *Invited speaker*, Strongly Correlated Physics in the Cuprates Conference, "Intertwined Orders in High Temperature Superconductors," Montauk, NY (September, 2012).
74. *Invited speaker*, Entanglement in Discrete and Continuous Quantum Systems Workshop, Princeton Center for Theoretical Science, Princeton University, "Entanglement and Multifractality," Princeton, NJ (October, 2012).
75. *Invited speaker*, International Workshop on "Entanglement Spectra in Complex Quantum Wavefunctions", Max Planck Institute for Complex Systems, "Entanglement and Multifractality," Dresden, Germany (November, 2012).
76. *Invited speaker*, Entangle This: Fields, Strings and Information Workshop, Institute of Theoretical Physics, "Entanglement and Multifractality," Madrid, Spain (November, 2012).

PAUL GOLDBART

1. *Invited Talk,* March Meeting of the American Physical Society, (work done in collaboration with P.M. Goldbart and others), "Superconductivity in DNA templated metal nanowires", Denver, CO (March, 2007).
2. *Invited Talk*, X. Xing (work done in collaboration with P.M. Goldbart and others), March Meeting of the American Physical Society, "Incompressibility, fluctuations, and elasticity in random solids", Denver, CO (March, 2007).
3. *Invited Talk*, A. Dorsey (work done with P.M. Goldbart and others), March Meeting of the American Physical Society, "Squeezing superfluid from a stone: Coupling superfluidity and elasticity in a supersolid", Denver, CO (March, 2007).
4. Department of Physics, Condensed Matter Theory Seminar, The Ohio State University, "Phase-slip avalanches in He-4 superflow through nano-aperture arrays", Columbus, OH (April, 2007).
5. Understanding Complex Systems Symposium, University of Illinois at Urbana-Champaign, "Phase-slip avalanches in the superflow of helium-4 through arrays of nano-apertures", Urbana, IL (May, 2007).
6. Statphys 23, "Phase-slip avalanching in the flow of superfluid helium-four through arrays of nanosize apertures", Genoa, Italy (July, 2007).
7. Materials Research Laboratory Seminar, Colloquium, University of California, "Chemical gels and their structural and elastic heterogeneity: A simple, Landau-type picture", Goleta, CA (October, 2007).

8. California Nanosystems Institute, Colloquium, University of California, Los Angeles, “Superconductivity and quantum interference at the nanoscale”, Los Angeles, CA (October, 2007).
9. Department of Physics, Seminar, University of California, Los Angeles, “Chemical gels and their structural and elastic heterogeneity: A simple, Landau-type picture”, Los Angeles, CA (October, 2007).
10. Department of Physics, Seminar, Rutgers University, “Synchronized phase-slippage and the flow of superfluid helium-four through nano-aperture arrays”, Piscataway, NJ (November, 2007).
11. Department of Physics, Seminar, Columbia University, “Synchronized phase-slippage and the flow of superfluid helium-four through nano-aperture arrays”, New York, NY (November, 2007).
12. Department of Physics, Colloquium, Yeshiva University, “Vulcanized matter: Its statistics, its physics, and its statistical physics”, New York, NY (November, 2007).
13. Department of Physics, Colloquium, Iowa State University, “Strands of superconductivity at the nanoscale”, Ames, IA (April, 2008).
14. Department of Physics, Colloquium, Louisiana State University, “Strands of superconductivity at the nanoscale”, Baton Rouge, LA (April, 2008).
15. Liquid Crystal Institute, Seminar, Kent State University, “Chemical gels and their structural and elastic heterogeneity: A simple, Landau-type picture”, Kent, OH (April, 2008).
16. Department of Physics, Colloquium, Kent State University, “Strands of superconductivity at the nanoscale”, Kent, OH (May, 2008).
17. *Invited Talk*, D. Pekker (work done in collaboration with P.M. Goldbart and others**),** ICAM Exploratory Workshop on Superconductivity and Superfluidity in Finite Systems, University of Wisconsin, “Josephson phenomena and the flow of superfluid helium-four through nano-aperture arrays”, Madison, WI (May, 2008).
18. *Invited Talk*, A. Bezryadin (work done in collaboration with P.M. Goldbart and others**),** ICAM Exploratory Workshop on Superconductivity and Superfluidity in Finite Systems, University of Wisconsin, “Macroscopic quantum tunneling in superconducting nanowires”, Madison, WI (May, 2008).
19. Workshop on Complexity, Disorder and Algorithms, Aspen Center for Physics, short talk, “Fluctuating random solids”, Aspen, CO (May–June, 2008).
20. Soft Solids and Complex Fluids*,* series of lectures at the summer school, University of Massachusetts Amherst, “Soft random solids: Their structure and elasticity”, Amherst, MA (June, 2008).
21. Osher Lifelong Learning Institute, course on Energy, Matter and the Universe, outreach lecture, University of Illinois at Urbana-Champaign, “More than three states of matter: liquid crystals are neither liquids nor crystals”, Urbana, IL (October, 2008).
22. Chemistry Department, Seminar, University of California, Los Angeles, “Chemical gels and their structural and elastic heterogeneity: A simple, Landau-type picture”, Los Angeles, CA (November, 2008).

23. Physics Department, Colloquium, University of Colorado, “Strands of superconductivity at the nanoscale”, Boulder, CO (December, 2008).
24. Physics Department, Seminar, University of Colorado, “Chemical gels and their structural and elastic heterogeneity: A simple, Landau-type picture”, Boulder, CO (December, 2008).
25. Physics Department, Seminar, Colorado State University, “Strands of superconductivity at the nanoscale”, Fort Collins, CO (December, 2008).
26. Physics Department, Seminar, Yale University, “Strands of superconductivity at the nanoscale”, New Haven, CT (February, 2009).
27. Riverside, Physics Department, Seminar, University of California, “Strands of superconductivity at the nanoscale”, Riverside, CA (March, 2009).
28. *Invited Talk*, N. Shah (work done in collaboration with P.M. Goldbart, A. Bezryadin and others), March Meeting of the American Physical Society, “Statistics of superconductive-resistive switching in nanowires: An effective probe for resolving phase-slip events”, Pittsburgh, PA (March, 2009).
29. *Keynote Address*, Eighth International Congress on Thermal Stresses, University of Illinois at Urbana-Champaign, “Heterogeneous solids and the micro/macro connection: structure and elasticity in architecturally complex media as emergent collective phenomena”, Urbana, IL (June, 2009).
30. Physics Department, Seminar, Northwestern University, “Random solids and their universal features: A simple, Landau-type picture”, Evanston, IL (June, 2009).
31. Physics Department, Colloquium, Northwestern University, “Strands of superconductivity at the nanoscale”, Evanston, IL (June, 2009).
32. Soft Matter Seminar, New York University, “Random solids and their universal features: A simple, Landau-type picture”, New York, NY (November 2009).
33. Physics Department, Colloquium, New York University, “Strands of superconductivity at the nanoscale”, New York, NY (November 2009).

LAURA GREENE

1. *Distinguished Lecturer*, CMS (condensed matter sciences), Brookhaven National Laboratory, “High temperature superconductors: Playgrounds for broken symmetries”, Upton, NY (January, 2007).
2. Department of Physics Colloquium, North Carolina State University, “Unconventional superconductors: Measuring broken symmetries”, Raleigh, NC (February, 2007).
3. Special session commemorating the 20th Anniversary of the Discovery of High-Temperature Superconductivity and the 20th Anniversary of the March Meeting “Woodstock” (which occurred in March, 1987), March Meeting of the American Physical Society, “High-T_c at Bellcore”, Denver, CO (March, 2007).
4. I2CAM/FAPERJ Spring School on Emergent Matter*,* lecture series, “New phenomena in highly correlated quantum matter”, Rio de Janeiro, Brazil (March, 2007).
5. Kathryn McCarthy Public Lecture, Tufts University, “High temperature superconductors: From broken symmetries to cell phones”, Medford, MA (April, 2007).
6. Department of Physics Colloquium, Tufts University, “High temperature superconductors: Playgrounds for broken symmetries”, Medford, MA (April, 2007).

7. International Conference on Strongly Correlated Electron Systems (SCES-07), public lectures to the Houston media with Paul Chu and Frank Steglich, “High temperature superconductors: From broken symmetries to cell phones”, Houston, TX (May, 2007).
8. International Conference on Strongly Correlated Electron Systems, “Andreev reflection spectroscopy of the pure and Cd-doped heavy-fermion superconductor $CeCoIn_5$: Detecting order parameter symmetry and competing phases”, Houston, TX (May, 2007).
9. Zhong Guan Cun Forum on Condensed Matter Physics, Chinese Academy of Sciences, “High-temperature superconductors: Playgrounds for broken symmetries”, Beijing, China (May, 2007).
10. Physics Seminar, Chinese Academy of Sciences, “Andreev reflection spectroscopy of the pure and Cd-doped heavy Fermion superconductor $CeCoIn_5$: Detecting order parameter symmetry and competing phases”, Beijing, China (May, 2007).
11. Department of Physics, colloquium, Peking University, “Planar quasiparticle tunneling and point contact Andreev reflection spectroscopies for measurement of broken symmetries in unconventional superconductors”, Beijing, China (May, 2007).
12. ICAM/I2CAM Workshop: 1-1-5 Materials: The Rosetta Stone for the Kondo Lattice, “Tunneling and point contact Andreev reflection spectroscopy of pure and Cd-doped $CeCoIn_5$", Aspen, CO (August, 2007).
13. Gordon Conference on Superconductivity, “Andreev reflection at novel superconducting interfaces”, Les Diablerets, SZ (September, 2007).
14. Center for Integrated Nanotechnologies, Colloquium, University of Illinois at Urbana-Champaign, “High-temperature superconductors: Playgrounds for broken symmetries”, Urbana, IL (December, 2007).
15. Public Lecture for the Dial Faculty Club, University of Illinois at Urbana-Champaign, “How nuclear weapons work”, Urbana, IL (February, 2008).
16. Workshop on Grant Writing: Steps and Strategies for Successful Proposals, Panelist, sponsored by the National Center for Supercomputing Applications (NCSA), Beckman Institute, University of Illinois at Urbana-Champaign, “Do’s and don’ts and lessons learned”, Urbana, IL (February, 2008).
17. Department of Physics, Condensed Matter Physics Seminar, University of California, Berkeley, “Point contact Andreev reflection tunneling spectroscopy (PCARTS) of the pure and Cd-doped heavy fermion superconductor $CeCoIn_5$", Berkeley, CA (March, 2008).
18. American Physical Society March Meeting, “Andreev reflection in heavy fermions and superconducting order parameter symmetry in $CeCoIn_5$", New Orleans, LA (March, 2008).
19. March Meeting of the American Physical Society, Lunch with the Experts, “Transforming science, policy, and the power grid with high temperature superconductivity”, New Orleans, LA (March, 2008).
20. March Meeting of the American Physical Society, Forum on International Physics, “She’s a physicist!?” New Orleans, LA (March, 2008).
21. Osher Life-Long Learning Institute (OLLI), lectures, University of Illinois at Urbana-Champaign, “Transforming science, policy, and the power grid with high temperature superconductivity”, Urbana, IL (April, 2008).

22. *Plenary Talk*, Conference on Complex Systems, University of Illinois at Urbana-Champaign, "Transforming science, policy, and the power grid with high temperature superconductivity", Urbana, IL (May, 2008).
23. Cavendish Laboratory, Quantum Physics Seminar, Cambridge University, “Point contact Andreev reflection tunneling spectroscopy (PCARTS) of the pure and Cd-doped heavy fermion superconductor $CeCoIn_5$”, Cambridge, United Kingdom (May, 2008).
24. The 25th International Conference on Low-Temperature Physics (LT-25), “On the origin of the conductance asymmetry in $CeMIn_5$ (*M*=Co, Rh, Ir)”, (given by Wan Kyu Park), Amsterdam, Netherlands (August 6-13, 2008).
25. Strongly Correlated Electron Systems - SCES Conference, "Point contact Andreev reflection spectroscopy of the pure and doped “115” heavy-fermions: $CeMIn_5$ (M=Co, Rh, Ir)", Armação dos Buzios, Rio de Janeiro, Brazil (August, 2008).
26. The International Conference on Strongly Correlated Electron Systems, “Point contact Andreev reflection tunneling spectroscopy (PCARTS) of the pure and Cd-doped heavy fermion superconductor $CeCoIn_5$”, Búzios, Brazil (August 17-22, 2008).
27. Chancellor’s Center for Advanced Study Lecture (evening public lecture), University of Illinois at Urbana-Champaign, “High-temperature superconductors: From broken symmetries to the power grid”, Urbana, IL (November, 2008).
28. Department of Physics, Saturday Physics Honors Program (for high-school students in the area), University of Illinois at Urbana-Champaign, “Transforming science, policy, and the power grid with high temperature superconductivity”, Urbana, IL (November, 2008).
29. ICAM/I2CAM Annual Meeting, “New superconductors: Fe-Pnictide and related”, Cambridge, UK (January 11-13, 2009).
30. Physics@FOM Veldhoven 2009, Masterclass, “Tunneling and Andreev reflection unconventional superconductors”, Eindhoven, NL (January 21-23, 2009).
31. *Plenary Talk*, Physics@FOM Veldhoven 2009, “High-temperature superconductors: playgrounds for broken symmetries,” Eindhoven, NL (January 21-23, 2009).
32. Physics and Applied Physics Departments' Student Hosted Colloquium, Stanford University, “Andreev reflection in heavy fermion superconductors: focus on CeCoIn5”, Stanford, CA (February, 2009).
33. Public lecture, University of Michigan, “High-temperature superconductivity: from broken symmetries to the power grid”, Ann Arbor, MI (March, 2009).
34. Department of Physics Colloquium, University of Michigan, “Andreev reflection in heavy fermions”, Ann Arbor, MI (March, 2009).
35. Spring Diversity Recruitment Lecture, University of Illinois at Urbana-Champaign, “Superconductivity and the power grid”, Urbana, IL (April, 2009).
36. I2CAM Workshop on Emergent Quantum Phenomena from the Nano to the Macro World, “Overview of Fe-Pnictide and related superconductors”, Cargèse, France (July 6-18, 2009).
37. Lecturer (two lectures), “Tunneling in high-temperature superconductors” and “Point contact Andreev reflection spectroscopy in heavy-fermion superconductors” at the Summer School on Novel Superconductors, sponsored by the International Center for Materials Research (ICMR), University of California at Santa Barbara and the Graduate School of

Excellence in Materials Science, Mainz, August 2 -15, 2009, Santa Barbara, CA (August, 2009).

38. Kavli Institute for Theoretical Physics (KITP), University of California, Santa Barbara, “Andreev reflection in the heavy Fermion superconductor $CeCoIn_5$”, Santa Barbara, CA (August, 2009).
39. General Physics Colloquium, University of York, “High-temperature superconductors: From broken symmetries to the power grid”, York, UK, (September, 2009).
40. Center for Nano and Molecular Science, Public Lecture, The University of Texas, Austin, “High-temperature superconductors: From broken symmetries to the power grid”, Austin, TX (September 2009). Department of Physics, Colloquium, Trinity College and Cavendish Laboratory, Cambridge University, “Point Contact Spectroscopy of Strongly-Correlated Electron Systems,” Cambridge, United Kingdom (March, 2010).
41. March Meeting of the American Physical Society, Division of Materials Physics, “Superconductivity and Energy Research,” Portland, OR (March, 2010).
42. Department of Physics, Colloquium, University of Texas, “High-Temperatures Superconductivity and Energy Research,” Arlington, TX (March, 2010).
43. Department of Physics, Condensed Matter Seminar, Northwestern University, “Point Contact Spectroscopy of Strongly-Correlated Electron Materials: Andreev Reflection, Multiband Superconductivity, and Magnetism,” Evanston, IL (May, 2010).
44. Department of Physics, Special Seminar, Imperial College, “Point Contact Spectroscopy: Detecting Superconducting and Magnetic Phase Correlations,” London, United Kingdom (June, 2010).
45. Department of Physics, talk to REU and other undergraduate students, University of Illinois, “High-Temperature Superconductors: From Broken Symmetries to the Power Grid,” Urbana, IL (July, 2010).
46. AFOSR-MURI Review, “Status of the CES-EFRC: Materials, Mechanisms, and Critical Currents,” Washington, D.C. (August, 2010).
47. Trieste Miniworkshop on Strongly Correlated Matter, ICTP, “The Search for Innovative Avenues Towards Developing New Families of Superconducting Materials: Report from US Centers,” Trieste, Italy (August, 2010).
48. Department of Physics and Texas Center for Superconductivity, Colloquium, University of Texas, “High-Temperature Superconductors: From Broken Symmetries to the Power Grid,” Houston, TX (September, 2010).
49. TcSUH Special Seminar, University of Texas, “Point Contact Spectroscopy of Strongly Correlated Electron Materials: Andreev Reflection, Multiband Superconductivity, and Magnetism,” Houston, TX (September, 2010).
50. US/China Workshop on Noel Superconductors, “Recent results in the CES-EFRC: Materials, Mechanisms, and Critical Currents,” Beijing, China (September, 2010).
51. Department of Physics, Colloquium, California Institute of Technology, “High-Temperature Superconductivity: Emergent Phases, Broken Symmetries, and the Power Grid,” Pasadena, CA (October, 2010).

52. Department of Physics, Solid State Physics Seminar, California Institute of Technology, "Point Contact Spectroscopy of Strongly-Correlated Electron Materials: Andreev Reflection, Multiband Superconductivity, and Magnetism," Pasadena, CA (October, 2010).
53. Department of Physics, Colloquium, University of Chicago, "High-Temperature Superconductivity: Emergent Phases and the Power Grid," Chicago, IL (November, 2010).
54. CES-EFRC Fall Workshop, "Innovative Avenues for the Design of New Families of High-Temperature Superconductors / Materials Overview," Stony Brook, NY (November, 2010).
55. CES-EFRC Fall Workshop, "Point Contact Spectroscopy on Fe-Based and New Superconductors," Stony Brook, NY (November, 2010).
56. CES-EFRC Fall Workshop, "CES Outreach: Report interaction with AFOSR MURIs and the Chinese Academy of Sciences; The International ad-hoc group to search for new high-temperature superconductors; The status of the CES-directed International Conference M2S 2012; and The Status of the CES-edited Reports on Progress in Physics – Institute of Physics (RoPP-IoP, UK) Special Issue on Fe-based Superconductors," Stony Brook, NY (November, 2010).
57. *Plenary talk*, 4th Annual Midwest Conference for Undergraduate Women in Physics, Purdue University, "Emergent Behavior in Life and Lab: Building on Internal Competitions," Purdue, IN (January, 2011).
58. Department of Physics, Colloquium, North Carolina State University, "High-Temperature Superconductivity: Emergent Phases, Broken Symmetries, and the Power Grid," Raleigh, NC (January, 2011).
59. Annual Meeting of the American Association for the Advancement of Science, (with Zachary Fisk), "The Search for New Superconductors," Washington, D.C. (February, 2011).
60. March Meeting of the American Physical Society, "Research Opportunities in New Superconducting Materials," Dallas, TX (March, 2011).
61. Workshop for the 100th Anniversary of Superconductivity: Hot Topics and Future Directions, Lorentz Center, "Measurement of the Hybridization Gap in the Kondo Lattice URu_2Si_2," Leiden, NL (April, 2011).
62. Annual Meeting of the Institute for Complex and Adaptive Matter (ICAM), Special Session Celebrating the 100th Anniversary of Superconductivity, "Research Opportunities in New Superconducting Materials," Hangzhou, China (April, 2011).
63. 2011 Hangzhou Workshop, Quantum Matter – Unconventional Superconductivity and Electron Correlations, Zhejiang University, "Observation of the of the hybridization gap and Fano resonance in the heavy-fermion superconductor URu_2Si_2," Hangzhou, China (April, 2011).
64. Department of Physics, Colloquium, University of California, "High-Temperature Superconductivity: From Broken Symmetries to the Power Grid," Santa Cruz, CA (May, 2011).
65. Institute for Condensed Matter Theory (ICMT), Seminar on Disordered Materials, University of Illinois, "Detection of Orbital Ordering and Nematicity in Fe-based Superconductors by Point Contact Spectroscopy," Urbana, IL (May, 2011).

66. *Plenary talk*, Annual Meeting of the Advanced Materials Network (RQMP), "Research Opportunities in New Superconducting Materials," Montreal, Canada (May, 2011).
67. Department of Physics, Colloquium, University of California, "High-Temperature Superconductivity: Building from Serendipity," Irvine, CA (June, 2011).
68. Lecture to REU and summer undergraduate research students, University of Illinois, "Future Prospects in Superconductivity Materials Research," Urbana, IL (June, 2011).
69. *Plenary talk*, 1st Centennial of Superconductivity: Trends on Nanoscale Superconductivity and Magnetism International Workshop, "Design of New Superconducting Materials, and Point Contact Spectroscopy as a Probe of Strong Electron Correlations," Cali, Colombia (June, 2011).
70. *Plenary talk*, 7th International Conference on Stripes and High Tc Superconductivity, Sapienza University, "Advances in Tunneling and Andreev Reflections in Novel Superconductors," Rome, Italy (July, 2011).
71. A New Century of Superconductivity: Iron Pnictides and Beyond Workshop, Aspen Center for Physics, "Detecting "normal-state" Electronic Order with Point Contact Spectroscopy: Heavy-fermions and Underdoped Iron-based Superconductors," Aspen, CO (July, 2011).
72. 26th International Conference on Low Temperature Physics, "Point Contact Spectroscopy in Fe-Pnictides and Fe-Chalcogenides: Detecting Hidden Order," Beijing, China (August, 2011) (given by student Hamood Arham).
73. 26th International Conference on Low Temperature Physics, "Direct Measurement of the Fano Resonance and Hybridization Gap in URu_2Si_2 with Quasiparticle Scattering Spectroscopy," Beijing, China (August, 2011).
74. *Plenary talk*, International Conference on Strongly Correlated Electron Systems, "Superconductivity as an Energy Carrier," Cambridge, United Kingdom (September, 2011).
75. Department of Physics, Colloquium, Temple University, "High-Temperature Superconductivity: Taming Serendipity," Philadelphia, PA (October, 2011).
76. Department of Physics, Condensed Matter Seminar, Temple University, "Point Contact Spectroscopy in Strongly-correlated Electron Materials," Philadelphia, PA (October, 2011).
77. Physics at the Nanoscale, Ivan Schuller Festschrift, "New Superconducting Materials Research – International Pursuits with Ivan," Madrid, Spain (October, 2011).
78. Department of Physics, Colloquium, Boston University, "High-Temperature Superconductivity: Taming Serendipity," Boston, MA (November, 2011).
79. Department of Physics, Colloquium, Northeastern University, "High-Temperature Superconductivity: Taming Serendipity," Boston, MA (November, 2011).
80. Department of Physics, Saturday Physics Honors Program (for high-school students in the area), University of Illinois, "Transforming Science, Policy, and the Power Grid with High Temperatures Superconductivity," Urbana, IL (November, 2011).
81. Department of Physics, Condensed Matter Seminar, University of Illinois, "Detecting Strong Correlations with Quasiparticle Scattering Spectroscopy," Urbana, IL (November, 2011).
82. Department of Physics, Colloquium, University of Connecticut, "High-Temperature Superconductivity: Taming Serendipity," Stores, CT (December, 2011).

83. China/US Superconductivity Workshop, "Superconducting Materials Research at the Center for Emergent Superconductivity," Santa Barbara, CA (December, 2011).
84. 5th Annual Midwest Women in Physics Conference, Case Western Reserve University, "High-Temperature Superconductivity: Taming Serendipity," Cleveland, OH (January, 2012).
85. Departments of Physics, Electrical Engineering, and Chemistry combined Seminar, Boston University, "Detection of Orbital Fluctuations above the Structural Transition in the Iron Pnictides and Chalcogenides by Quasiparticle Scattering Spectroscopy," Boston, MA (February, 2012).
86. March Meeting of the American Physical Society, Division of Materials Physics, "Towards the Design of new High-Temperature Superconductors for Renewable Energy," Boston, MA (February, 2012).
87. Department of Physics, Condensed Matter Seminar, City College of New York, "Detection of Orbital Fluctuations above the Structural Transition in the Iron Pnictides and Chalcogenides by Quasiparticle Scattering Spectroscopy," New York, NY (March, 2012).
88. Department of Physics, Colloquium, City College of New York, "High-Temperature Superconductivity: Taming Serendipity," New York, NY (March, 2012).
89. ADVANCE-STEM Lecture, Texas A&M University, "And, I am a Materials Girl, and this is a Materials World" (with apologies to Madonna), College Station, TX (March, 2012).
90. Department of Physics, Colloquium, Texas A&M University, "High-Temperature Superconductivity: Taming Serendipity," College Station, TX (March, 2012).
91. Optical Sciences, Colloquium, University of Arizona, "High-Temperature Superconductivity: Taming Serendipity," Tucson, AZ (April, 2012).
92. Department of Physics, Colloquium, Rice University, "High-Temperature Superconductivity: Taming Serendipity," Houston, TX (April, 2012).
93. Department of Physics, Condensed Matter Seminar, Rice University, "Detecting Electronic Order with Quasiparticle Scattering Spectroscopy: Hybridization Gap and Fano Resonance in a Heavy Fermion and Orbital Ordering in Fe-based Superconductors," Houston, TX (April, 2012).
94. Department of Physics, Condensed Matter Seminar, Imperial College, "Detection of Orbital Fluctuations above the Structural Transition in the Iron Pnictides and Chalcogenides by Quasiparticle Scattering Spectroscopy," London, United Kingdom (April, 2012).
95. Brazilian Condensed Matter Physics Annual Meeting, "High-Temperature Superconductivity: Taming Serendipity," Aguas de Lindoia, Brazil (May, 2012).
96. Department of Physics, Colloquium, University of California, "High-Temperature Superconductivity: Taming Serendipity," Davis, CA (June, 2012)
97. International Conference on Magnetism, "Detection of Orbital Ordering Fluctuations in the Fe-based Superconductors by Quasiparticle Scattering Spectroscopy," Bexco, Busan, Korea (July, 2012).
98. Public Lecture for the Physics Summer School for Outstanding Students in Basic Sciences, Zhejiang University, "High-Temperature Superconductivity: Taming Serendipity," Hangzhou, China (July, 2012).

99. Physics Summer School for Outstanding Students in Basic Sciences, Zhejiang University, "Planar Tunneling and Andreev Reflection Spectroscopies: Powerful Probes of Broken Symmetries and the Superconducting Order Parameter," Hangzhou, China (July, 2012).
100. Physics Summer School for Outstanding Students in Basic Sciences, Zhejiang University, "Detection of Novel Electron Order in Heavy Fermions and Fe chalcogenides and Pnictides with Point Contact Spectroscopy," Hangzhou, China (July, 2012).
101. Lecture to summer REU students, University of Illinois, "Why Electron Matter Matters," Urbana, IL (July, 2012).
102. International Conference on Quantum Criticality and Novel Phases, "Detection of the Hybridization Gap and Fano Resonance in the Kondo Lattice URu_2Si_2," Dresden, Germany (August, 2012).
103. Department of Physics, Condensed Matter Seminar, Eidgenössische Technische Hochschule (ETH), "Detecting Electronic Order with Quasiparticle Scattering Spectroscopy: Hybridization Gap and Fano Resonance in a Heavy Fermion and Orbital Ordering in Fe-based Superconductors," Zürich, Switzerland (October, 2012).
104. Department of Physics, Colloquium, Eidgenössische Technische Hochschule (ETH), "High-Temperature Superconductivity: Taming Serendipity," Zürich, Switzerland (October, 2012).
105. Dasan Conference on Superconductivity, "Superconductivity as an Energy Carrier," Jeju Island, Korea (November, 2012).
106. Department of Physics, Condensed Matter Seminar, University of Maryland, "Detecting Orbital Ordering and Other States of Electron Matter with Point Contact Spectroscopy," College Park, MD (November, 2012).
107. *Plenary talk*, 5th Annual Meeting on Undergraduate Women in Physics, Midwest Section, "Searching Outside the Known Paths: Andreev Bound States, Broken Time Reversal Symmetry, and Electron Matter," Urbana, IL (January, 2013).
108. Winter School for High-Temperature Superconductivity, "Guiding Platforms for the Search for New and Practical High Temperature Superconductors at the Center for Emergent Superconductivity, and How Point Contact Spectroscopy Helps," Hong Kong (January, 2013).
109. AFOSR MURI-China Workshop, "Status of the Search for Practical New Superconductors at the Center for Emergent Superconductivity," Hong Kong (January, 2013).
110. Department of Physics, Colloquium, California State University, "High-Temperature Superconductivity: Taming Serendipity," Long Beach, CA (February, 2013).
111. Department of Physics, Condensed Matter Seminar, University of Pittsburgh, "Detecting Orbital Ordering and Other States of Electron Matter with Quasiparticle Scattering Spectroscopy," Pittsburgh, PA (February, 2013).
112. Department of Physics, Colloquium, University of Pittsburgh, "High-temperature Superconductivity: Taming Serendipity," Pittsburgh, PA (February, 2013).

TAYLOR L. HUGHES

1. APS March Meeting, "Topological Insulator Magnetic Tunnel Junctions: Quantum Hall Effect and Fractional Charge Via Folding," Boston, MA (February, 2012).

2. Mini-Workshop on Topological Insulators and Superconductors, Stanford University, "Interplay Between Magnetism, Superconductivity, and Spin-Orbit Coupling in Topological Insulators," Stanford, CA (April, 2012).
3. Workshop on Innovative Nanoscale Devices and Systems, "Topological Phenomena in Doped Topological Insulators," Kohala Coast, HI (December, 2012).
4. BIRS Workshop: Topological Phenomena in Quantum Dynamics and Disordered Systems, "Torsional anomalies and viscosity response in topological insulators", Banff, Alberta (February, 2013).
5. Mini-Workshop on Topological Insualtors and Superconductors in Honor of S.C. Zhang 50^{th} Birthday, "Torsional anomalies and viscosity response in topological insulators," Monterey, CA (March, 2013).
6. Condensed Matter Seminar at California Institute of Technology, "Topological Viscosity Response due to Torsion and the bulk-boundary correspondence," Pasadena, CA (June, 2013).
7. International Symposium on Advanced Nanodevices and Nanotechnology, "Electronic Properties and Response of Topological Semi-Metals in Bulk and Low-Dimensional Materials," Koloa, HI (December, 2013).

ANTHONY LEGGETT

1. University of Delhi, "Testing the limits of quantum mechanics: Motivation, state of play, prospects", Delhi, India (January, 2007).
2. University of Delhi, "Does the everyday world really obey QM?" Delhi, India (January, 2007).
3. University of Kolkata, "What can we do with a quantum liquid?" Kolkata, India (January, 2007).
4. University of Mumbai, "Introduction to high energy low temperature physics", Mumbai, India (January, 2007).
5. Chennai, "What can we do with a quantum liquid?" Chennai, India (January, 2007).
6. IIT Kharagpur, "Superfluidity, phase coherence and the new Bose-condensed alkali gases", Kharagpur, India (January, 2007).
7. Perimeter Institute for Theoretical Physics, panel on "Information and Reality", (December, 2007).
8. Department of Physics, Annual Donald B. Hamister Distinguished Lecture in Physics, Kenyon College, "Does the everyday world really obey quantum mechanics?" Gambier, OH (February, 2007).
9. Ahronov Lecture Series and the Public Lecture on Quantum Theories, George Mason University, "Does everyday world really obey quantum mechanics," Fairfax, VA (February, 2007).
10. University of Texas, "Does the everyday world really obey QM?" Dallas, TX (March, 2007).
11. University of Maryland, "Condensed matter physics and quantum information: Their mutual impact," (March, 2007).

12. Department of Physics, The BCS Theory of Superconductivity – 50 Years, Brown University, "BCS theory applied to 3-He", Providence, RI (April, 2007).
13. Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilians-Universitaet Muenchen, "Bell's theorem, entanglement, quantum teleportation and all that", Munich, Germany (April, 2007).
14. Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilians-Universitaet Muenchen, "Superfluidity, phase coherence and the new Bose-condensed alkali gases", Munich, Germany (April, 2007).
15. Arnold Sommerfeld Center for Theoretical Physics, Ludwig-Maximilians-Universitaet Muenchen, "Testing the limits of quantum mechanics: motivation, state of play, prospects", Munich, Germany (April, 2007).
16. University of Missouri, "Testing the limits of quantum mechanics: Motivation, state of play, prospects", Columbia, MO (April, 2007).
17. Institute Henri Poncare, Paris, "Fundamental concepts of many-body physics," Paris, France (April-May, 2007).
18. Institute for Quantum Computing, University of Waterloo, 6 Lectures on "Condensed matter systems possibly relevant to quantum computing", (May-June, 2007).
19. Ideacity, "Quantum information: from ethereal abstraction to hard-nosed application", Toronto, Canada (June, 2007).
20. Workshop on Fault-Tolerant Quantum Computation, Perimeter Institute for Theoretical Physics, (June, 2007).
21. Department of Physics, Fifty Years of Condensed Matter Physics: A Symposium on the Occasion of Vinay Ambegaokar's Retirement, Cornell University, "Macroscopic quantum coherence in the 60's and today", Ithaca, NY (June, 2007).
22. *Plenary Talk*, 2007 CAP Congress, Canadian Association of Physicists, "Testing the limits of quantum mechanics: Motivation, state of play, prospects", Saskatoon, SK, Canada (June, 2007).
23. University of Illinois at Urbana-Champaign, "Plato's Timaeus: Resonances in modern physics and cosmology", Urbana, IL (September, 2007).
24. Gordon Research Conference, discussion leader, "BCS at the frontier", Les Diablerets, Switzerland (September, 2007).
25. University of Maryland East Shore, "Why can't time run backwards?" Princess Ann, MD (October, 2007).
26. BCS@50, Department of Physics, University of Illinois at Urbana-Champaign, " Application of BCS-like ideas to superfluid helium-3", Urbana, IL (October, 2007).
27. Cornell University, "Testing the limits of quantum mechanics: Motivation, state of play, prospects", Ithaca, NY (November, 2007).
28. The Frank Batten College of Engineering and Technology, Public Lecture, Old Dominion University, "What can we do with a quantum liquid?" Norfolk, VA (November, 2007).
29. Arizona State University, "Quantum coherence in complex environments," Tempe, AZ (December, 2007).
30. Kavli Institute for Theoretical Physics, University of California at Santa Barbara, "Thoughts on Sr_2RuO_4", Santa Barbara, CA (December, 2007).

31. Symposium on Information and Relativity, Perimeter Institute, Waterloo, Ontario (December, 2007).
32. Workshop on Frontiers in Nanoscale Science and Engineering, Basel Center for Quantum Computing and Quantum Coherence and the Nanoscale Science and Engineering Center (Harvard), "Meso-and macroscopic qubits: Why are they so surprisingly coherent?" Basel, Switzerland (January, 2008).
33. 9th International Symposium on the Frontiers of Fundamental Physics, University of Udine and International Center for Theoretical Physics, "Is quantum mechanics the whole truth?" Udine, Italy (January, 2008).
34. University of California-Santa Cruz, "Superfluidity, phase coherence and the new Bose-condensed alkali gases", Santa Cruz, CA (February, 2008).
35. California Institute of Technology, "Testing the limits of quantum mechanics: motivation, state of play, prospects", Pasadena, CA (February, 2008).
36. Gordon Research Conference, "Mesomechanical systems as testbeds for the foundations of quantum mechanics", Ventura, CA (February, 2008).
37. Department of Physics, Knight Lecture, University of Manitoba, “Why can’t time run backwards?” Manitoba, Canada (February, 2008).
38. Department of Physics, Colloquium, University of Manitoba, "Bell's theorem, entanglement, teleportation, quantum cryptography, quantum computing and all that", Manitoba, Canada (February, 2008).
39. Fermi National Laboratory, Fermilab Colloquium, "Bell's theorem, entanglement, teleportation, quantum cryptography, quantum computing and all that", Batavia, IL (March, 2008).
40. Universidad Complutense, “Why can’t time run backwards?” Madrid, Spain (March, 2008).
41. Universidad Complutense, “Superfluid 3-He: The early days as seen by a theorist”, Madrid, Spain (March, 2008).
42. Universite Federale Polytechnique de Lausanne, Switzerland, course (12-15 hours) in "3eme cycle de Physique en Suisse Romande" on "Superconducting Qubits" Lausanne, Switzerland (April, 2008).
43. CERN (European Organization for Nuclear Research), “What can we do with a quantum liquid?” Geneva, Switzerland (April, 2008).
44. Universite de Fribourg, “Bell’s theorem, entanglement, teleportation, quantum cryptography, quantum computing and all that”, Fribourg, Switzerland (April, 2008).
45. Langton Star Centre, “What can we do with a quantum liquid?” Canterbury, UK (April, 2008).
46. Magdalen College, “Does the everyday world really obey quantum mechanics?” Oxford, UK (April, 2008).
47. University of St. Andrews, “Superfluidity, phase coherence and the new Bose-condensed alkali gases”, Fife, Scotland (April, 2008).
48. University of Edinburgh, “Introduction to high-energy low-temperature physics”, Edinburgh, Scotland (April, 2008).
49. Keio University, "An unusual route to the Nobel prize", Tokyo, Japan (April, 2008).

50. University of Waterloo, Institute for Quantum Computing, course of eight lectures on “Prospects for topological quantum computation”, Waterloo, Canada (June-July, 2008).
51. CIFAR Quantum Information Project Program Meeting, "Noise, fluctuations and decoherence: A very elementary introduction", Montreal, Canada (July, 2008).
52. Nanyang Technological University Summer School, three lectures on "Introduction to superconducting qubits", Singapore (August, 2008).
53. IIITA, commencement speech, Allahabad, India (August, 2008).
54. University of Illinois at Urbana-Champaign, Institute for Condensed Matter Theory, Urbana-Champaign, IL (September, 2008).
55. University of Rochester, “Introduction to high-energy low-temperature physics”, Rochester, NY (September, 2008).
56. University of Rochester, “Why can’t time run backwards?” Rochester, NY (September, 2008).
57. Department of Physics and Astronomy, The Elliott W. Montroll Lecture-Physics & Astronomy Colloquium, University of Rochester, “Testing the limits of quantum mechanics: motivation, state of play, prospects”, Rochester, NY (September, 2008).
58. NKS workshop, Indiana University, “Does the everyday world really obey quantum mechanics?” Bloomington, Indiana (November, 2008).
59. Workshop in celebration of 80th birthday of A.A.Abrikosov, Argonne National Laboratory, "Excitations on half-quantum vortices in (p+ip) Fermi superfluids", Argonne, IL (November, 2008).
60. Illinois Institute of Technology, “Bell’s theorem, entanglement, teleportation, quantum cryptography, quantum computing and all that”, Chicago, IL (November, 2008).
61. Arizona State University, "Is quantum mechanics the whole truth? What do existing experiments (not) tell us?" Tempe, Arizona (December, 2008).
62. Academia Sinica, “What can we do with a quantum liquid?” Taipei, Republic of China (January, 2009).
63. Academia Sinica, “Cuprate superconductivity without a ‘model’”, Taipei, Republic of China (January, 2009).
64. Academia Sinica, “Why can’t time run backwards?” Taipei, Republic of China (January, 2009).
65. Academia Sinica, “Bell’s theorem, entangelement, teleportation, quantum cryptography, quantum computing and all that”, Taipei, Republic of China (January, 2009).
66. First Workshop on Quantum Effects in Biological Systems, Centre for Quantum Technologies and National University of Singapore, "Quantum effects in biology: How severe are the constraints imposed by decoherence considerations?" Singapore (January, 2009).
67. NTT2009 Conference, “Some thoughts on the prospects for topological quantum computing”, San Jose, CA (January, 2009).
68. UK-Japan Quantum Information Workshop, “Some thoughts on the prospects for topological quantum computing”, Tokyo, Japan (January, 2009).

69. RIKEN, “Some thoughts on the prospects for topological quantum computing”, Wako-shi, Japan (January, 2009).
70. Tokyo University, “Cuprate superconductivity without a ‘model’”, Tokyo, Japan (January, 2009).
71. Department of Physics, University of California-Los Angeles, “Bell’s theorem, entanglement, teleportation, quantum cryptography, quantum computing and all that”, Los Angeles, CA (February, 2009).
72. Princeton University, “Some thoughts on the prospects for topological quantum computing”, Princeton, NJ (February, 2009).
73. Fysiikan Paivat ("Physics Days" of Finnish Physical Society), "Testing quantum mechanics towards the level of everyday life: Recent progress and current prospects", Otaniemi, Espoo, Finland (March, 2009).
74. Helsinki Technical University, “Some thoughts on the prospects for topological quantum computing”, Helsinki, Finland (March, 2009).
75. Institute for Quantum Optics and Quantum Information, “Some thoughts on the prospects for topological quantum computing”, Vienna, Austria (March, 2009).
76. University of Ulm, “Testing the limits of quantum mechanics: Motivation, state of play, prospects”, Ulm, Germany (March, 2009).
77. University of Heidelberg, Hans Jensen Lecture, “Testing the limits of quantum mechanics: Motivation, state of play, prospects”, Heidelberg, Germany, (March, 2009).
78. ICTP, Trieste, “Some conceptual problems in Bose-condensed systems”, Trieste, Italy (May 2009).
79. Institute for Quantum Computing, (course of 8 lectures), “Prospects for topological quantum computing”, Waterloo, Ontario (June-July 2009).
80. National University of Singapore, “Prospects for topological quantum computing”, Singapore (August 2009).
81. Los Alamos National Laboratory, “Superfluidity, phase coherence and the new Bose-condensed alkali gases”, Los Alamos, NM (September 2009).
82. University of Central Florida, “Superfluidity, phase coherence and the new Bose-condensed alkali gases”, Orlando, FL (October 2009).
83. University of Central Florida, “Does the everyday world really obey quantum mechanics?” Orlando, FL (October 2009).
84. University of St. Andrews, (minicourse of 4 lectures), “Introduction to topological quantum computing”, St. Andrews, Fife, Scotland (November 2009).
85. University of Chicago, “Bell’s theorem, entanglement, quantum teleportation and all that”, Chicago, IL (December 2009). University of Western Ontario, “Cuprate Superconductivity: The Current State of Play, Does the Every Day World Really Obey Quantum Mechanics?,” Ontario, Canada (March, 2011).
86. DPG Annual Meeting, “What is Realism in Physics? What is the Price for Maintaining it?,” Dresden, Germany (March, 2011).
87. University of Vienna, “Schroedinger's Cat and Her Laboratory Cousins,” Vienna, Austria (March, 2011).

88. APS March Meeting, "Theoretical Work on Superconductivity up to 1956," Dallas, TX (March, 2011).
89. CIFAR Winter School, "Introduction to Topological Quantum Computing," Canada (April, 2011).
90. University of Tokyo, Address to Entering Graduate Students, Tokyo, Japan (April, 2011).
91. Universite Paul Sabatier, "Exotic Superconductivity (8 lectures)," Toulouse, France (April, 2011).
92. QDNS '12 Workshop in Celebration of Uli Eckern's 60th birthday, "Quantum Dissipation: What Can and Can't be Done with Oscillator Baths," Augsburg, Germany (April, 2012).
93. International Symposium on Topological Quantum Phenomena (TQP), "Some Remarks about Majorana Fermions and Their Use in Topological Quantum Computing," Nagoya, Japan (May, 2012).
94. University of Tokyo, "Physics in Two Dimensions (8 lectures)," Tokyo, Japan (May, 2012).
95. YA Fest 2012, "Macrorealism, Noninvasiveness and Weak Measurement," Easton, PA (August, 2012).
96. Quantum Foundations Symposium, Joint Quantum Institute, University of Maryland, "Quantum Mechanics in the Macroscopic Limit: What Do Recent Experiments Tell Us?," Baltimore, MD (October, 2012).
97. Horizons of Quantum Physics, "Quantum Mechanics in the Macroscopic Limit: What do Recent Experiments Tell Us?," Taipei, Taiwan (October, 2012).

GREGORY MACDOUGALL

1. Snowmass on the Mississippi, University of Minnesota, "Broader Impacts of Project X at FermiLab: μSR," Minneapolis, MN (July, 2013).
2. Joint Neutron and Nano User Meeting, Oak Ridge National Laboratory, "Magnetic Order and Excitations in Spinel FeV_2O_4," Oak Ridge, TN (August,2013).
3. Condensed Matter Seminar, University of Tennessee, "Muons as a Probe of Condensed Matter: A Powerful Complement to Neutron Scattering," Knoxville, TN (October, 2013).
4. Condensed Matter Seminar, University of Kentucky, "Orbital and Spin Magnetism in the Spinel-Vanadate, FeV_2O_4," Lexington, KY (October, 2013).
5. Workshop on Quantum Condensed Matter, Lawrence Berkeley National Laboratory, "Complementarity of Neutron Scattering and μSR: a 10-year Outlook," Berkeley, CA (December, 2013).

LANE W. MARTIN

1. Towards Strain 2.0 – Coupling Epitaxy and Defect Structures to Enable Colossal Strain, Materials Research Society Spring Meeting (Apr. 2014, San Francisco, CA).
2. Effect of Growth Induced (Non)Stoichiometry on Interfacial Conductance in $LaAlO_3/SrTiO_3$, American Physical Society March Meeting 2014 (March 2014, Denver, CO).

3. Light-Absorption, Photovoltaic Effects, and Photocatalytic Activity in "Metallic" Oxide Heterostructures, International Conference on Hydrogen Production 2014 (Feb. 2014, Fukuoka, Japan).
4. The Science and Engineering of Functional Complex Oxide Thin Films, Department of Physics Colloquium, Indiana University (Jan. 2014, Bloomington, IN).
5. Next Generation Energy Materials: Challenges in Controlling Complex Oxides for Advanced Applications, International Conference on Processing and Manufacturing of Advanced Materials, THERMEC' 2013 (Dec. 2013, Las Vegas).
6. Epitaxial Strain in Functional Oxide Thin Films Version 2.0: Engineering Strain Gradients, Materials Research Society Fall Meeting (Dec. 2013, Boston, MA).
7. The Science and Engineering of Functional Complex Oxide Thin Films, School of Applied and Engineering Sciences Colloquium, Harvard University (Oct. 2013, Cambridge, MA).
8. The Science and Engineering of Functional Complex Oxide Thin Films, Department of Physics, University of Nebraska, Lincoln (Oct. 2013, Lincoln, NE)
9. The Science and Engineering of Functional Complex Oxide Thin Films, Department of Materials Science and Engineering Seminar, Drexel University (Aug. 2013, Philadelphia, PA).
10. The Science and Engineering of Functional Complex Oxide Thin Films, Department of Materials Science and Engineering Colloquium, University of Illinois, Urbana-Champaign (Aug. 2013).
11. The Science and Engineering of Magneto-Electro-Thermal Responses of Materials, International Conference & Exhibition on Advanced & Nano Materials (ICANM 2013), NSF Professional Development Workshop (Aug. 2013, Quebec, Canada).
12. Flexoelectric Effects in Compositionally Graded Ferroelectric Thin Films – Towards Strain 2.0, IEEE International Symposium on Applications of Ferroelectrics Meeting (July 2013, Prague, Czech Republic).
13. Surfaces and Interfaces in Complex Oxide Electronics, Physical Electronics Conference 2013 (June 2013, Raleigh, NC).
14. Probing and Controlling Thermal-Electrical Responses in Exotic Ferroelectric Thin Films, Department of Physics Colloquium, West Virginia University (April 2013, Morgantown, WV).
15. Fundamentals of Complex Oxide Thin-Film Growth and Characterization, Invited Tutorial, American Physical Society March Meeting 2013 (March 2013, Baltimore, MD).
16. Domain Structures and Switching in Ferroelectric Thin Films, 12th International Workshop on Piezoresponse Force Microscopy and Nanoscale Electromechanics: Theory, Techniques, and Applications, Oak Ridge National Laboratory (March 2013, Oak Ridge, TN).
17. "Mining" Existing Materials for Useful Functionalities – A Material Maker's Perspective, National Science Foundation, Materials By Design II Workshop (Feb. 2013, Arlington, VA).
18. The Science and Engineering of Thermal-Electrical Responses of Materials, Department of Materials Science and Engineering Colloquium, University of California, Berkeley (Feb. 2013, Berkeley, CA).

19. Enhanced Photocatalysis from Anomalous Light Absorption in the Correlated Oxide Metal $SrRuO_3$, Materials Research Society Fall Meeting (Dec. 2012, Boston, MA).
20. Unraveling Chemical Complexity at Complex Oxide Heterointerfaces – A Case Study of $LaAlO_3/SrTiO_3$, 8th Annual Minnesota Nanotechnology Workshop (Nov. 2012, Minneapolis, MN).
21. Understanding the Evolution of Complex Phase Structures in Highly-Strained $BiFeO_3$ Thin Films, Royal Society of London, Kavli Center Meeting on Magnetoelectrics (Sept. 2012, Milton Keynes, England).
22. Next Generation Energy Materials: Challenges in Controlling Complex Oxides for Advanced Applications, AVS Prairie Chapter, Materials for Energy Meeting (Sept. 2012, Urbana, IL) [Plenary].
23. Engineering New Phenomena and Functionality in Complex Oxide Thin Film Heterostructures, SPIE Nanoscience + Engineering, Nanoepitaxy: Materials and Devices (Aug. 2012, San Diego, CA).
24. Unraveling the Complex Phase Evolution in Highly-Strained $BiFeO_3$ Thin Films: Thickness, Temperature, and Chemical-Alloying Evolution, Villa Conference on Complex Oxide Heterostructures (April 2012, Orlando, FL).
25. Nano-scale Pyro-Electro-Mechanical Electron Source, Extensible X-Ray Systems and Algorithms for Computed Tomography (EXACT), DARPA/MTO Workshop (April 2012, San Deigo, CA).
26. Enhanced Thermal-Electrical Responses in Ferroelectric Thin Films, Département de Physique de la Matière Condensée Colloquium, Université de Genève (March 2012, Geneva, Switzerland).
27. Engineering Thermal-Electrical Responses in Complex Oxides: Enhanced Dielectric and Pyroelectric Response in Epitaxially Strained Ferroelectric Thin Films, Department of Materials Science and Engineering Colloquium, University of Michigan (Jan. 2012, Ann Arbor, MI).
28. Engineering Functional Composites: Large Electromechanical Responses in Highly-Strained $BiFeO_3$ Thin Films, Composites at Lake Louise (Oct. 2011, Lake Louise, Alberta, Canada).
29. Engineering New Functionalities in Materials: Large Electromechanical Responses in Highly-Strained $BiFeO_3$ Thin Films, Materials Science and Technology 2011 (Oct. 2011, Columbus, OH).
30. Engineering Thermal Properties and Response of Epitaxial Oxide Thin Films for Advanced Devices, Workshop on Oxide Electronics (Sept. 2011, Napa, CA).
31. Understanding and Manipulating Defects in Complex Oxide Materials – Implications for Properties and Devices, HP Labs Colloquium (Sept. 2011, Palo Alto, CA).
32. Engineering Thermal-Electrical Responses in Complex Oxides: Enhanced Dielectric and Pyroelectric Response in Epitaxially Strained Ferroelectric Thin Films, Department of Materials Science and Engineering Colloquium, University of California, Berkeley (Sept. 2011, Berkeley, CA).

33. Engineering New Functionalities in Materials: Complex Oxide Thin Films and Nanostructures for Next Generation Devices, CNST Annual Nanotechnology and nPEAP Workshop (May 2011, Urbana, IL).
34. Oxide Thin Films for Pyroelectric Energy Conversion, DoD Interagency Advanced Power Group Meeting (May 2011, Washington, D.C.).
35. Pathway for Enhanced Electromechanical Response via Strain Engineering in Multiferroic $BiFeO_3$ Thin Films, Villa Conference on Complex Oxide Heterostructures (April 2011, Las Vegas, NV).
36. Engineering New Functionalities in Materials: Complex Oxides for Multiferroics, Energy, and Beyond, Department of Materials Science and Engineering Colloquium, North Carolina State University (Feb. 2011, Raleigh, NC).
37. Engineering New Functionalities in Materials: Complex Oxides for Multiferroics, Energy, and Beyond, Frederick Seitz Materials Research Laboratory Colloquium Series (Feb. 2011, Urbana, IL)
38. Functional Complex Oxide Heterostructures for Energy Conversion, Electronic Materials and Applications 2011, American Ceramic Society (Jan. 2011, Orlando, FL).
39. Engineering New Functionalities in Materials: Complex Oxides for Multiferroics, Energy, and Beyond, Department of Materials Science and Engineering Colloquium, Stanford University (Nov. 2010, Palo Alto, CA).
40. Multiferroic Heterostructures for Novel Functionalities, Materials Science and Technology 2010 (Oct. 2010, Houston, TX).
41. Oxide Materials for Energy Applications, 2010 Gordon Conference in Solid State Studies in Ceramics (Aug. 2010, New London, NH).
42. Understanding and Controlling Defects in $BiFeO_3$, Argonne National Laboratory Workshop on the Analysis and Control of Defects in Complex Oxides (July 2010, Argonne, IL).
43. Multifunctional Composites – Engineering New Functionalities with Multiferroics, Composites at Lake Louise (Oct. 2009, Lake Louise, Alberta, Canada) [Plenary].

NADYA MASON

1. Nanoelectronics at the Center for Nanomaterials Workshop, Argonne National Laboratory, "Correlated electronics in carbon nanotubes", Argonne, IL (May, 2007).
2. Quantum Phenomena in Confined Dimensions Conference, "Quantum phenomena in carbon nanotubes", Trieste, Italy (June, 2007).
3. Osher Lifelong Learning Institute, Seminar, University of Illinois at Urbana-Champaign, "The nanoworld", Urbana, IL (September, 2008).
4. Department of Physics, Seminar, Yale University, "Probing electrons in carbon nanotubes", New Haven, CT, (October, 2008).
5. Department of Physics, Colloquium, Vanderbilt University, "Nanotubes and the electronics of small-scale structures", Nashville, TN (December, 2008).
6. Department of Physics, Seminar, Ohio State University, "Probing electrons in carbon nanotubes", Columbus, OH (January, 2009).

7. Department of Physics and Chemistry, Colloquium, Eastern Illinois University, “Nanotubes and the electronics of small-scale structures”, Charleston, IL (March, 2009).
8. Department of Physics, Colloquium, Ohio University, “Probing electrons in carbon nanotubes”, Athens, OH (April, 2009).
9. Workshop on Emergent Phenomena from the Nano to the Macro World, "Superconducting tunneling in carbon nanotubes", Cargese, Corsica (July 2009).
10. Workshop on Quantum Materials at the Nanoscale, Materials Research Laboratory, University of Illinois at Urbana-Champaign, “Nonequilibrium tunneling spectroscopy of carbon nanotubes”, Urbana, IL (September 2009).
11. *Invited Award Talk*, Anita Borg Conference, “Life and research in the academy”, Tucson AZ (October 2009).
12. Department of Physics, Colloquium, University of Alberta, “Nanotubes and the electronics of small-scale structures”, Edmonton, Canada (November 2009).
13. Department of Physics, Colloquium, University of California at Riverside, “Probing electrons in carbon nanostructures”, Riverside, CA (January 2010). Department of Physics, Colloquium, University of California at Riverside, “Probing Electrons in Carbon Nanostructures,” Riverside, CA (January 2010).
14. *Invited session*, APS March Meeting, “Superconducting Tunneling Spectroscopy in Carbon Nanotubes,” Portland, OR (March 2010).
15. AAPT Chicago Section Meeting, Chicago State University, “Over the Moon with Carbon Nanotubes,” Chicago IL (April 2010).
16. Center for Nanoscale Science and Technology Annual Workshop, “Probing Carbon Nanostructures using Superconductors – and Vice-Versa,” Urbana, IL (May 2010).
17. Aspen Center for Physics, “Spectroscopy of Hybrid Superconductor-Carbon Nanostructure Systems,” Aspen, CO (August 2010).
18. Midwest Solid State Conference, “Transport through Andreev Bound States in a Graphene Quantum Dot,” Norman, OK (October 2010).
19. Department of Physics, Seminar, University of Kentucky, “Transport through Andreev Bound States in a Graphene Quantum Dot,” Lexington, KY (November 2010).
20. Workshop on Superconductor-Insulator Transitions, “Dissipation and Proximity Effects in Nanostructured Superconductors,” Argonne, IL (November 2010).
21. Department of Physics, Seminar, University of Illinois, “Transport through Andreev Bound States in a Graphene Quantum Dot,” Urbana, IL (December 2010).
22. Workshop on Quantum Dynamics in Nanoscale Heterostructures, “Transport through Andreev Bound States in a Graphene Quantum Dot,” Konstanz, Germany (December 2010).
23. Department of Physics, Seminar, Purdue University, “Transport through Andreev Bound States in a Graphene Quantum Dot,” West Lafayette, IN (January 2011).
24. Department of Physics, Seminar, Michigan State, “Transport through Andreev Bound States in a Graphene Quantum Dot,” East Lansing, MI (January 2011).
25. Department of Physics, Seminar, Stanford University, “Transport through Andreev Bound States in a Graphene Quantum Dot,” Palo Alto, CA (February 2011).

26. Departments of Physics and Chemistry, Colloquium, Albion College, "Superconductivity in Graphene," Albion, MI (March 2011).
27. Department of Physics, Seminar, University of Texas, "Transport through Andreev Bound States in a Graphene Quantum Dot," Austin, TX (April 2011).
28. Workshop on Superconducting Hybrids, "Transport through Andreev Bound States in a Graphene Quantum Dot," Villard de Lans, France (September 2011).
29. National Conference of Black and Hispanic Physicists, "Using Graphene to Study Superconductivity," Austin, TX (September 2011).
30. Department of Physics, Seminar, University of California, "Transport through Andreev Bound States in a Superconductor-Quantum Dot-Graphene System," Berkeley, CA (October 2011).
31. Department of Physics, Seminar, California Institute of Technology, "Transport through Andreev Bound States in a Superconductor-Quantum Dot-Graphene System," Pasadena, CA (October 2011).
32. Department of Physics, Seminar, University of Notre Dame, "Transport through Andreev Bound States in a Superconductor-Quantum Dot-Graphene System," South Bend, IN (November 2011).
33. Department of Physics, Colloquium, University of Victoria, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Canada (November 2011).
34. Department of Physics, Colloquium, University of British Columbia, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Vancouver, Canada (December 2011).
35. Department of Physics, Seminar, University of British Columbia, "Proximity Effects and Metallic States
36. in Mesoscopic Superconductor- Normal Metal-Superconductor Arrays," Vancouver, Canada (December 2011).
37. Department of Physics, Colloquium, Fraser University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Vancouver, Canada (December 2011).
38. KITP Conference Fundamental Aspects of Graphene, "Measuring Andreev Bound States in Superconductor-Quantum Dot-Graphene Systems," Santa Barbara, CA (January 2012).
39. Argonne National Laboratory Labwide Special Seminar, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Argonne, IL (February 2012).
40. APS March Meeting Maria Goeppert Mayer Award Lecture, "Spectroscopy of Hybrid Superconductor-Carbon Nanostructure Systems," Boston, MA (February 2012).
41. Department of Physics, Seminar, University of Illinois, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Urbana, IL (March 2012).
42. Department of Physics, Colloquium, Rutgers University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," New Brunswick, NJ (April 2012).
43. Department of Physics, Colloquium, Massachusetts Institute of Technology, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Cambridge, MA (April 2012).

44. Department of Physics, Seminar, Massachusetts Institute of Technology, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Cambridge, MA (April 2012).
45. Department of Physics, Colloquium, University of North Dakota, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Grand Forks, ND (April 2012).
46. Department of Materials Science, Colloquium, Stanford University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Palo Alto, CA (May 2012).
47. Physical Sciences Division Colloquium, Argonne National Lab, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Argonne, IL (May 2012).
48. CECAM Workshop on Control and Enhancement of Superconductivity in Nanostructures, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Lausanne, Switzerland (June 2012).
49. Departments of Chemistry and Physics, Colloquium, Sebelas Maret University, "Using Graphene to Study Superconductivity," Surakarta, Indonesia (July 2012).
50. Joint NAS-Indonesia Kavli Symposium, "NanoElectronic Systems," Solo, Indonesia (July 2012).
51. Materials and Mechanisms of Superconductivity Workshop, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Washington, DC (August 2012).
52. Department of Physics, Colloquium, Duke University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Durham, NC (September 2012).
53. Department of Physics, Colloquium, Boston University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Boston, MA (October 2012).
54. Department of Physics, Condensed Matter Seminar, Boston University, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Boston, MA (October 2012).
55. Argonne National Lab Workshop on Unconventional Insulator, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Argonne, IL (November 2012).
56. Department of Physics, Colloquium, Duke University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Durham, NC (September 2012).
57. Department of Physics, Colloquium, Boston University, "Using Graphene to Study Superconductivity (New Tricks for an Old Dog)," Boston, MA (October 2012).
58. Department of Physics, Condensed Matter Seminar, Boston University, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Boston, MA (October 2012).
59. Argonne National Lab Workshop on Unconventional Insulator, "Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays," Argonne, IL (November 2012).
60. Department of Physics, Colloquium, University of San Diego, "Small Dots Make it Big: Studying Collective Phenomena in Arrays of Superconducting Islands," San Diego CA (Feb. 2013).

61. Department of Physics, Seminar, University of Toronto, Department of Physics, “Symmetry-Protected Josephson Supercurrents in 3D Topological Insulators,” Toronto CA (Feb. 2013).
62. Department of Physics, Colloquium, University of Toronto, Department of Physics, “Small Dots Make it Big: Studying Collective Phenomena in Arrays of Superconducting Islands,” Toronto CA (Feb. 2013)
63. Pitt Joint Quantum Institute Workshop, “Manipulating Quantum Interactions in Arrays of Superconducting Islands,” Pittsburgh PA (Apr. 2013).
64. Department of Physics, Colloquium, Northwestern University, “Small Dots Make it Big: Studying Collective Phenomena in Arrays of Superconducting Islands,” Evanston IL (April 2013)
65. Depts. of Physics and Chemistry, Colloquium, Dalhousie University, “Using Graphene to Study Superconductivity (New Tricks for an Old Dog),” Nova Scotia CA (May 2013).
66. Workshop on Frontiers in Quantum Engineered Devices, “Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays”, Obergurgl Austria (Aug. 2013).
67. Department of Physics, Colloquium, University of Oklahoma, “In Proximity to Novel Physics: Topological Insulators Connected to Superconductors,” Norman OK (Sept. 2013).
68. Department of Physics, Colloquium, Pennsylvania State University, “In Proximity to Novel Physics: Topological Insulators Connected to Superconductors,” State College PA (Sept. 2013).
69. Department of Physics, Colloquium, John’s Hopkins University, “Small Dots Make it Big: Studying Collective Phenomena in Arrays of Superconducting Islands,” Baltimore MD (Oct. 2013).
70. Department of Physics, Colloquium, Indiana University, “In Proximity to Novel Physics: Topological Insulators Connected to Superconductors,” Bloomington IN (Nov. 2013).
71. Department of Physics, Colloquium, Columbia University, “In Proximity to Novel Physics: Topological Insulators Connected to Superconductors,” New York, NY (Nov. 2013).
72. Department of Physics, Seminar, Columbia University, “Proximity Effects and Metallic States in Mesoscopic Superconductor-Normal Metal-Superconductor Arrays,” New York, NY (Nov. 2013).
73. Department of Physics, Colloquium, Case Western University, “In Proximity to Novel Physics: Topological Insulators Connected to Superconductors,” Cleveland OH (Dec. 2013).

DALE VAN HARLINGEN

1. Colloquium, University of Waterloo, “Complex triplet superconductivity and chiral order parameter domain dynamics in the unconventional superconductor Sr_2RuO_4", Waterloo, Canada (November, 2007).
2. Kavli Institute for Theoretical Physics, University of California, Santa Barbara, “Phase-sensitive symmetry measurements in unconventional superconductors”, Santa Barbara, CA (December, 2007).

3. Decoherence in Superconducting Qubits Workshop, University of California at Berkeley, “Sources of decoherence in superconducting qubits - critical current fluctuations in Josephson tunnel junctions”, Berkeley, CA (December, 2007).
4. *Invited Talk*, Applied Superconductivity Conference, “Roger Koch memorial session: The search for complex order parameter symmetry in unconventional superconductors”, Chicago, IL (August, 2008).
5. Whitfield Lecture, Colloquium, Pennsylvania State University, “The search for complex order parameter symmetry in unconventional superconductors”, State College, PA (October, 2008).
6. Colloquium, University of California-Berkeley, “The search for complex order parameter symmetry in unconventional superconductors”, Berkeley, CA (October, 2008).
7. ICMT Workshop on Topological Phases, University of Illinois at Urbana-Champaign, workshop presentation, “Experimental evidence for complex chiral superconductivity in Sr2RuO4 and UPt3”, Urbana, IL (October, 2008).
8. Northwestern University, Condensed Matter Seminar, “Complex triplet superconductivity and chiral order parameter domain dynamics in the unconventional superconductors,” Evanston, IL (April, 2009).
9. Colloquium, Ohio State University, “The search for complex order parameter symmetry in unconventional superconductors”, Columbus, OH (April, 2009).
10. Kavli Institute for Theoretical Physics, University of California, Santa Barbara, “The search for complex order parameter symmetry in unconventional superconductors”, Santa Barbara, CA (August, 2009).
11. Quantum Fluids and Solids Conference, Northwestern University, “The search for complex order parameter symmetry in unconventional superconductors”, Evanston, IL (August, 2009).
12. Materials and Mechanisms in Superconductivity Conference, “The search for complex order parameter symmetry in unconventional superconductors”, Tokyo, Japan. (September, 2009)
13. March APS Meeting, “Non-sinusoidal Josephson current-phase relations in SFS junctions”, Portland, OR (March, 2010). March APS Meeting, “Non-Sinusoidal Current–Phase Relations in SFS π-Josephson Junctions,” Portland, OR (March, 2010).
14. Condensed Matter Seminar, Iowa State University, “The Search for Complex Order Parameter Symmetry in Unconventional Superconductors,” Ames, IA (September, 2010).
15. Caltech, “The Search for Complex Order Parameter Symmetry in Unconventional Superconductors,” Pasadena, CA (October, 2010)
16. Fradkin-Fest Seminar, Stanford University, “Noisy Stripy Dynamics in the Pseudogap Phase of the Cuprates”, Stanford, CA (December, 2010).
17. Condensed Matter Seminar, Karlsruhe Institute of Technology, “The Search for Complex Order Parameter Symmetry in Unconventional Superconductors,” Karlsruhe, Germany (April, 2011).
18. Topological Aspects of Quantum-Coherent States in New Materials, “Searching for Complex Order Parameters and majorana Fermions in Superconducting Materials and Josephson Devices,” Chicago, IL October, 2011).

19. Microsoft Station-Q Workshop, Kavli Institute for Theoretical Physics, “Searching for Complex Order Parameters and majorana Fermions via Phase-Sensitive Josephson Experiments,” Santa Barbara, CA (December, 2011).
20. Coherence in Flux Qubits Workshop, “Critical Current Fluctuations in Josephson Junctions: Characterizing, Understanding, Reducing,” San Francisco, CA (January, 2012).
21. TQP2012 Topological Quantum Phenomena, “Searching for Complex Order Parameters and majorana Fermions in Superconducting Materials and Josephson Devices,” Nagoya, Japan (May, 2012).
22. 50th Anniversary Celebration of the Josephson Effect, “Determining the Order Parameter Symmetry of Unconventional Superconductors by Josephson Interferometer,” Cambridge, England (June, 2012).
23. Materials and Mechanisms of Superconductivity Conference, “Mapping the Transition Between Real and Complex Order Parameter Phases in UPt_3,” Washington, DC (August, 2012).
24. Condensed Matter Seminar, University of Illinois, “It’s Just a Phase – Josephson Interferometry of Exotic Superconductors,” Urbana, IL (September, 2012).

SMITHA VISHVESHWARA

1. Indian Institute of Science, "Inhomogeneous phases of bosons in optical lattices", Bangalore, India (January, 2007).
2. Indian Institute for Mathematical Sciences, "Detecting fractional statistics – anyon there?" Chennai, India (January, 2007).
3. Johns Hopkins University, "Inhomogeneous phases of bosons in optical lattices", Baltimore, MD (March, 2007)
4. Northwestern University, "Detecting fractional statistics – anyon there?" Evanston, IL (March, 2007)
5. Yale University, "Probing fractional statistics in quantum Hall systems– anyon there?" New Haven, CT (April, 2007).
6. Boston University, "Inhomogeneous phases of bosons in optical lattices", Boston, MA (April, 2007).
7. Penn State University, "A \nu angle on fractional statistics", State College, PA (June, 2007).
8. International Centre for Theoretical Physics, "Superconducting proximity effects in carbon nanotubes", Trieste, Italy (June, 2007).
9. Indiana University-Purdue University Indianapolis, "Inhomogeneous phases of bosons in optical lattices", Indianapolis, IN (October, 2007).
10. Wellesley College, "Exploration in Physics at UIUC", Wellesley, MA (October, 2007).
11. University of Illinois at Urbana-Champaign, "Detecting fractional statistics – anyon there?" Urbana, IL (January, 2008).
12. University of Wisconsin, Madison, "Josephson coupling in Mott-superfluid systems", Madison, WI (May, 2008).

13. Quantum Computation with Topological Phases of Matter, BIRS, "A \nu angle on fractional statistics", Banff Center, Canada (July, 2008).
14. University of Kentucky, "Fractional statistics in quantum Hall systems– anyon there?" Lexington, KY (October, 2008).
15. Mahabaleshwar, "Physics of co-existent Mott-superfluid systems", Mahabaleshwar, India (December, 2008).
16. Mid-West Undergrad Women in Physics Conference, University of Illinois at Urbana-Champaign, "Explorations in condensed matterphysics – a personal journey", Urbana, IL (January, 2009).
17. University of Minnesota, "Physics of co-existent Mott-superfluid systems", Minneapolis, MN (February, 2009).
18. Kavli Institute for Theoretical Physics, "Anyons in the lowest Landau level", Santa Barbara, CA (March, 2009).
19. Northwestern University, "One-dimensional conduction properties in carbon nanotubes", Evanston, IL (May, 2009).
20. Aspen Center for Physics, “Josephson physics and anyons in condensed matter and cold atomic systems”, Aspen, CO (May, 2009).
21. UIUC, Convocation Address, Physics Convocation, Urbana, IL (May, 2009).
22. Indian Institute of Science, "Inhomogeneous phases of bosons in optical lattices", Bangalore, India (September, 2009).
23. Nordita, "Correlators and beam splitters for quantum Hall anyons", Stockholm, Sweden (September, 2009).
24. University of Washington at St. Louis, "Fractional statistics and beam splitters in quantum Hall anyons", St. Louis, MO (November, 2009).
25. Ohio State University, "Fractional statistics and beam splitters in quantum Hall anyons", Columbus, OH (November, 2009)
26. American Physical Society Annual March Meeting, “Field-Effects and Fractionalization in Nanotubes and Nanorings,” Portland, OR (March, 2010)
27. Correlated Phenomena in Low-Dimensional Systems Workshop, Max-Planck Institute for the Physics of Complex Systems, “Fractionalization in Mesoscopic Rings,” Dresden, Germany (July, 2010).
28. Condensed Matter Seminar, Case Western Reserve University, “Fractionalization in Mesoscopic Rings,” Cleveland, OH (October, 2010).
29. Departments of Physics and Quantum Optics, Condensed Matter Seminar, University of Rochester, “Fractional Statistics and Beam-Splitters in Quantum Hall Systems,” Rochester, NY (November, 2010).
30. Department of Physics, Condensed Matter Seminar, University of Virginia, “Fractional Statistics and Beam-Splitters in Quantum Hall Systems,” Charlottesville, VA (November, 2010).
31. James Franck Institute Theory Seminar, University of Chicago, “Topological Phases and Dynamics in Superconducting Wires and Spin Chains,” Chicago, IL (May, 2012).

32. Program Presentation for Quantum Dynamics in Far from Equilibrium Thermally Isolated Systems, Kavli Institute for Theoretical Physics, "Quenches and Kibble-Zurek Physics in Periodic Spin and Topological Systems," Santa Barbara, CA (September, 2012).