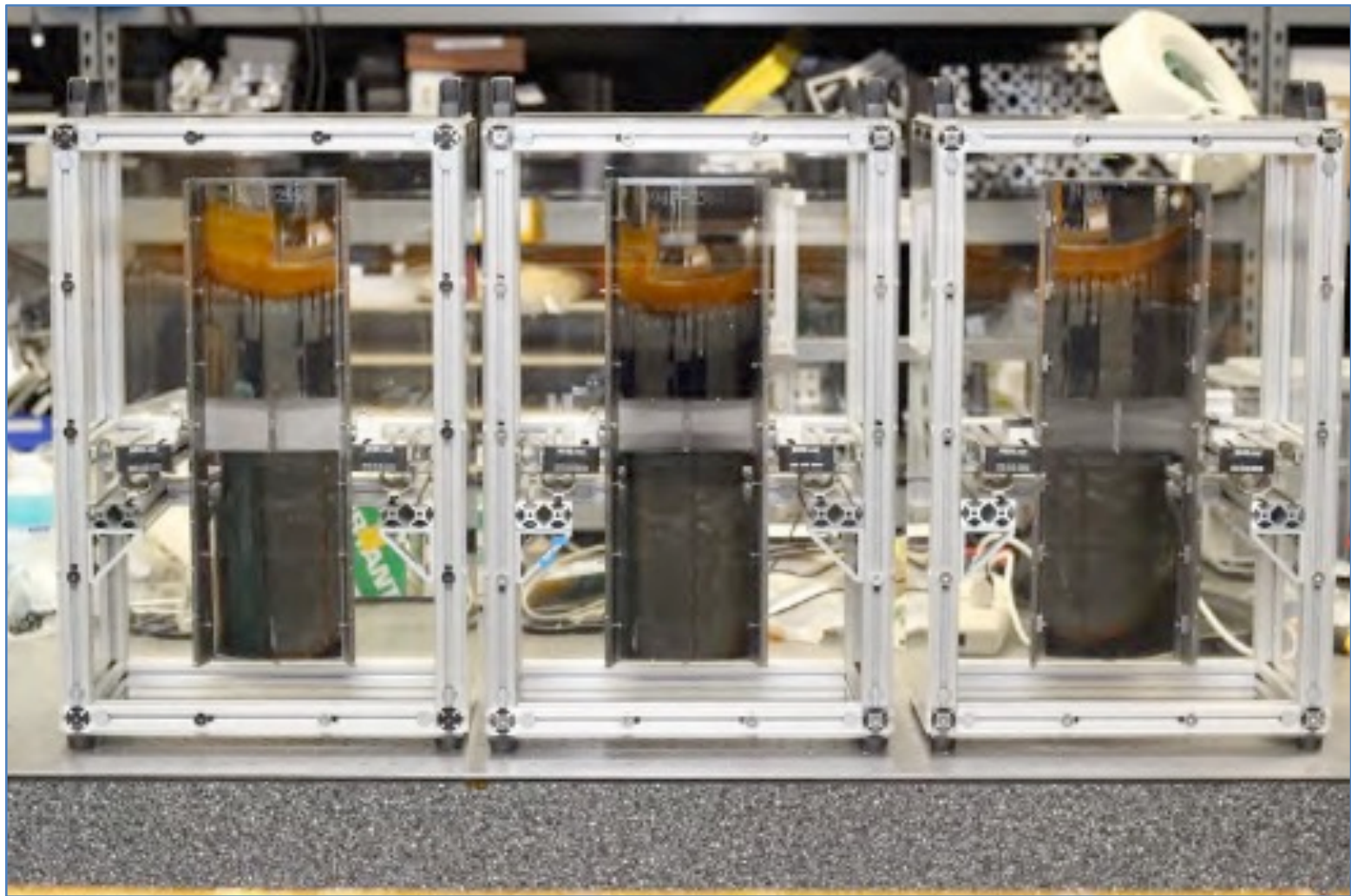




2013 Hardware Images

PCOS and COR Strategic Technology Portfolio

For more information about these technologies visit our Technology Database (<http://www.astrostrategictech.us>)

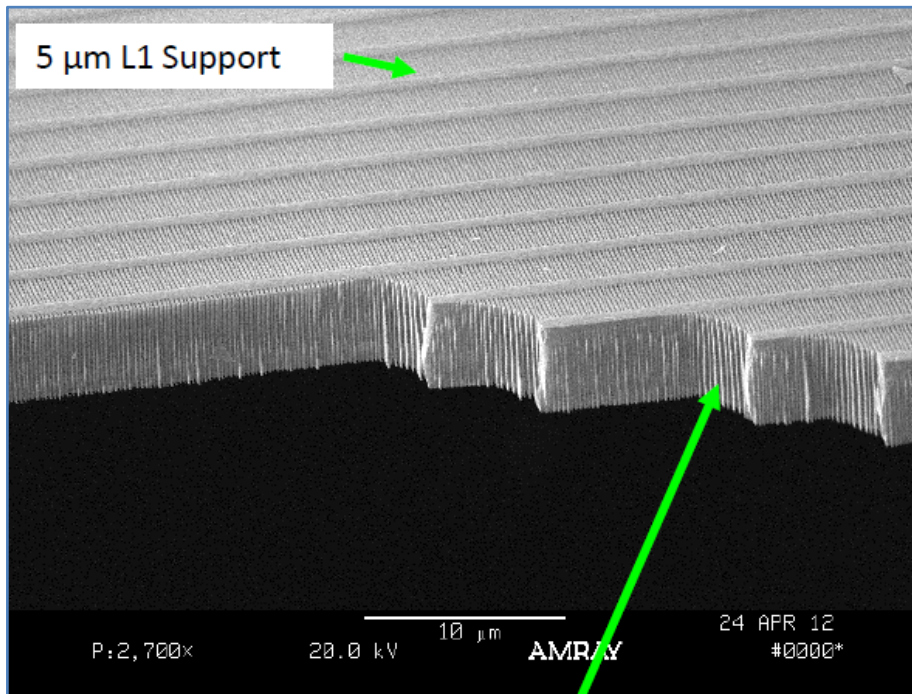


Three technology demonstration modules, each containing three pairs of thin X-ray mirrors

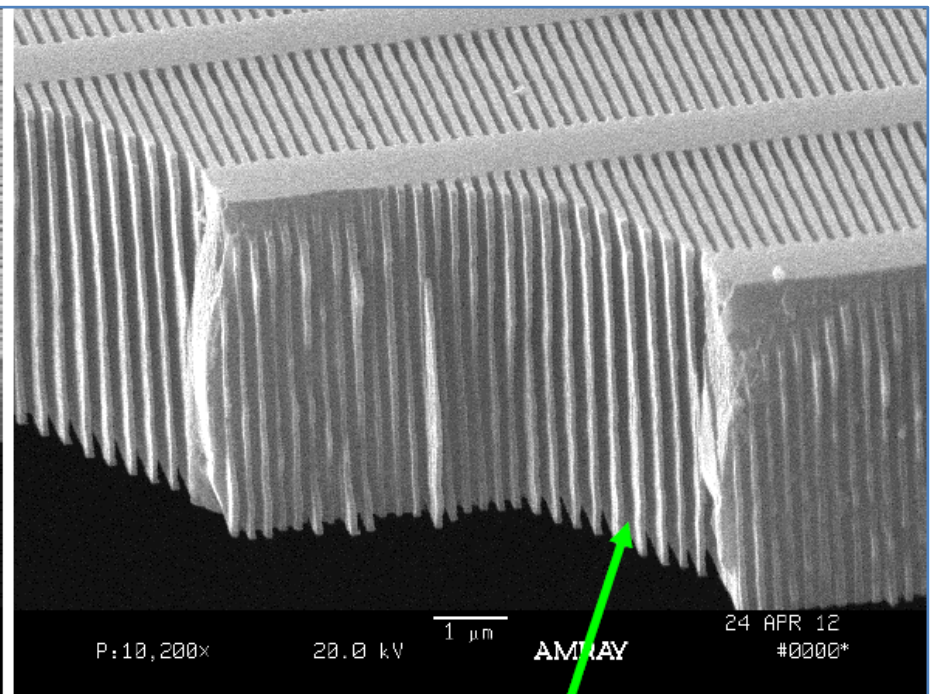
Significance: This slumped glass technique provided some of the world's best thin grazing-angle X-ray mirror performance at the time, and was the predecessor for even better single-crystal silicon mirrors that are baselined for Lynx X-ray flagship mission concept

Project Title: Next Generation X-ray Optics: High Resolution ,Light Weight, and Low Cost

PI: Zhang, William (GSFC)



200 nm pitch CAT grating bars



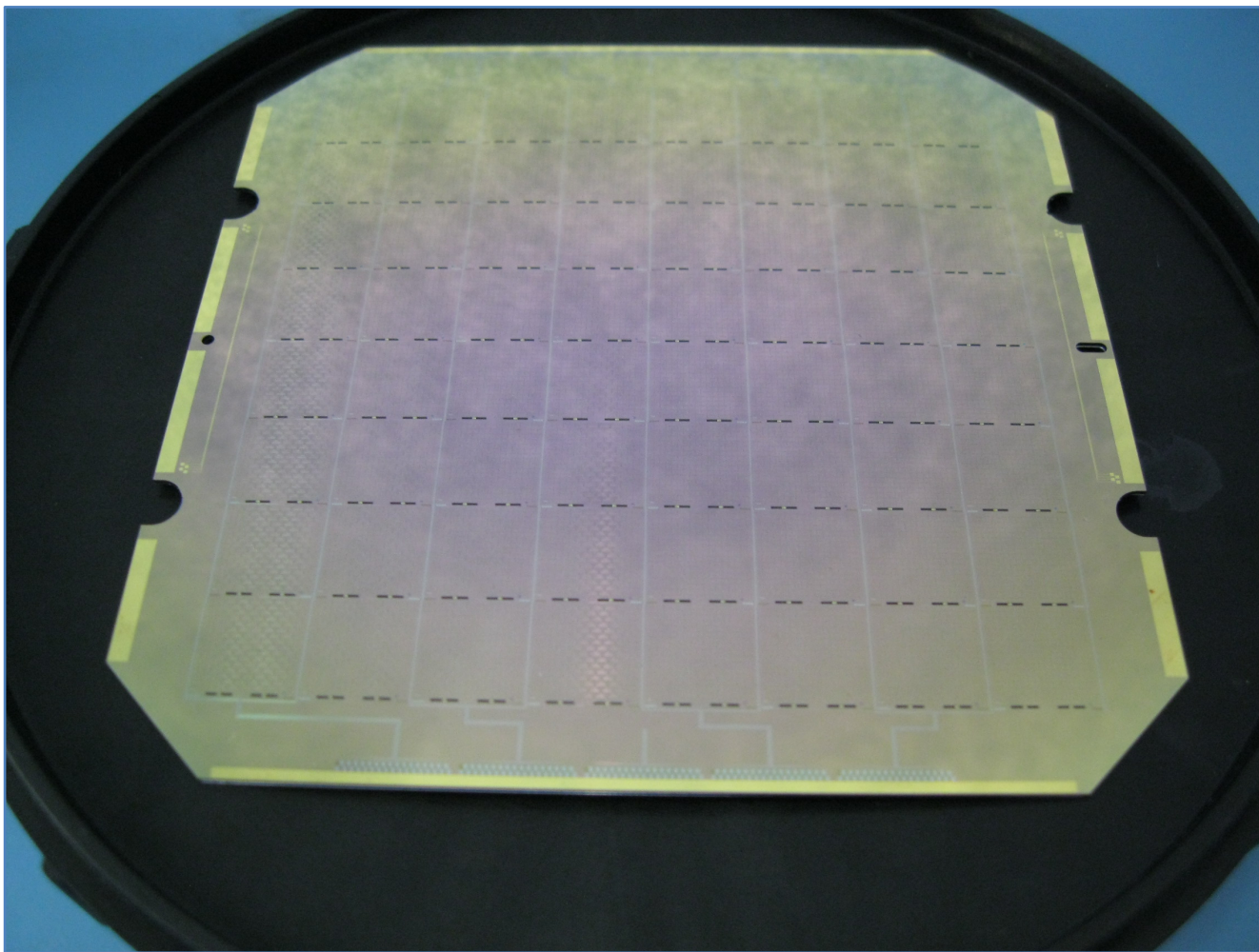
200 nm pitch CAT grating bars

Scanning Electron Microscope (SEM) images of cleaved prototype X-ray Critical-Angle Transmission (CAT) grating

Significance: Highest-resolution X-ray grating technology; baselined for Lynx X-ray flagship mission concept

Project Title: Development of Fabrication Process for X-Ray CAT Gratings

PI: Mark Schattenburg (MIT Kavli Institute for Astrophysics and Space Research)

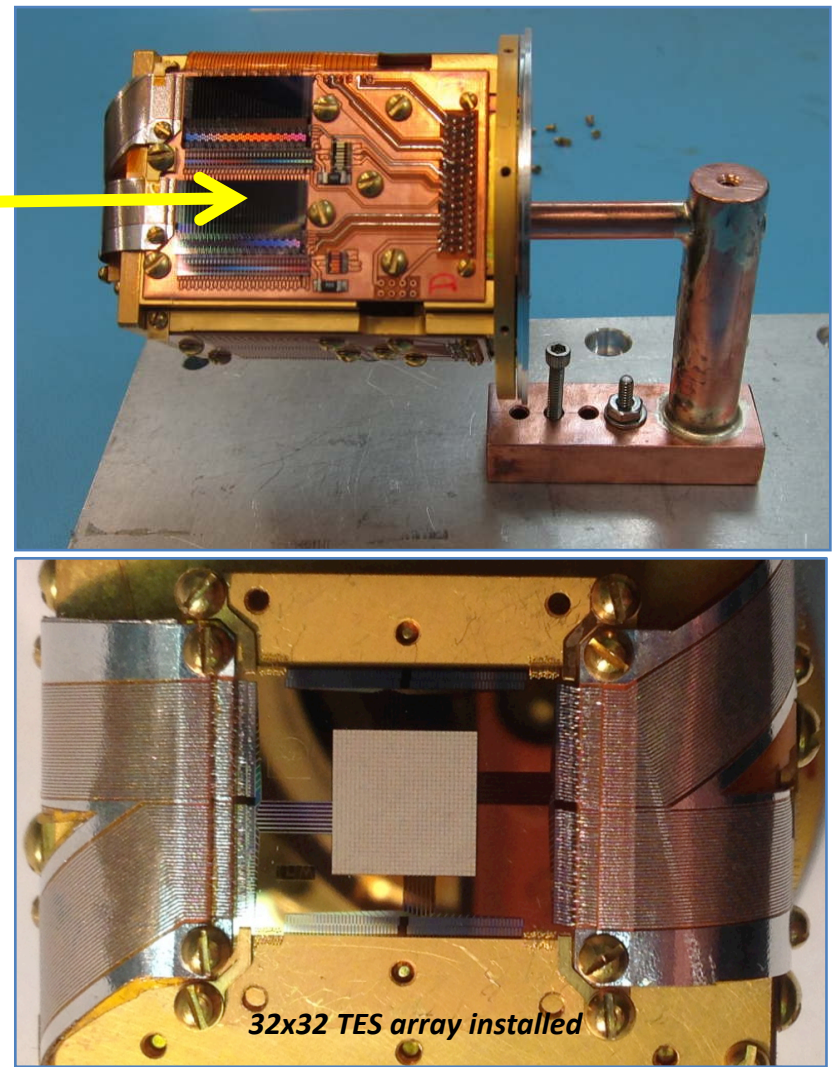
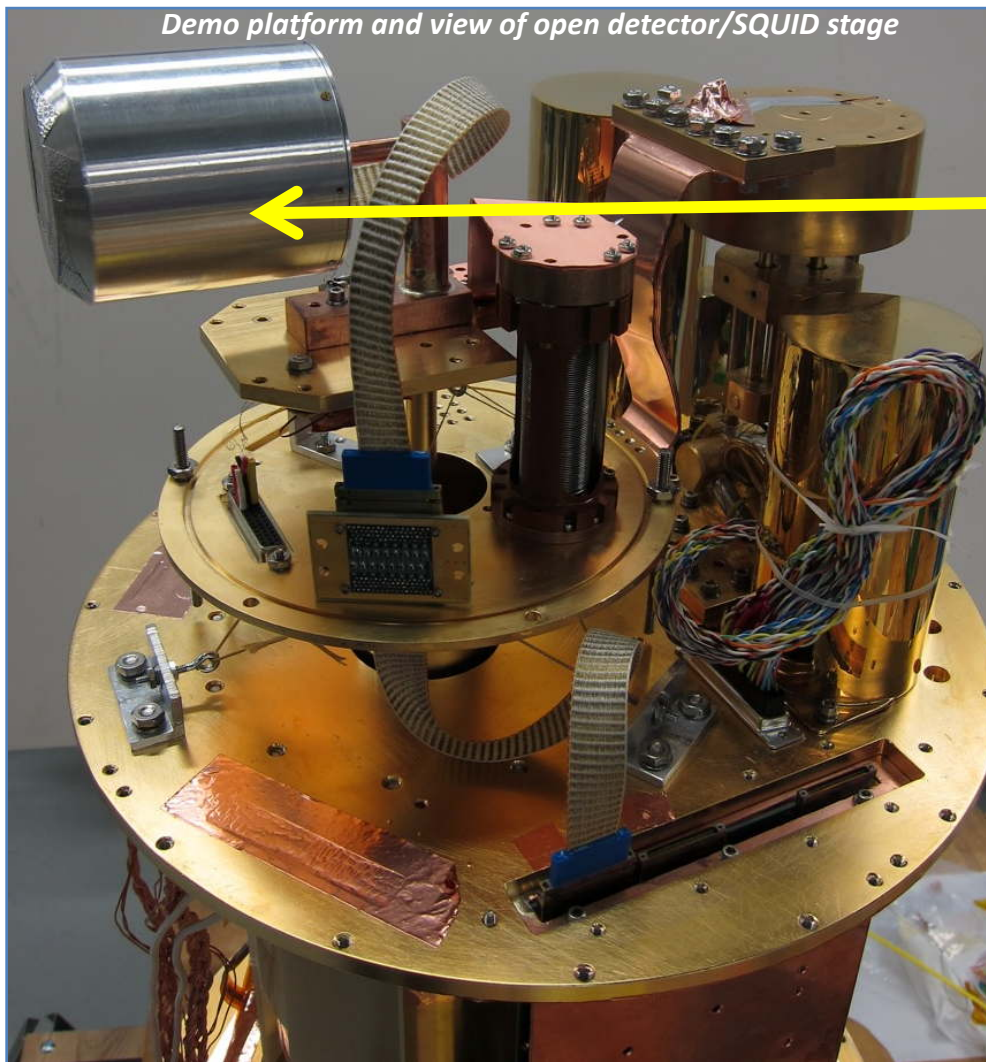


95 GHz sub-array tile with 128 transition-edge bolometers developed for the BICEP3 ground experiment for Cosmic Microwave Background (CMB) polarimetry

Significance: Developing antenna designs providing sensitivity, stability, and minimized particle susceptibility for bands required by the Inflation Probe, enabling identification of Inflation instants after the Big Bang

Project Title: Planar Antenna-Coupled Superconducting Detectors for CMB Polarimetry

PI: James Bock (JPL/Caltech)

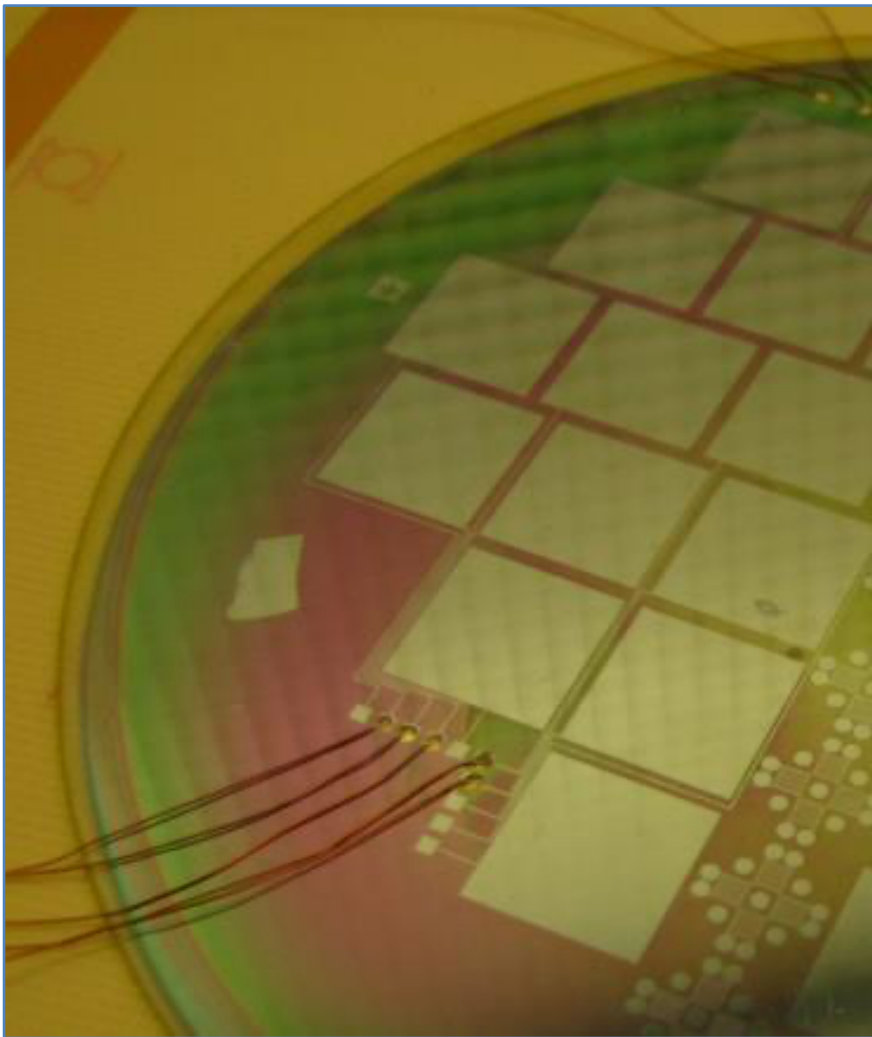


Test platform for Transition-Edge-Sensor (TES) arrays with 32×32-pixel array installed

Significance: TES microcalorimeters offer energy resolution for advanced X-ray observatories such as the European ATHENA mission

Project Title: High-Resolution Imaging X-ray Spectrometer

PI: Caroline Kilbourne (GSFC)



Flat test mirror with square piezo cells mounted to allow figure adjustment (left) and reaction structure for testing adjustable full-shell X-ray mirrors (right)

Significance: Adjustable X-ray optics are a backup technology for the Lynx large mission concept

Project Title: Adjustable X-ray Optics with Sub-Arcsecond Imaging / Moderate Angular Resolution Adjustable Full-shell Grazing Incidence X-ray Optics

PI: Paul Reid (SAO)

CCD X-ray detector with blocking filter deposited on all but a narrow strip on right

Significance: X-ray detectors operate far better when filters allow X-ray photons through and block longer wavelength light

Project Title: Directly-Deposited Blocking Filters for X-ray Imaging Detectors

PI: Mark Bautz (MIT Kavli Institute for Astrophysics and Space Research)



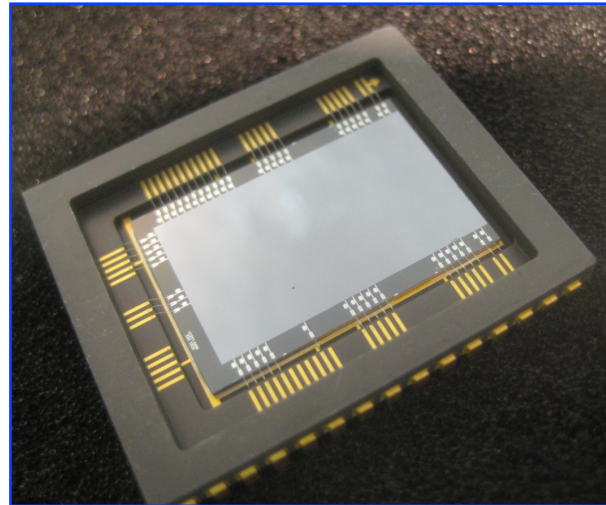
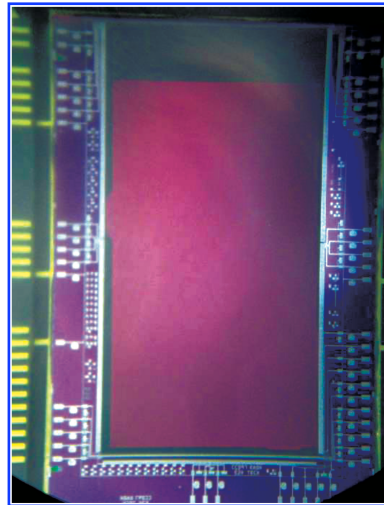
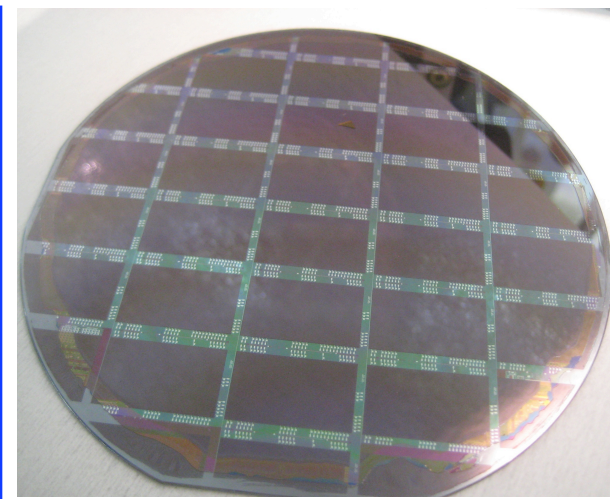
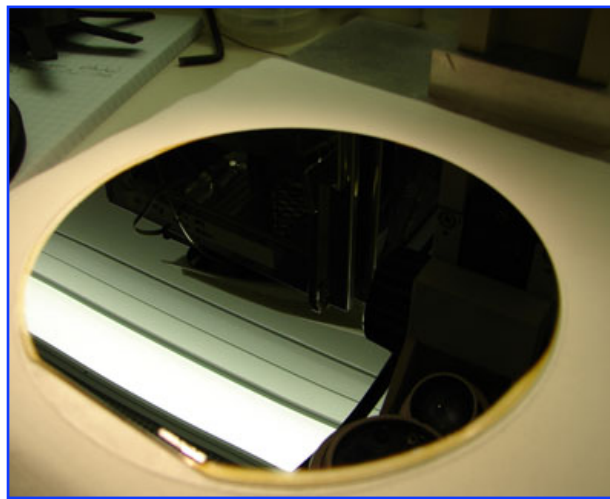
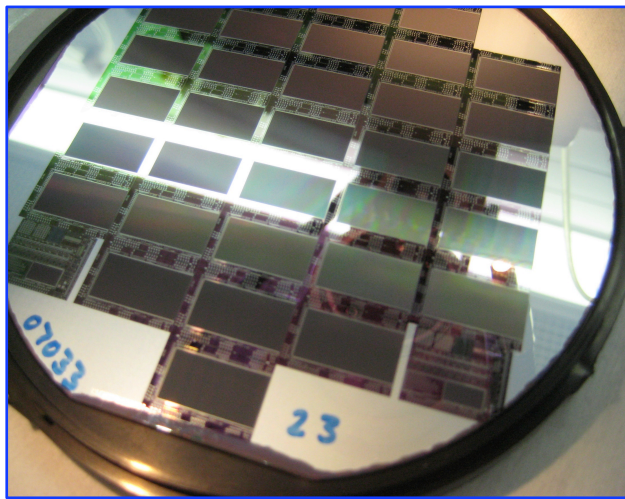


Thermal testing 43-cm-diameter deep-core mirror from 250 to 300 K

Significance: Deep-core manufacturing enables 4-m-class mirrors such as planned for the HabEx exoplanet observatory concept with significantly lower cost and risk

Project Title: Advanced Mirror Technology Development (AMTD) for Very Large Space Telescopes

PI: H. Philip Stahl (MSFC)

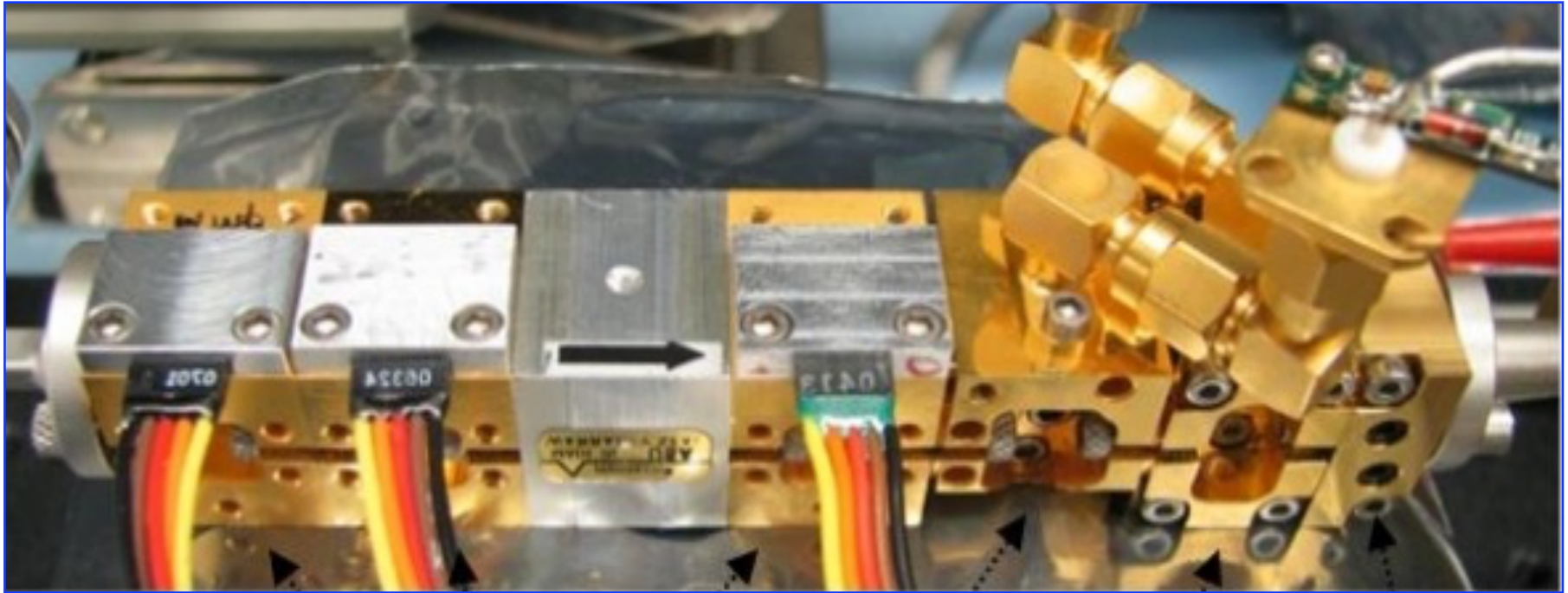


Delta-doped CCD detector fabrication: wafer (top left); bonded, thinned, and delta doped (top center); bond pads exposed (top right); diced (bottom left); and packaged (bottom right)

Significance: Advanced detectors developed by this team are baselined by SHIELDS, HabEx, LUVOIR, and ground facilities

Project Title: High-Efficiency Detectors in Photon Counting and Large Focal Plane Arrays

PI: Shouleh Nikzad (JPL/Caltech)

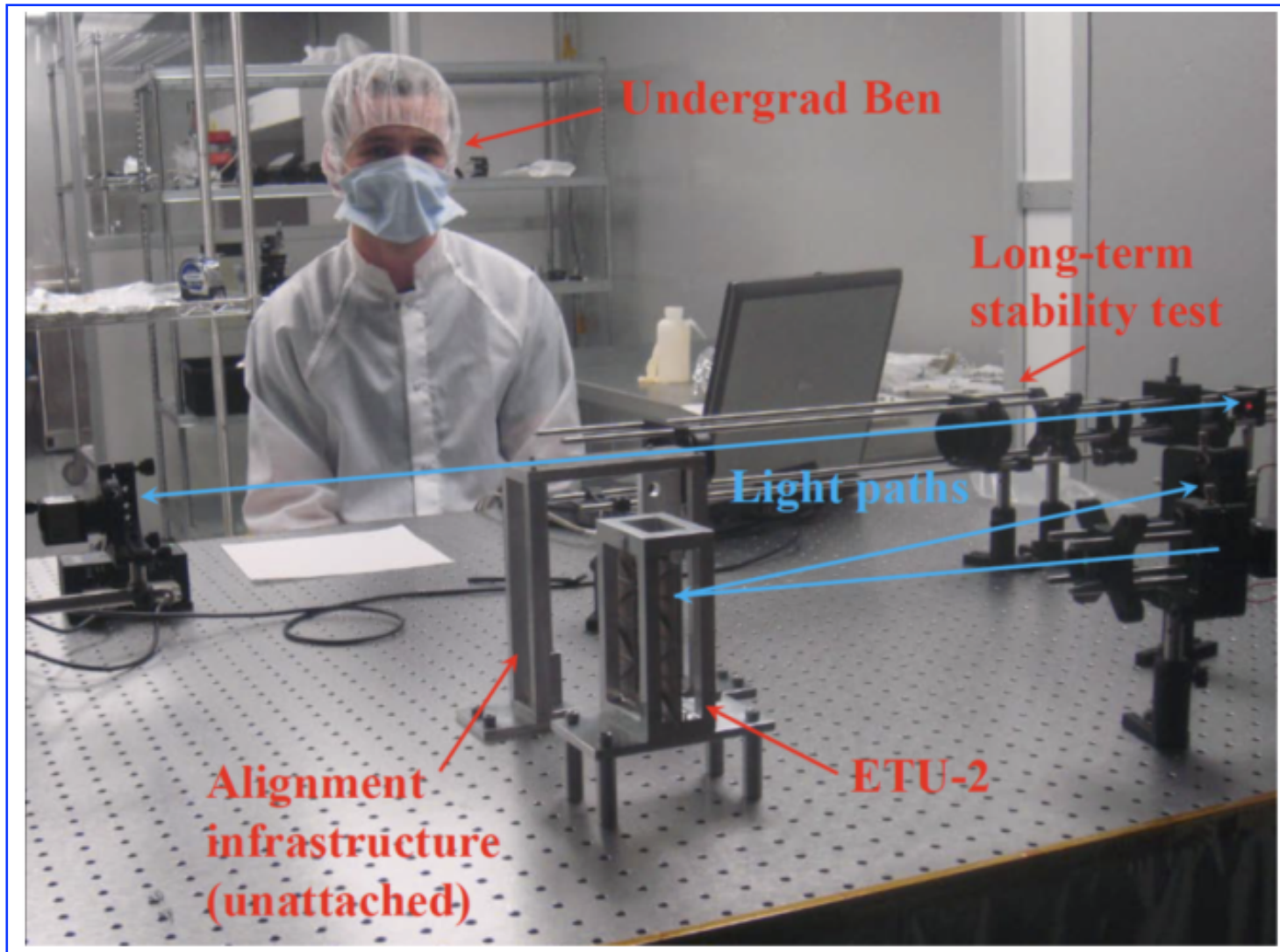


1.9-THz Local Oscillator (LO) source for a far-IR heterodyne detector

Significance: This high-resolution multi-pixel far-IR detector technology may enable or enhance future missions

Project Title: Heterodyne Technology for SOFIA (Stratospheric Observatory for Infrared Astronomy)

PI: Paul Goldsmith and Imran Mehdi (JPL)

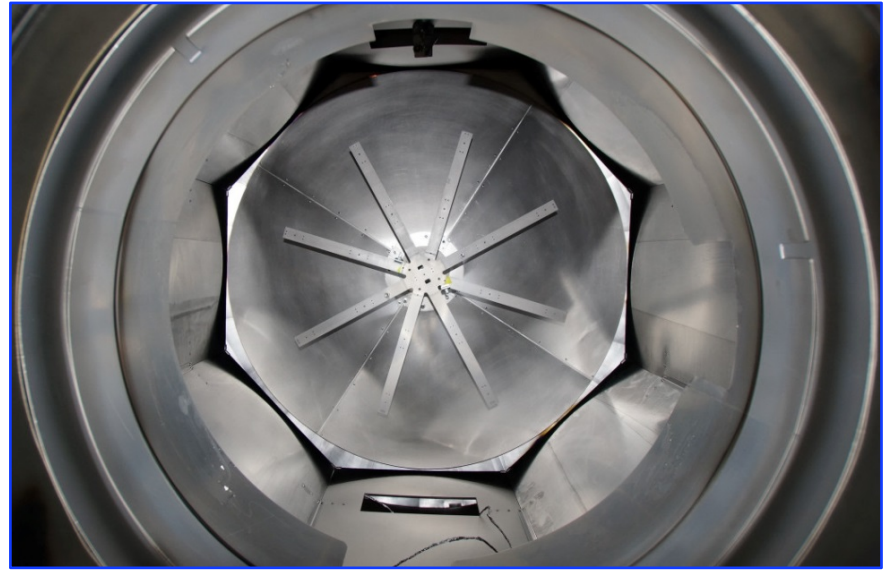
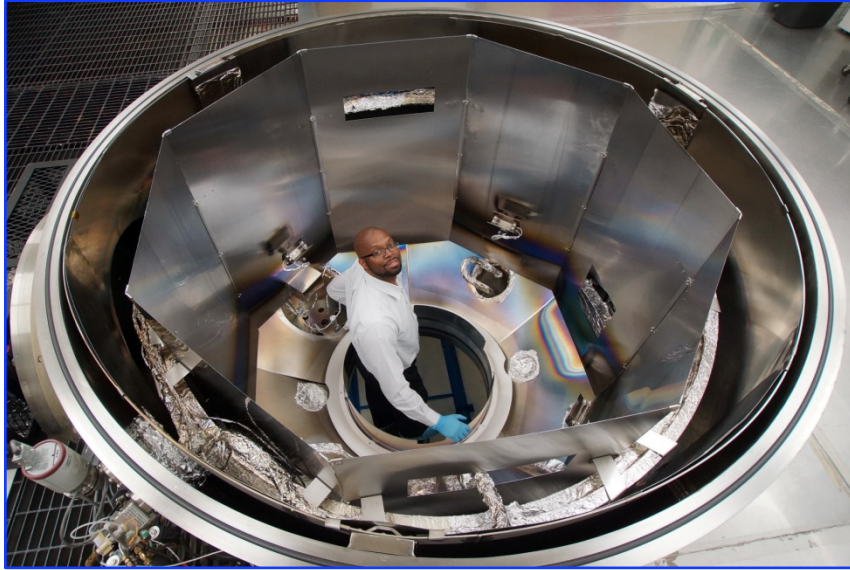


Alignment and long-term stability testing of off-plane X-ray reflection grating

Significance: X-ray reflection gratings enable high throughput, high spectral resolving power below 2 keV, a spectral band holding major astrophysics interest

Project Title: Off-Plane Grating Arrays for Future Missions

PI: Randall McEntaffer (PSU)

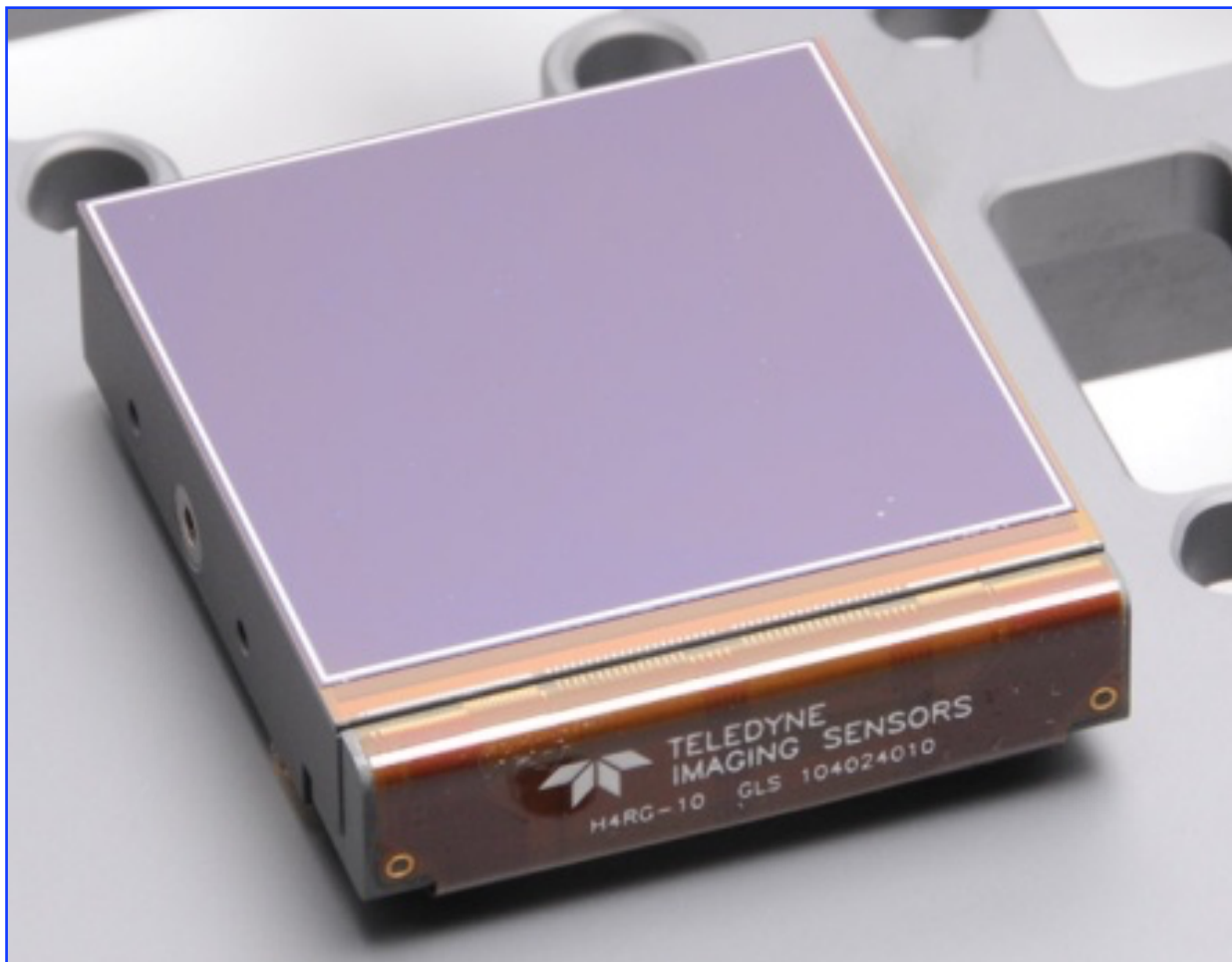


2-m coating chamber bottom (left) and bottom view of chamber top (right)

Significance: Advanced coatings with high reflectivity in the far UV enable future astrophysics missions by greatly enhancing system throughput in photon-starved far-UV observations

Project Title: Enhanced Al Mirrors for Far-UV Space Astronomy

PI: Manuel Quijada (GSFC)



Teledyne H4RG near-IR detector array for the Roman Space Telescope (previously WFIRST)

Significance: The Wide-Field Infra-Red Survey Telescope (WFIRST), renamed to the Roman Space Telescope, expected to launch in the mid-2020s, is a NASA observatory designed to study dark energy and dark matter, search for and image exoplanets, and explore many topics in IR astrophysics.

Project Title: H4RG Near-IR Detector Array with 10- μm pixels for WFIRST and Space Astrophysics

PI: Bernard Rauscher (GSFC)