SAND2019-13446PE

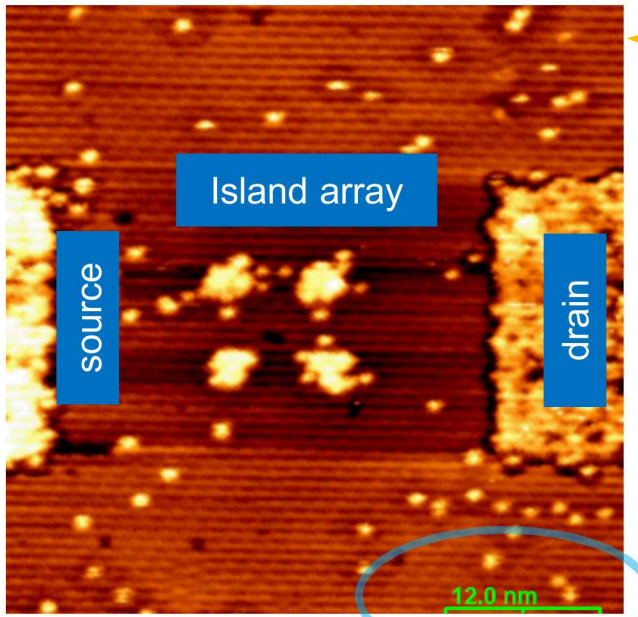
FAIR DEAL GC Project Introduction and Charge

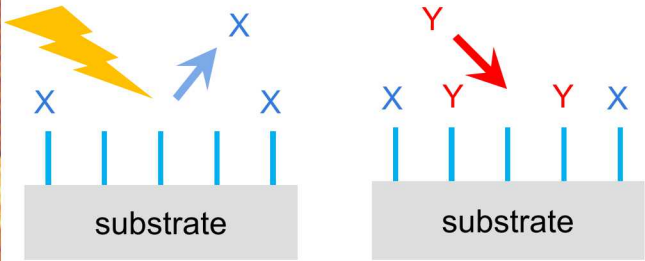
David White

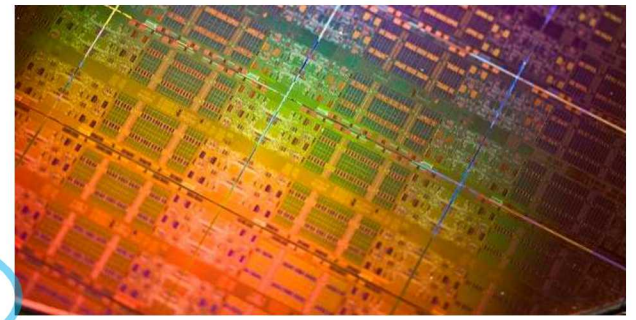
Director Champion

Second EAB Meeting

November 4, 2019







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EAB Charter

The EAB will serve in an advisory capacity to assess and provide external, independent review and guidance to the GC team and Sandia National Laboratories' management on the GC's strategy, relevance/impact, quality, capabilities, and partnerships.

Five Elements of Research Assessment

Sandia National Laboratories

ELEMENT	
Strategy	Execute a research strategy that is clear, aligns discretionary investments (e.g., LDRD) with the research strategy, and supports DOE/NNSA priorities.
Mission Relevance & Impact	Ensure that research is relevant, enables the national security missions, and benefits DOE/NNSA and the nation.
Quality	Ensure that research is transformative, innovative, leading edge, high quality, and advances the frontiers of science and engineering.
Capabilities	Maintain a healthy and vibrant research environment that enhances technical workforce competencies and research capabilities.
Partnerships & Technology Transitions	Research and develop high-impact technologies through effective partnerships and technology transfer mechanisms that support the laboratory's strategy, DOE/NNSA priorities, and impact the public good.

External reviews are linked to
SNL Performance Objective: Science, Technology and Engineering Mission

Project leads' focus questions to EAB

- What would you advise as the top 2-4 things for us to change to achieve more transformative, leading-edge R&D results?
- What do you assess are our biggest 2-4 risks in Year 2? What changes would you recommend to address them?
- What do you view as the top 2-4 differentiating capabilities are we on track for? Is there a high value target we have missed?

Agenda

Sandia National Laboratories

Bldg 858EL/L2000, Breakout Room 858EL/L1410

Monday, November 4, 2019

9:00 am	Welcome	**Greg Frye-Mason** *Manager, LDRD & Academic Programs*
9:05 am	Introduction and Charge	**David White** *Director, Threat Intelligence Center*
9:10 am	Programmatic Overview	**Robert Koudelka** *Senior Manager, Information Technology Group*
9:30 am	Technical Overview	**Shashank Misra** *Member Technical Staff, Multiscale Fab S&T Development*
10:30 am	Break	
10:45 am	Thrust #1: APAM devices	**Shashank Misra** *Member Technical Staff, Multiscale Fab S&T Development*
11:45 pm	Lunch	
1:15 pm	Thrust #2: Modeling	**Suzey Gao** *Member Technical Staff, Electrical Models & Simulation*
2:15 pm	Thrust #3: CMOS Integration	**Dan Ward** *Member Technical Staff, Multiscale Fab S&T Development*
3:15 pm	Break	
3:30 pm	Thrust #4: Application Platform	**George Wang** *Member Technical Staff, Advanced Materials Science*
4:30 pm	Caucus	
5:30 pm	Adjourn	

Tuesday, November 5, 2019

9:00 am	Poster Session
10:00 am	Caucus
11:00 am	Outbrief
12:00 pm	Adjourn

FAIR DEAL GC Project Programmatic Overview

Robert Koudelka

PM

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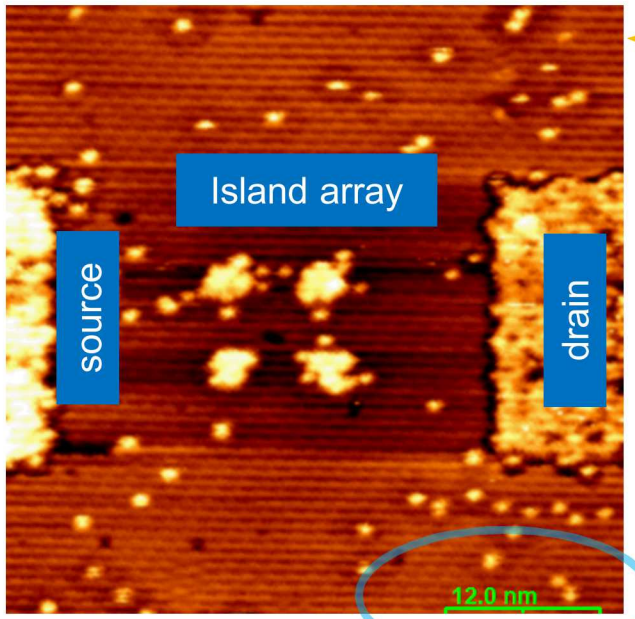
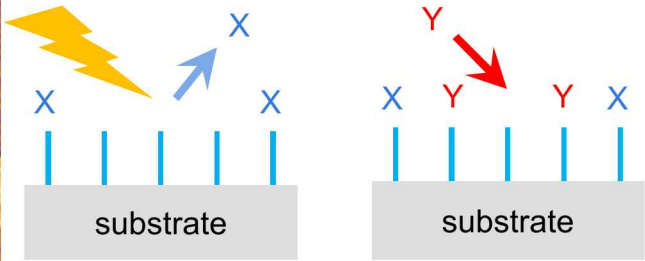
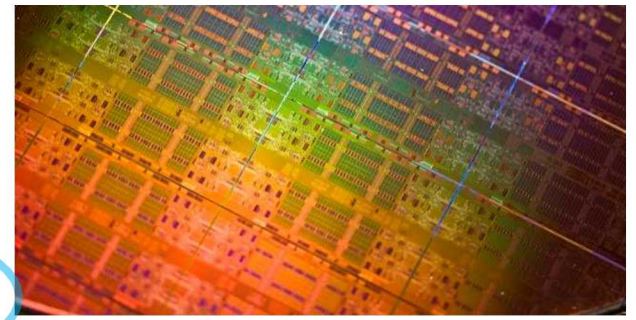


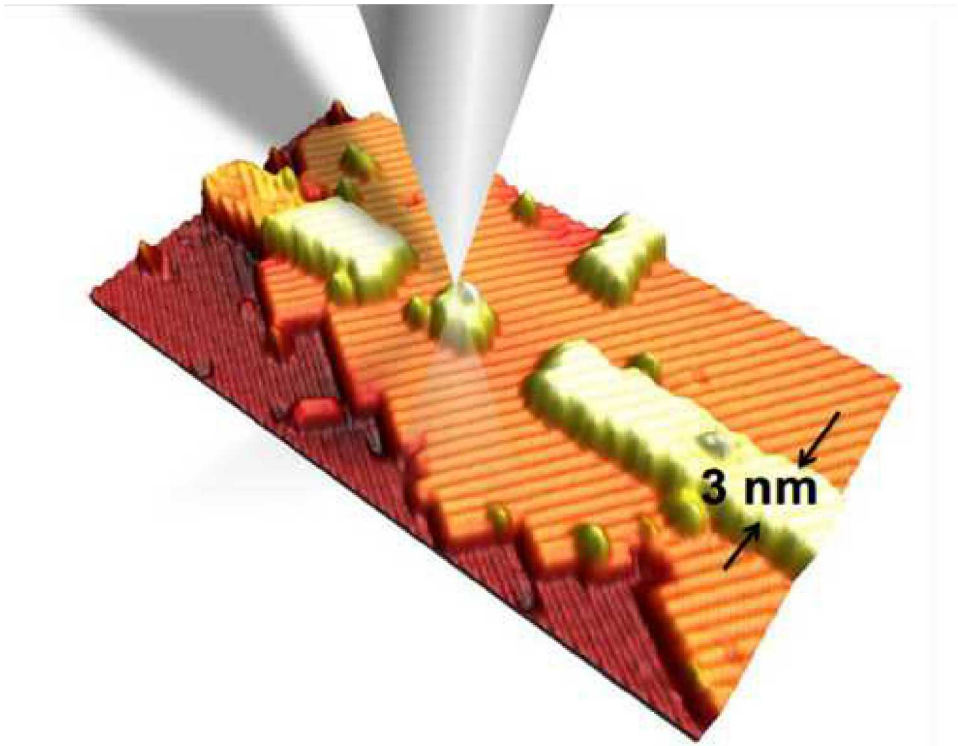




Why Digital Electronics at the Atomic Limit (DEAL)?

Sandia National Laboratories

- Atomically precise advanced manufacturing (APAM) is enabled by selective surface chemistry methods to define desired microelectronics features.
- Microelectronics – increasingly hard to approach the atomic scale
- Recent developments suggest CMOS compatible APAM processes are possible.
- Four technical thrusts guide this research
  - Device fabrication
  - Modeling materials, devices, and circuits
  - Integration with CMOS
  - Application platform



Far-reaching Application, Implication, and Realization of Digital Electronics at the Atomic Limit (FAIR DEAL)

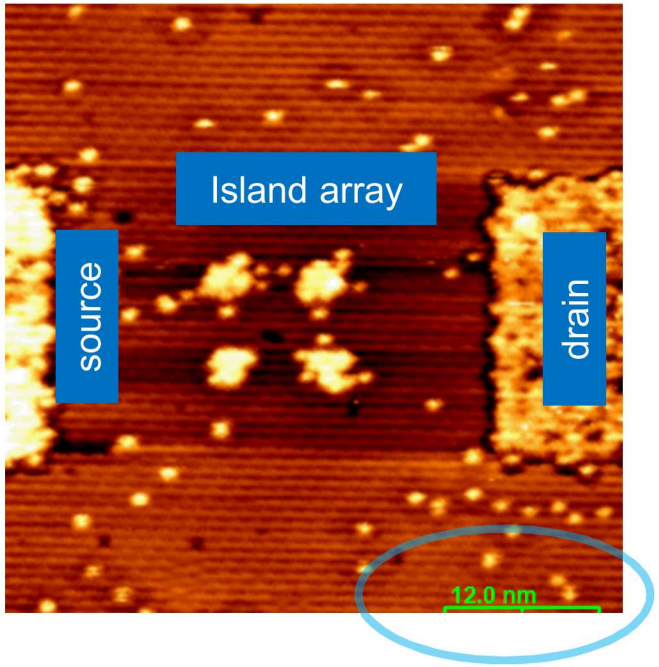
What's Enabled and the Opportunity Space

Sandia National Laboratories

- APAM enables
  - Observation of device physics at the physical limit, new material properties
  - "Digital" nature of atoms, different phase space for processing
  - New devices that utilize novel material properties
- Opportunity Space
  - Devices: Can APAM-inspired device elements improve MOS performance?
  - Processing: Can atomic-scale processing impact manufacturing?
  - Modeling: Toolbox to understand device physics and function
  - Trust and assurance applications for USG (e.g. supply chain assurance)
  - Assess the technical implications for national security before broad commercial development and adoption

Why Sandia?

- A FFRDC role is advanced R&D on strategically important capabilities in the national interest. *Sustain and Explore.*
- Support DOE NNSA, DoD, and other government agencies National Security missions as a trusted advisor for microelectronics technologies



What Should Our Legacy Be?

Sandia National Laboratories

- Scope future work in APAM – applications, new opportunities (e.g. optoelectronics), new spaces where atomic precision manipulation may help (e.g. quantum sensing)
- Knowledge base –
  - Being on the forefront of developing science and technology, e.g. surface chemistry, device physics, silicon processing, integrating novel technologies with CMOS
- Partnerships –
  - Academic: surface chemistry (Rochester, Maryland, Delaware)
  - Industry: microelectronics (Skywater), processing (IBM), surface chemistry (Zyvex)
  - Government: connectivity to customer interests
- Capabilities –
  - Modeling: quantum/ semiclassical device modeling
  - Instruments: ‘Full suite’ APAM tool, research-scale silicon processing
- Technical advances –
  - Lithographic processes, sensors, integration of CMOS and APAM devices

Focus Questions to the EAB

- *Thank you for serving as external advisors!*

- What would you advise as the top 2-4 things for us to change to achieve more transformative, leading-edge R&D results?

- What do you assess are our biggest 2-4 risks in Year 2 of the project? What changes would you recommend to address them?

- What do you view as the top 2-4 differentiating capabilities are we on track for? Is there a high value target we have missed?