

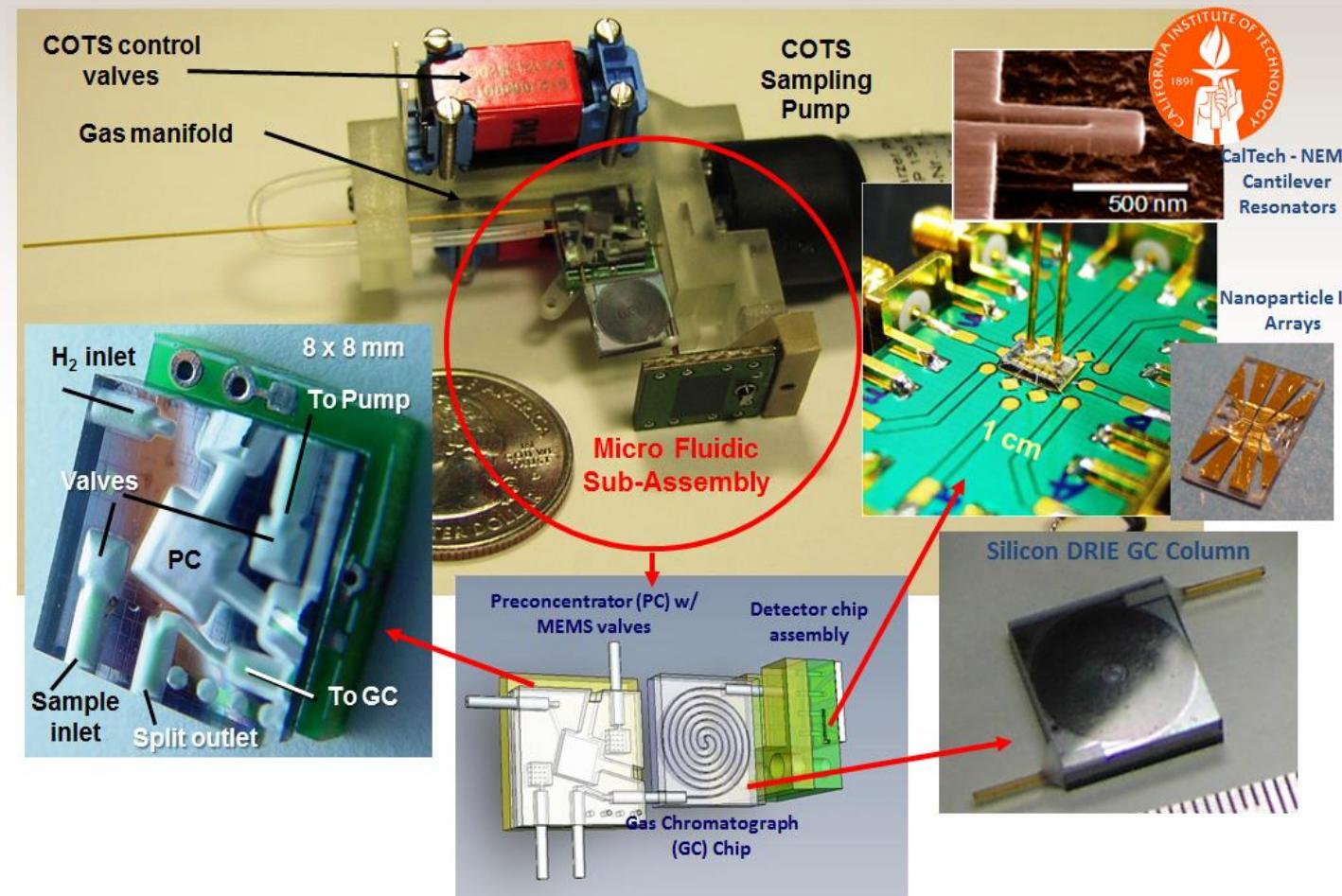


# MESA Microfabrication and Integration Capabilities

<http://www.sandia.gov/mstc>

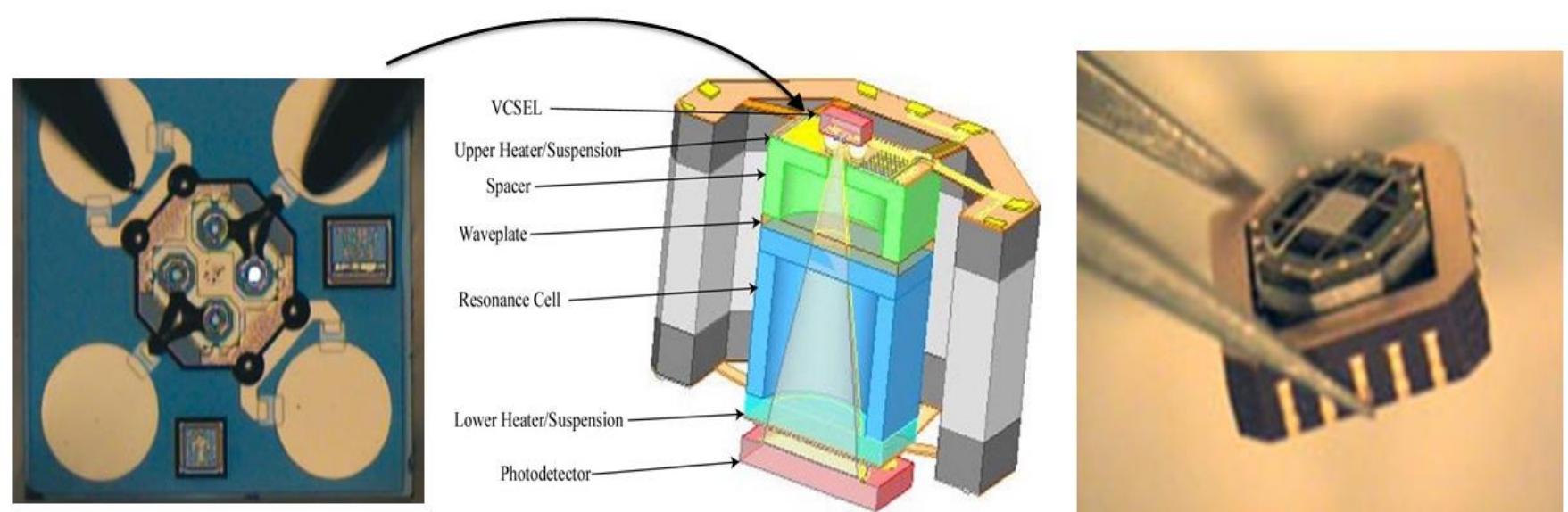
## Integrated Microsystem Solutions

### • Micro Gas Analyzer – Phase 4 Microsystem Solution



### • Chip-Scale Atomic Clock – Partnered for Phase 4 Microsystem Solution

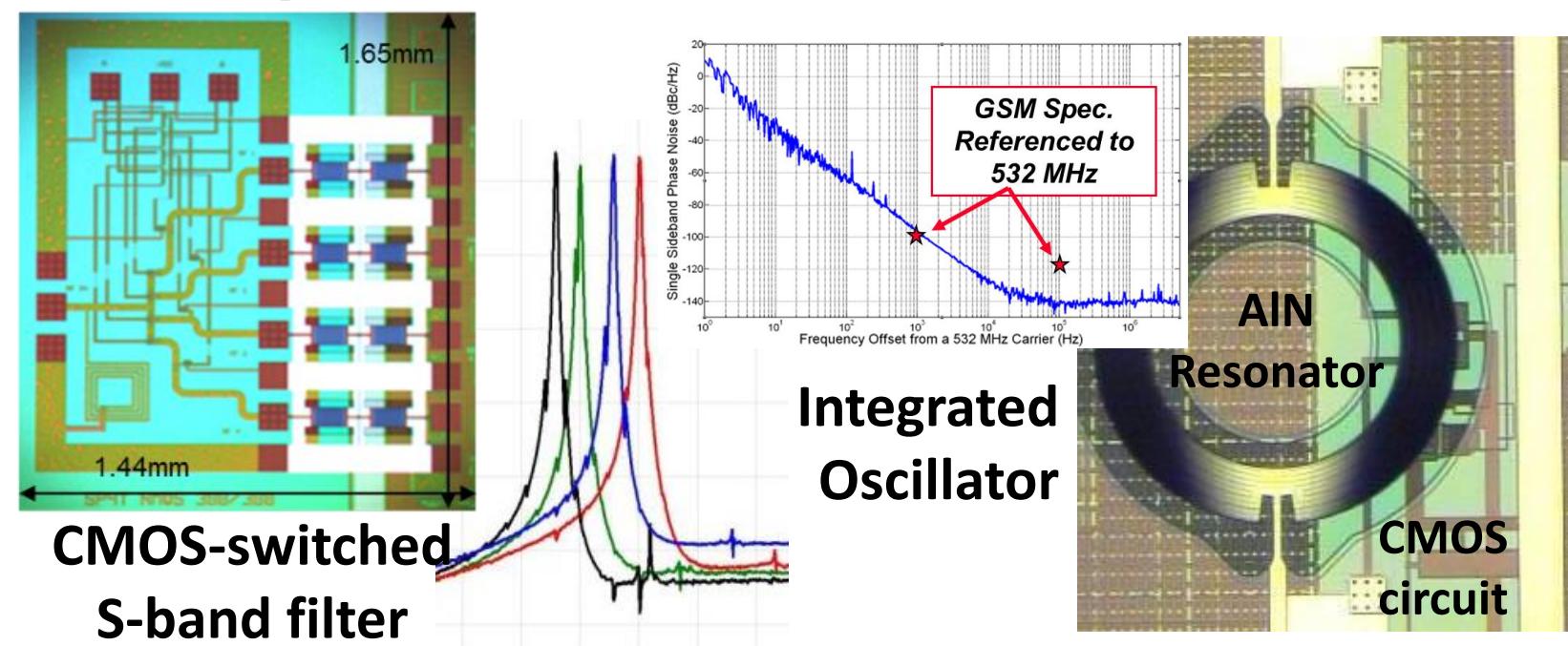
#### • Sandia Developed Custom VCSEL for Atomic Reference



## Piezoelectric Devices

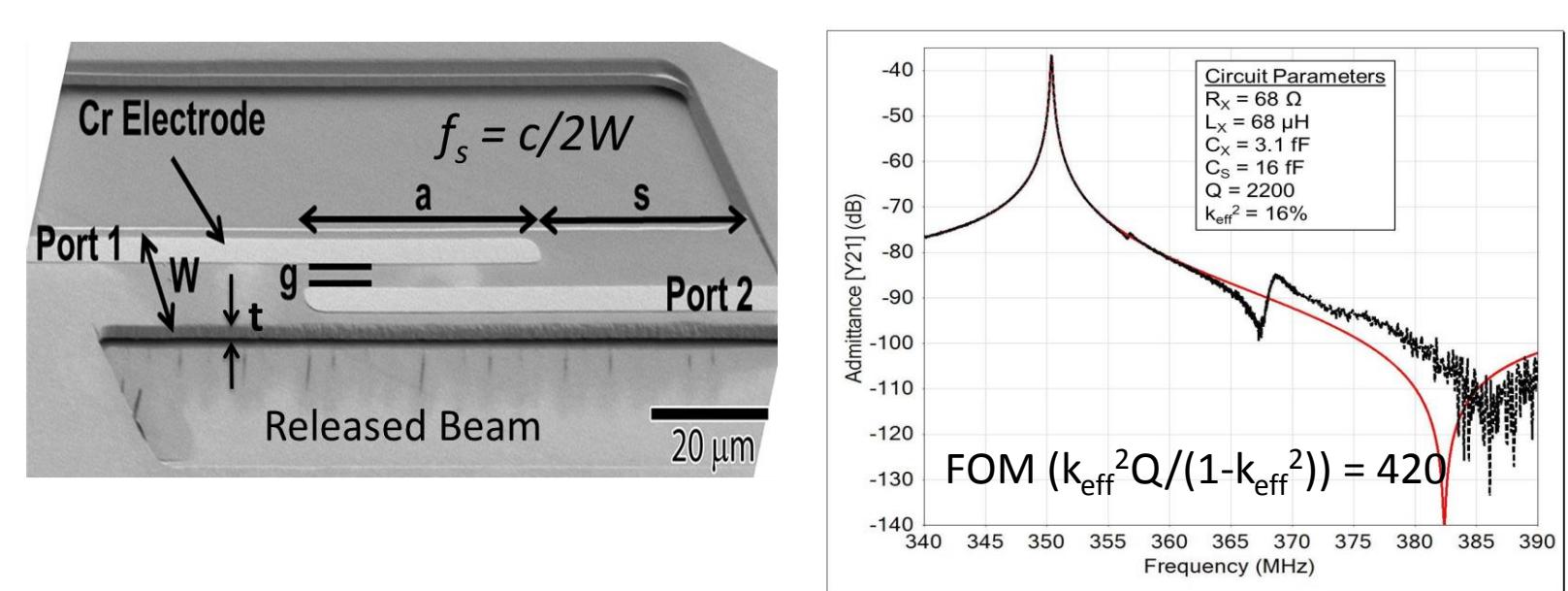
### • CMOS/AlN MEMS Integration

- High-Q CMOS-compatible resonators for Filters and Frequency References
- Frequencies from <10 MHz to >10 GHz

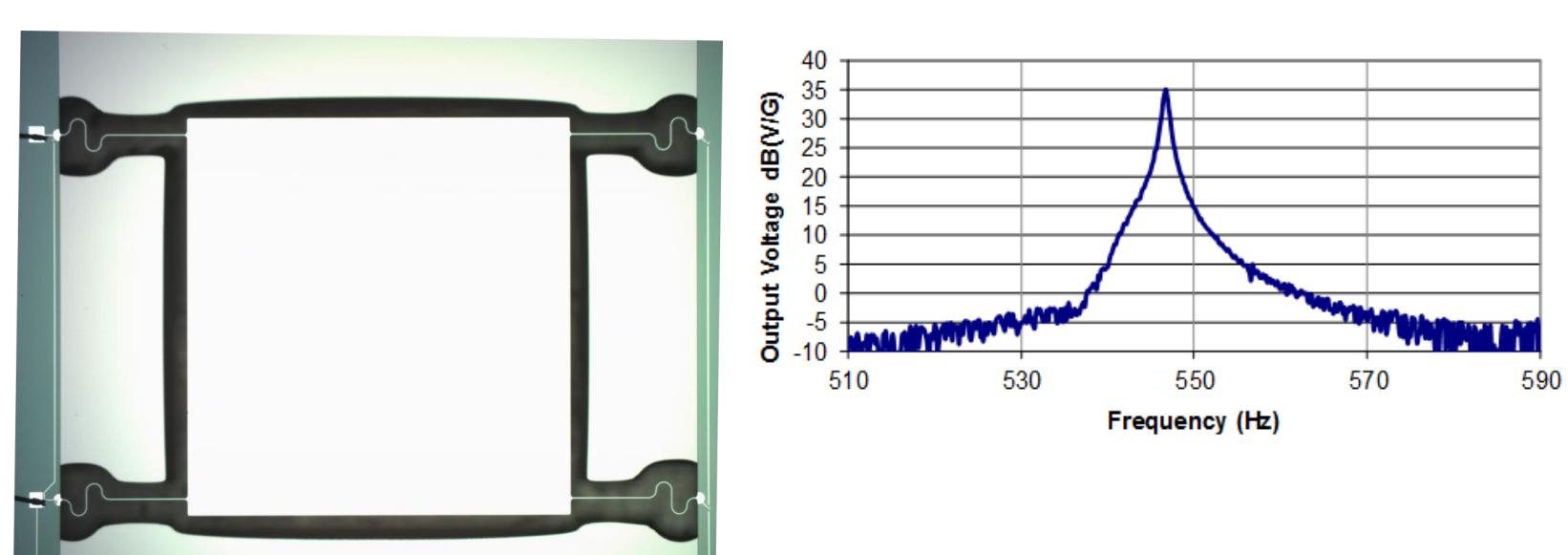


### • LiNbO3 MEMS Resonators and Filters

- Superior Coupling compared to AlN



### • AlN Resonant Accelerometer



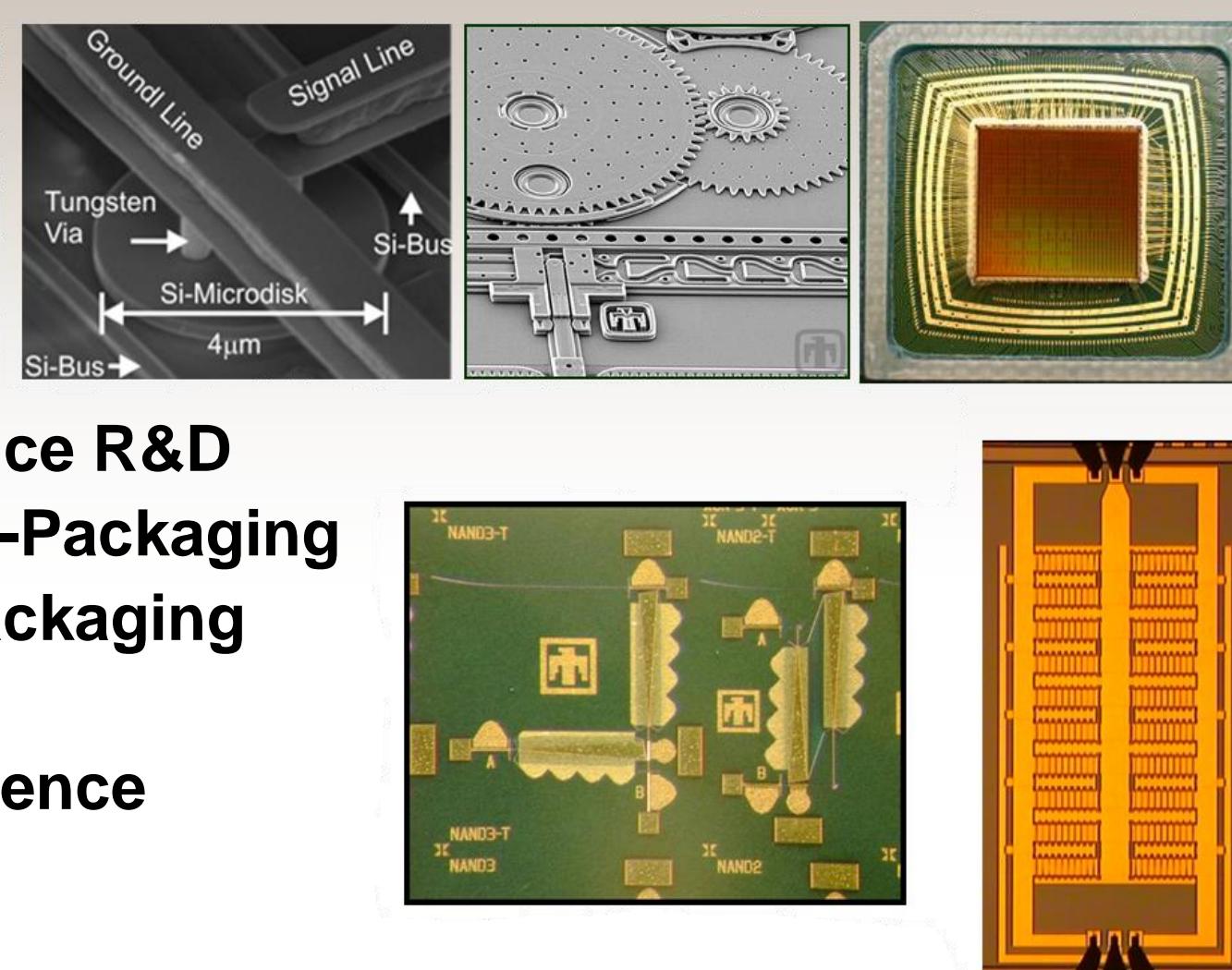
### • Novel Materials and Device R&D

- Piezoelectric Materials: PZT, LiTaO3, etc.
- Ferroelectric Materials: BST, STO, etc.
- Devices: Biosensors, Actuators, Transducers, etc.

## Microsystem Facilities

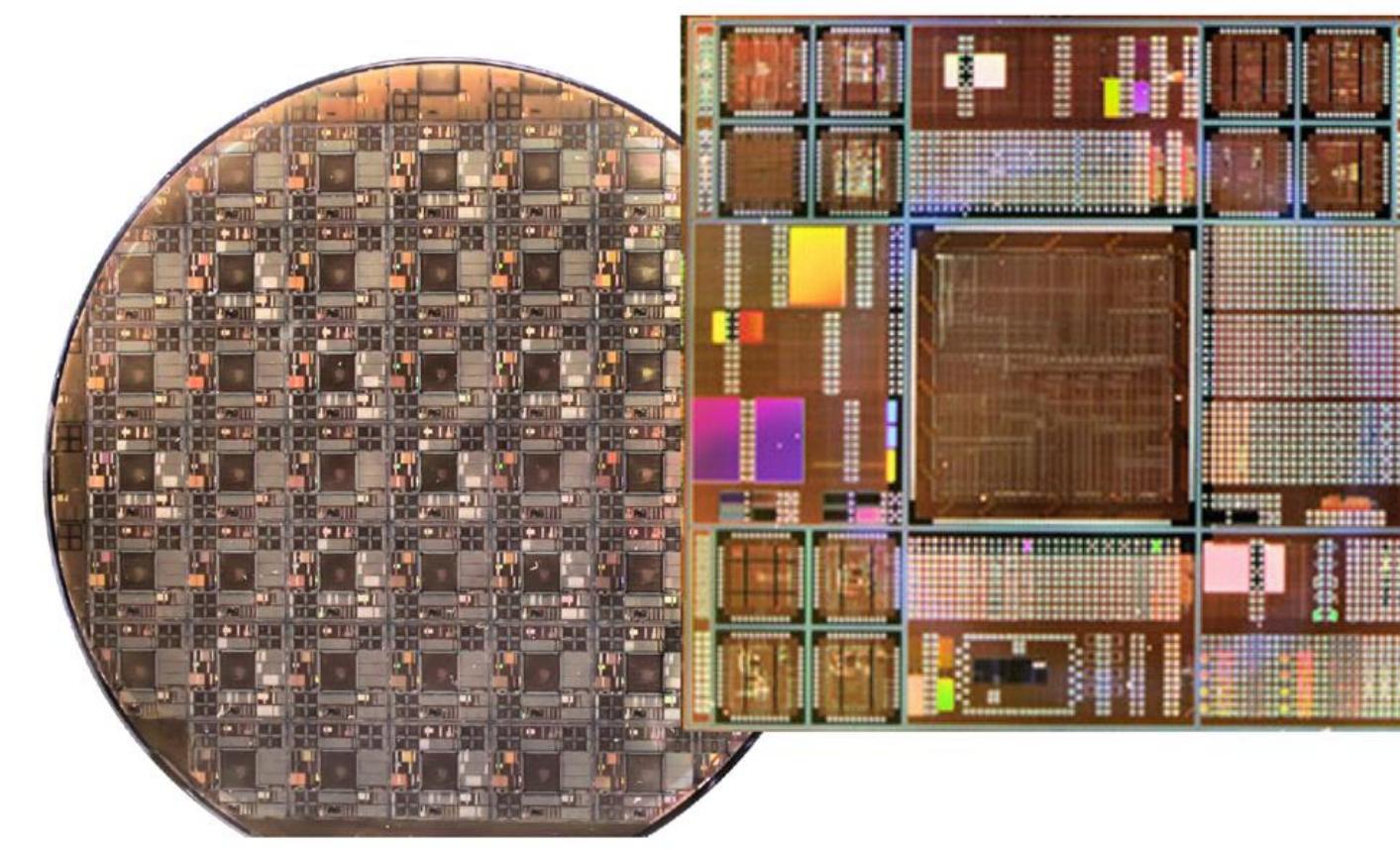
### • Si & III-V Fabs Under One Roof: 65,000 ft<sup>2</sup> facility

- Trusted Si & III-V Microelectronics Production
- Si & AlN MEMS & Photonics R&D Prototyping
- III-V Photonics & MEMS R&D Prototyping
- nBn, GaN, Graphene, Memristor Process & Device R&D
- RF MEMS Oscillators/Switches and Wafer-Level-Packaging
- Chip Stacking, Hetero-Integration, and Novel Packaging
- CINT: Center for Integrated Nanotechnologies
- National User Facility Devoted to Nanoscale Science
- Multi-disciplinary Scientific Community
- CRADAs with Industry, Team on BAA Responses



## Trusted Electronics

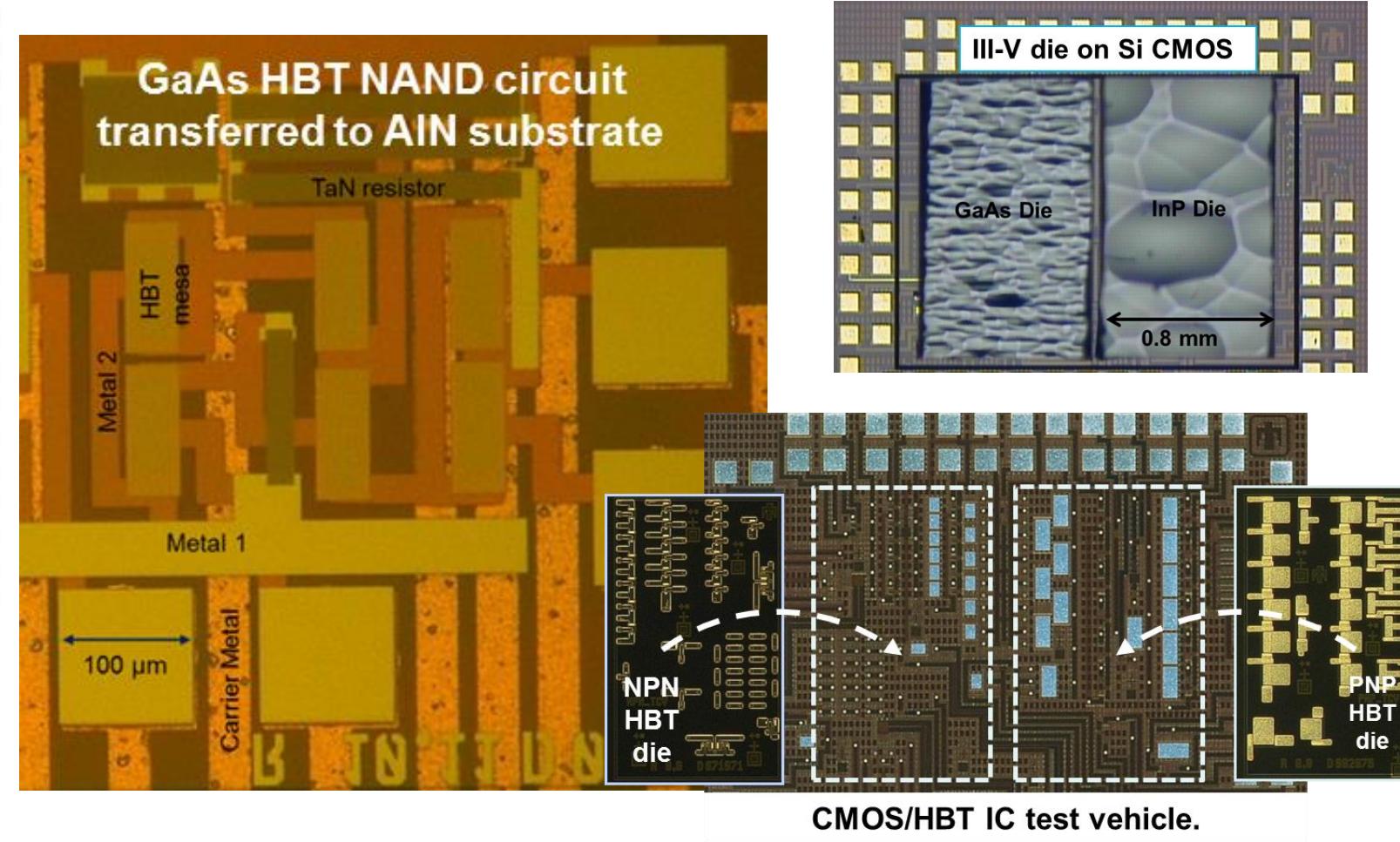
- Custom & Structured ASIC Design & Fab
- CMOS Multi-Project Wafer Program
  - Rad-Hard Mixed Signal SOI CMOS
  - ISO 9001:2000 Certified, High-Reliability Production
- Trusted Design Services
  - DMEA 1A Certification of Trust
  - Internal & External Foundries to 14 nm



## Heterogeneous Integration

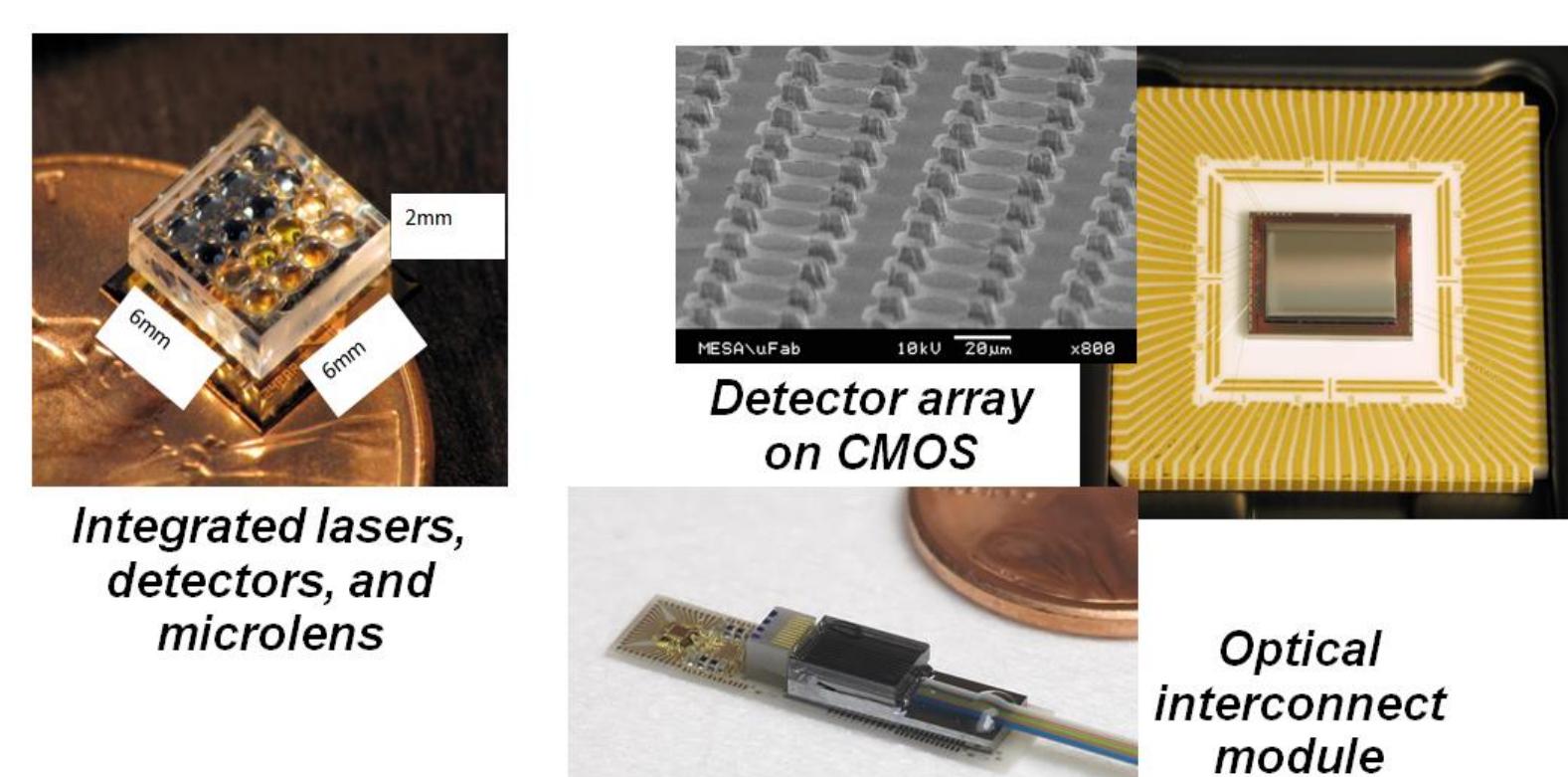
### • III-V HBT / Si CMOS Integration

- Flip-chip Integration & Substrate Removal of GaAs & InP Devices & Circuits on Silicon



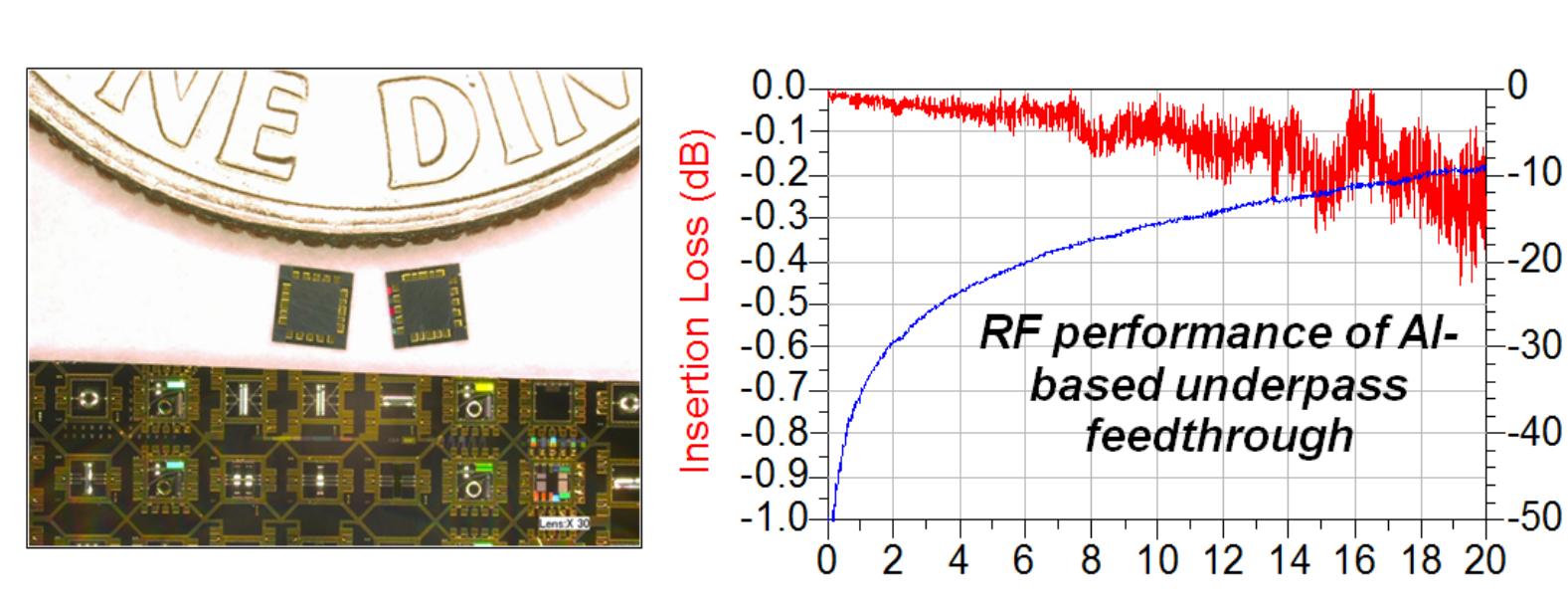
### • Optoelectronic Device Integration

- Integration of Optoelectronics and CMOS



### • Wafer-Scale Packaging

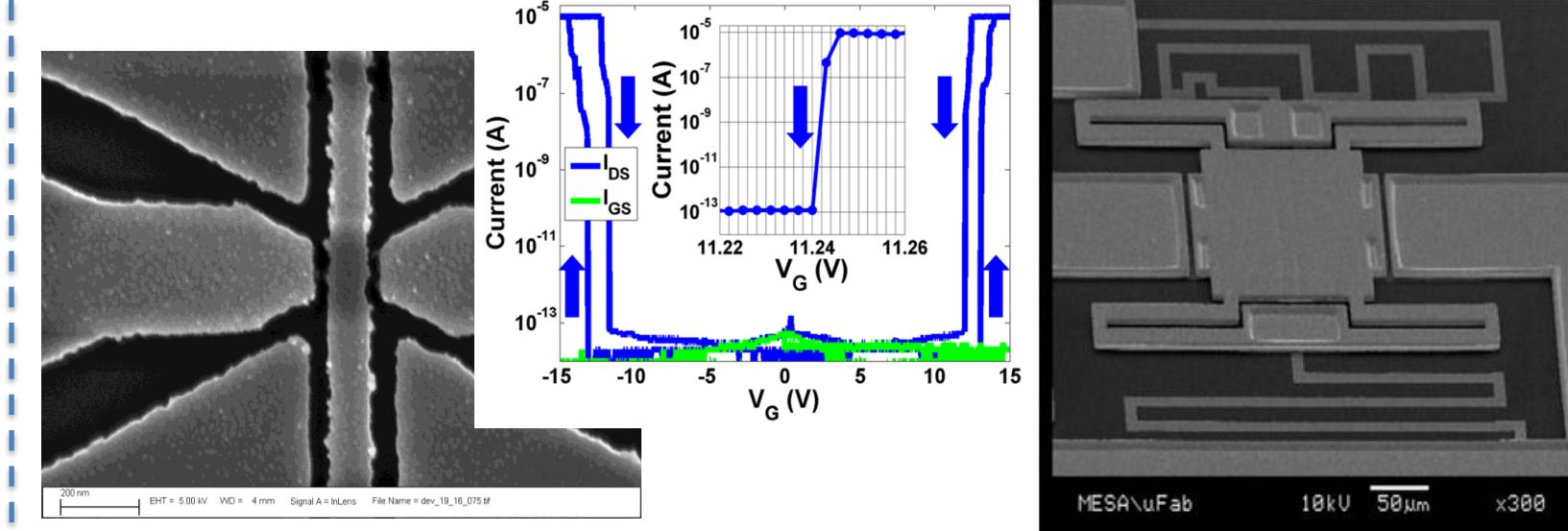
- Key element for Microsystems Integration
- Hermetic with >20 GHz Bandwidth



## Device Technologies

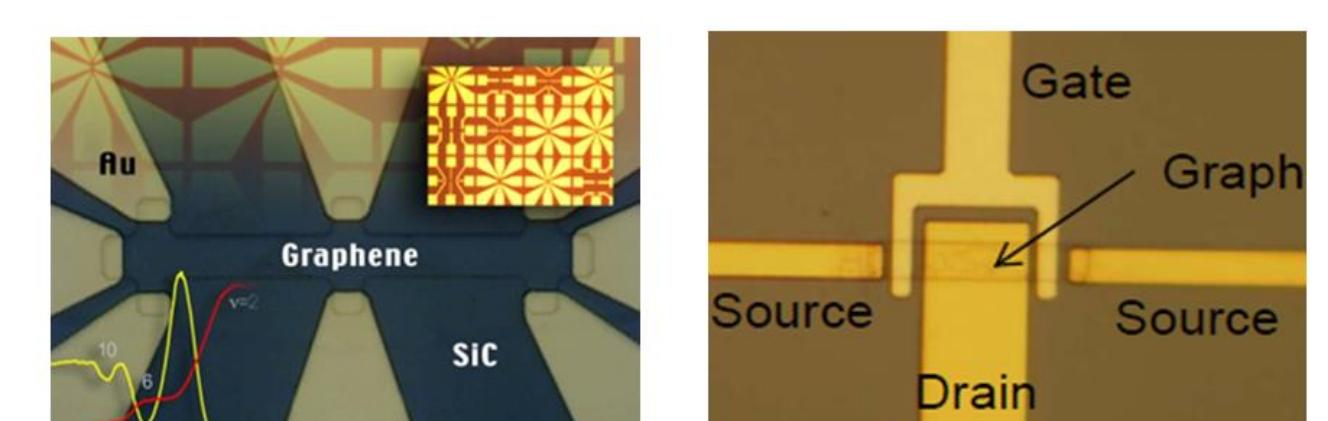
### • Micro- and Nano- Scale Switches

- Low-loss RF/microwave Switching
- High Subthreshold-slope Detection



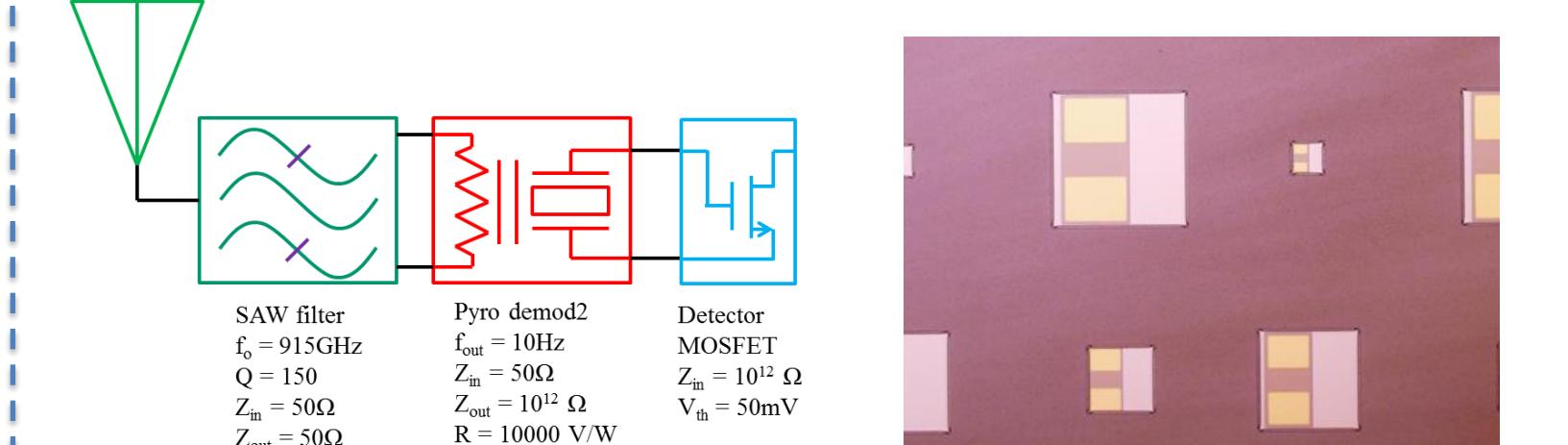
### • Graphene Electronics & Sensors

- Large area Graphene Synthesis
- Bilayer and Twisted Layer Innovation



### • Pyroelectric RF Detector

- PZT-based RF demodulation



### • Ultra Wideband SAW Correlators

