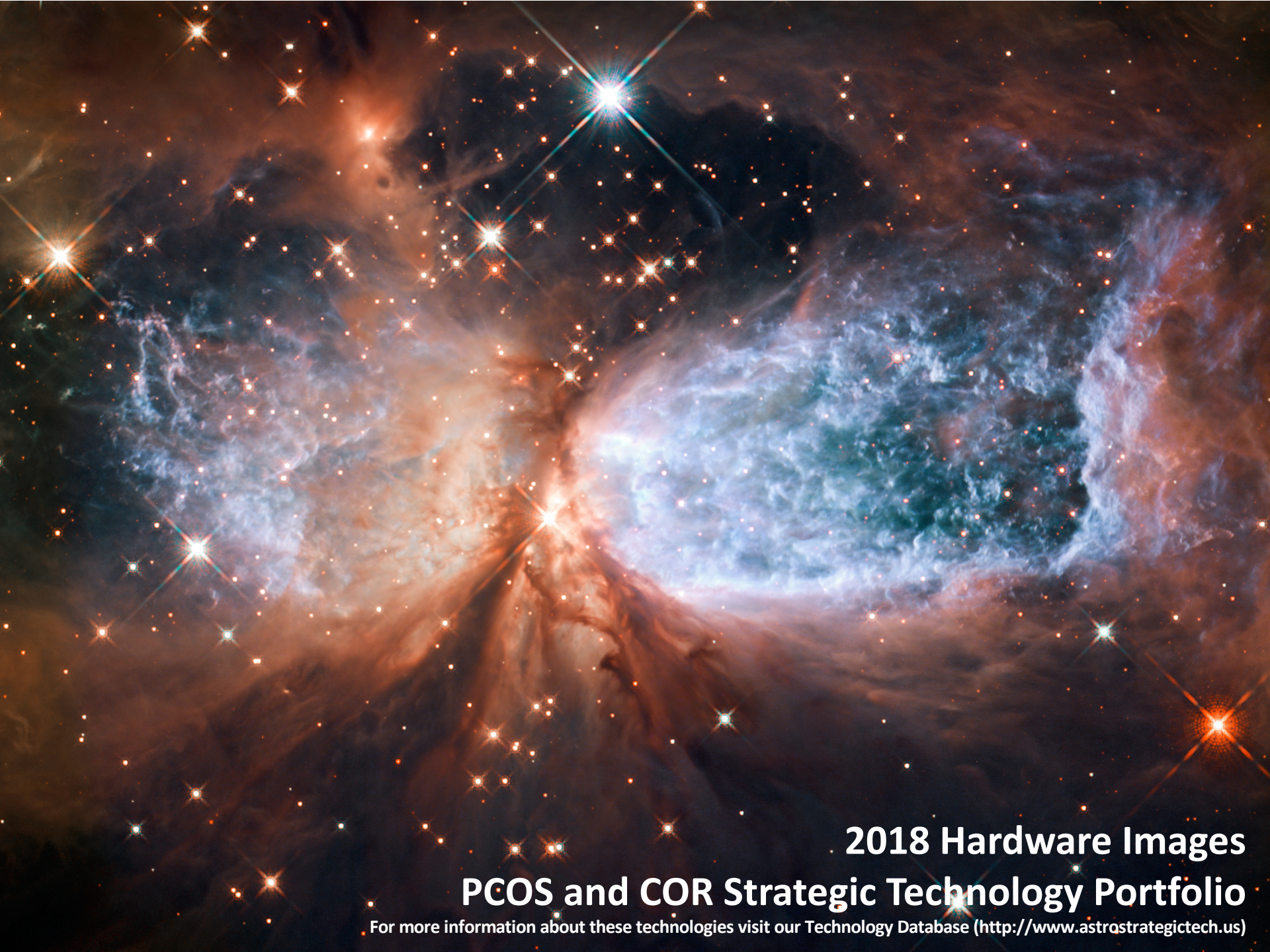
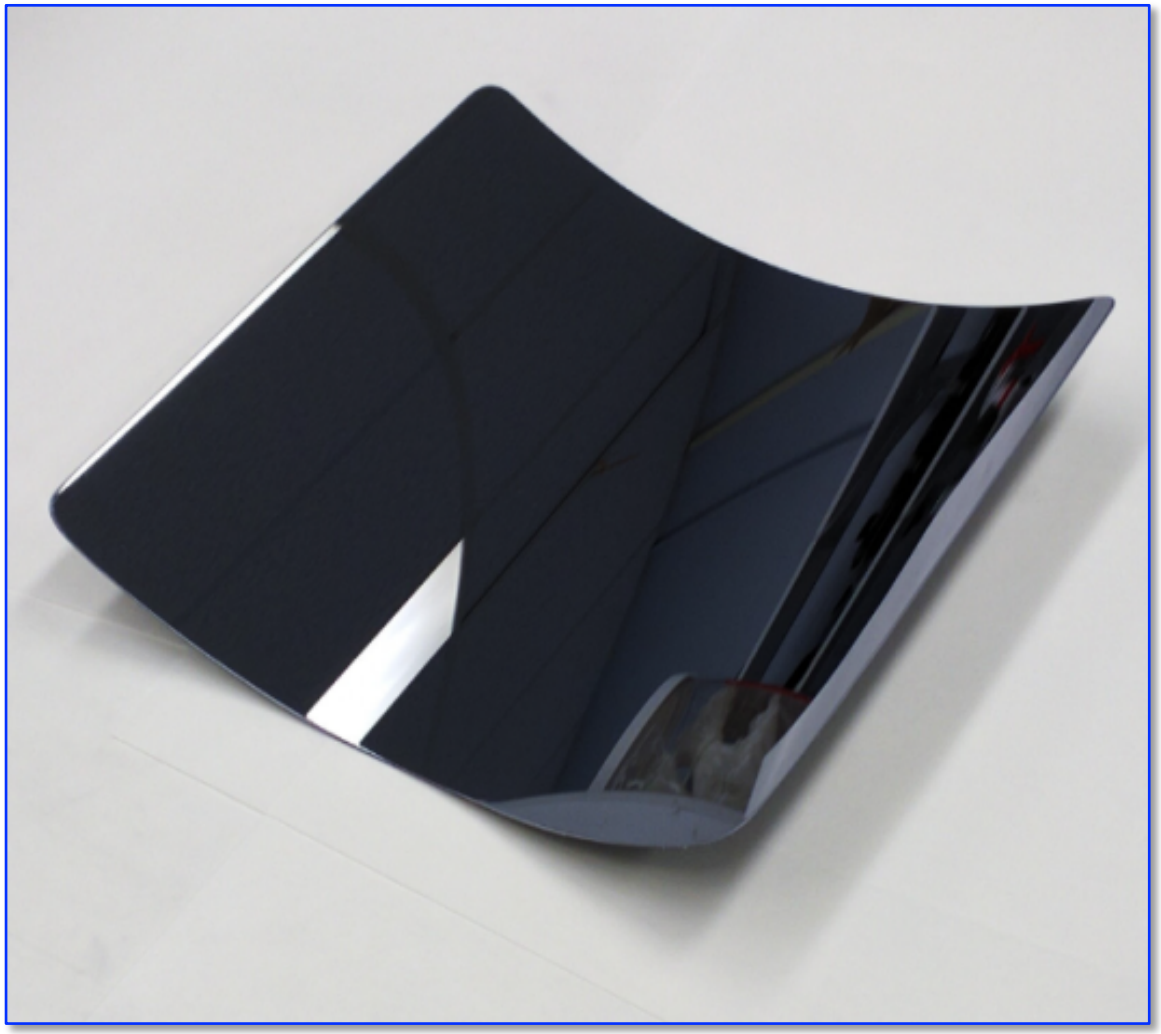


2018 Hardware Images

PCOS and COR Strategic Technology Portfolio

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

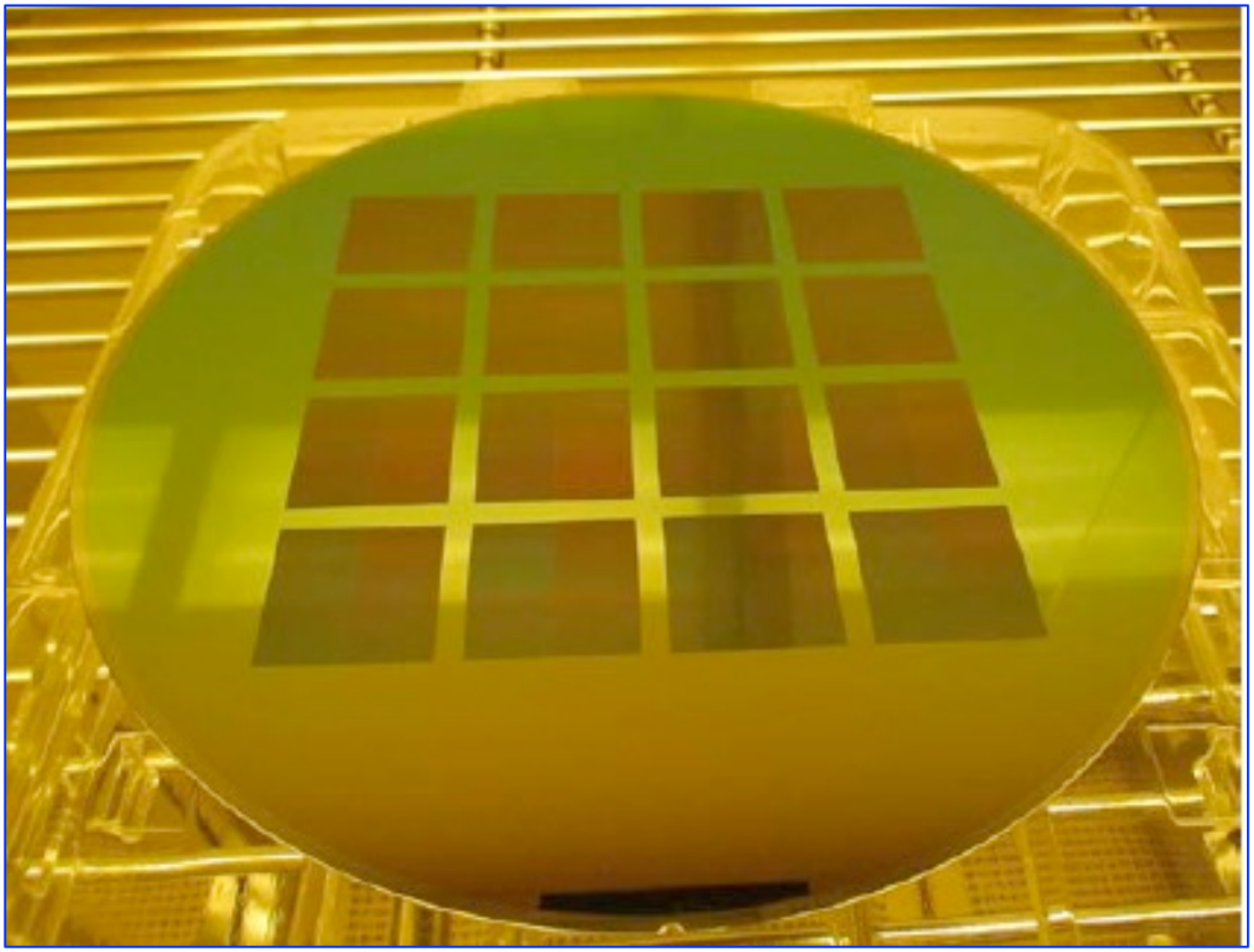


Thin single-crystal silicon X-ray mirror segment (before trimming)

Significance: World-class thin grazing-angle X-ray mirror technology; 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)

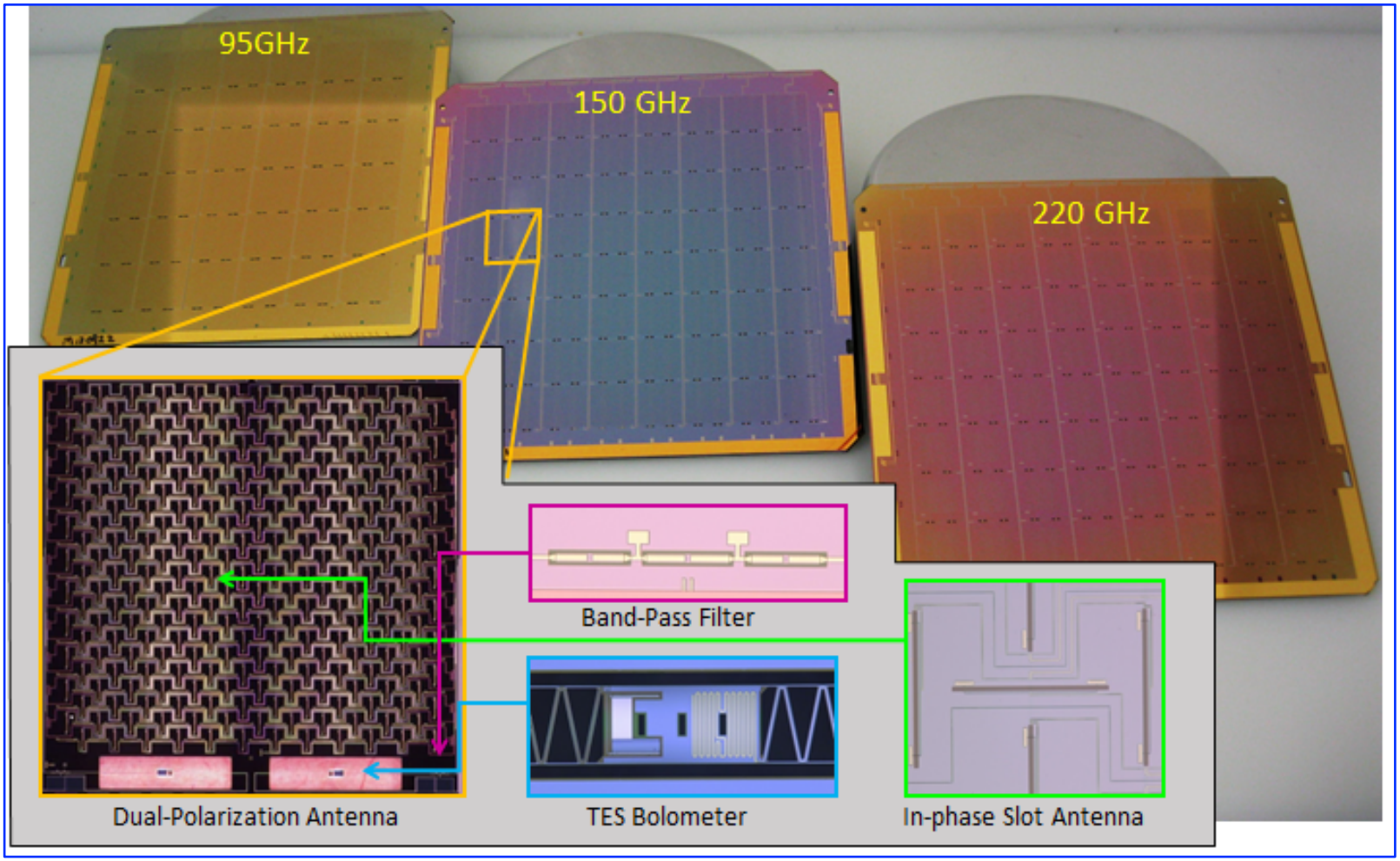


Fully patterned 200-mm X-ray Critical-Angle Transmission (CAT) grating wafer

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

Project Title: Development of a CAT Grating Spectrometer

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

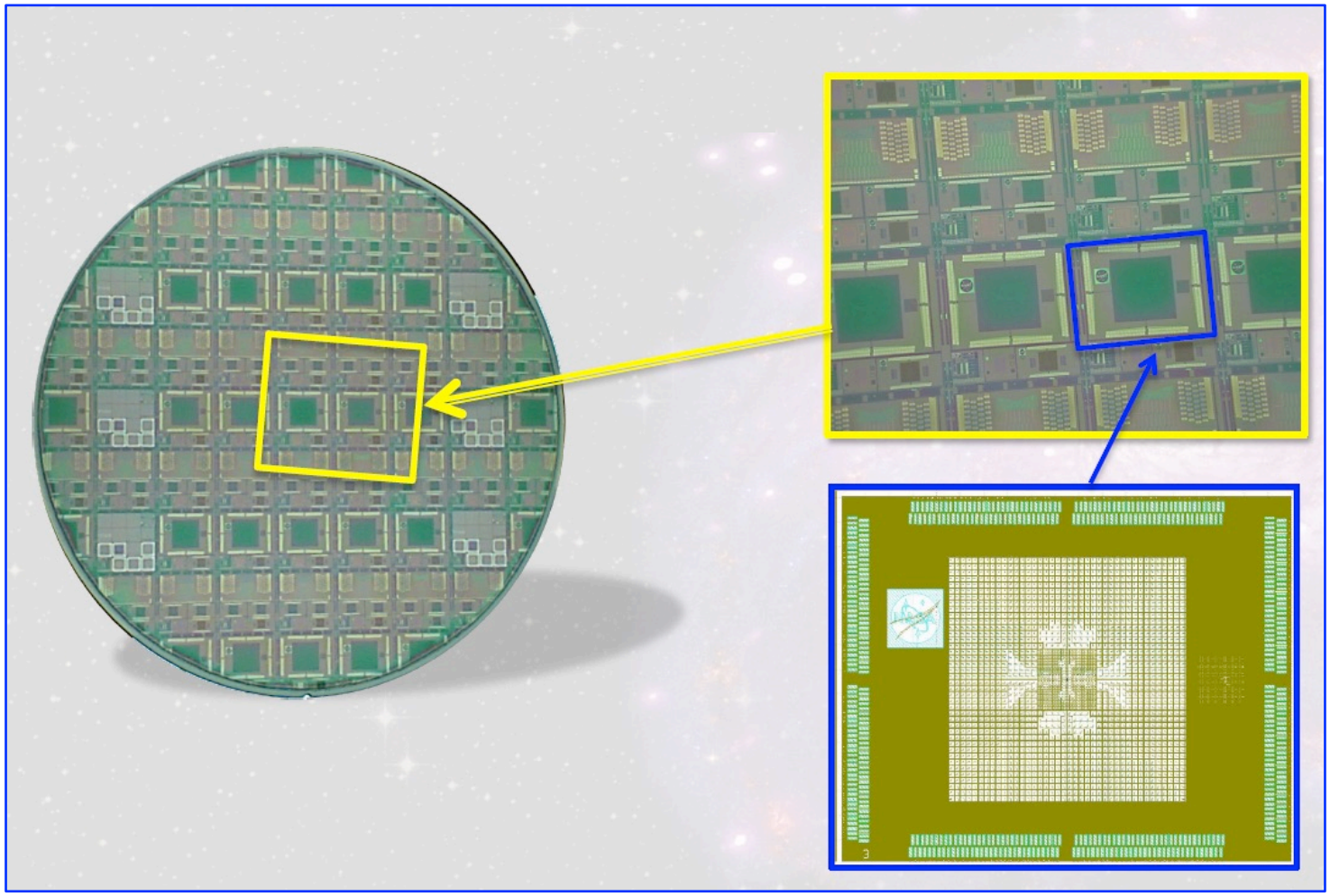


Lithographed 'Polarimeter on a Chip' enabling large multi-frequency arrays of Transition Edge Sensor (TES) bolometers for Cosmic Microwave Background (CMB) polarimetry

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)

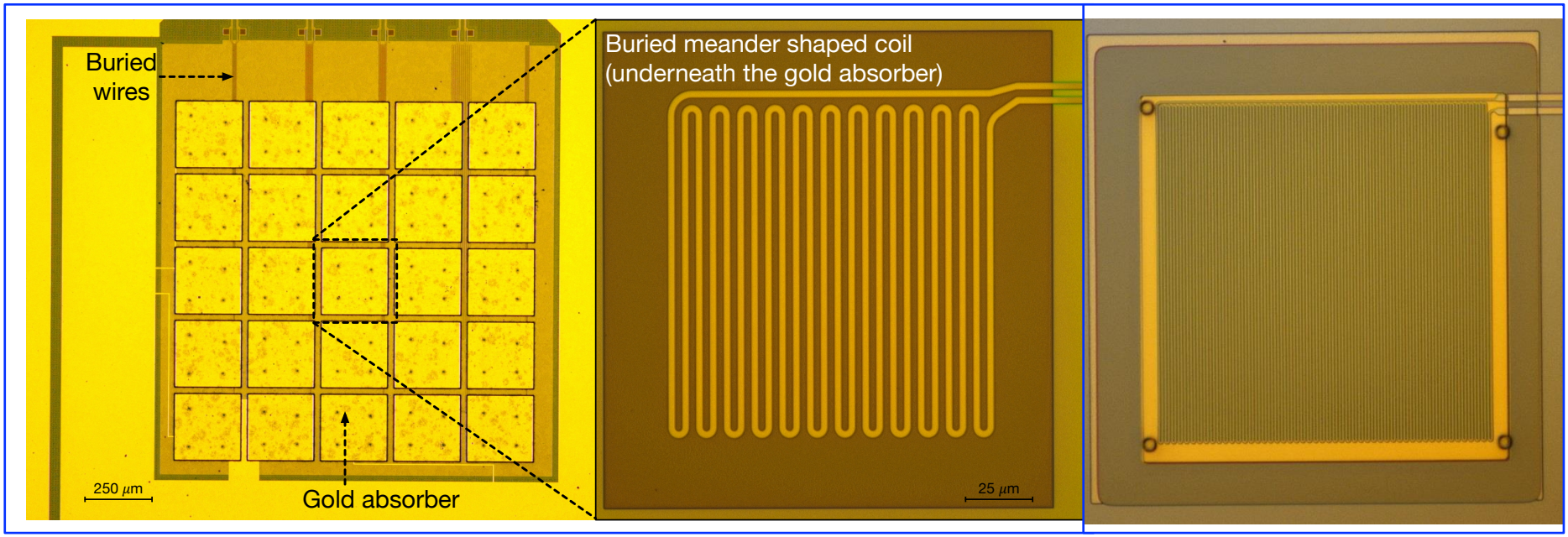


Lynx X-ray Microcalorimeter (LXM) prototype arrays using Transition-Edge Sensors (TESs) – 8” wafers cored down into 4” wafers

Significance: TES microcalorimeters offer energy resolution that may enable future missions such as the Lynx X-ray flagship mission concept

Project Title: Advanced X-ray Microcalorimeters: TES Microcalorimeters

PI: Caroline Kilbourne (GSFC)

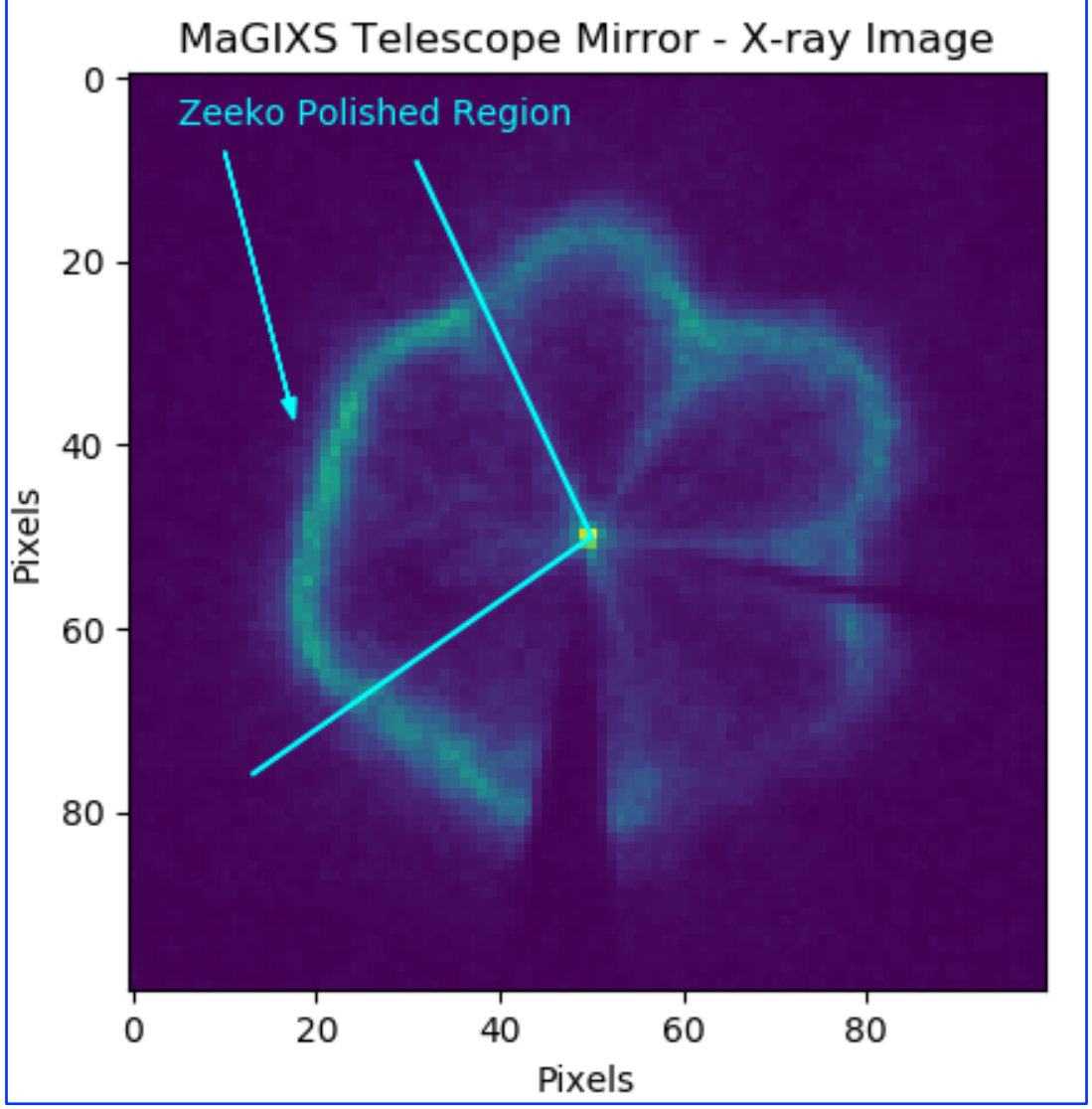


First Magnetically-Coupled Microcalorimeters (MMCs) fabricated with buried meander coils

Significance: MMCs offer energy resolution that may enable future X-ray missions such as the Lynx X-ray flagship mission concept

Project Title: MMC Arrays for X-ray Astrophysics

PI: Simon Bandler (GSFC)

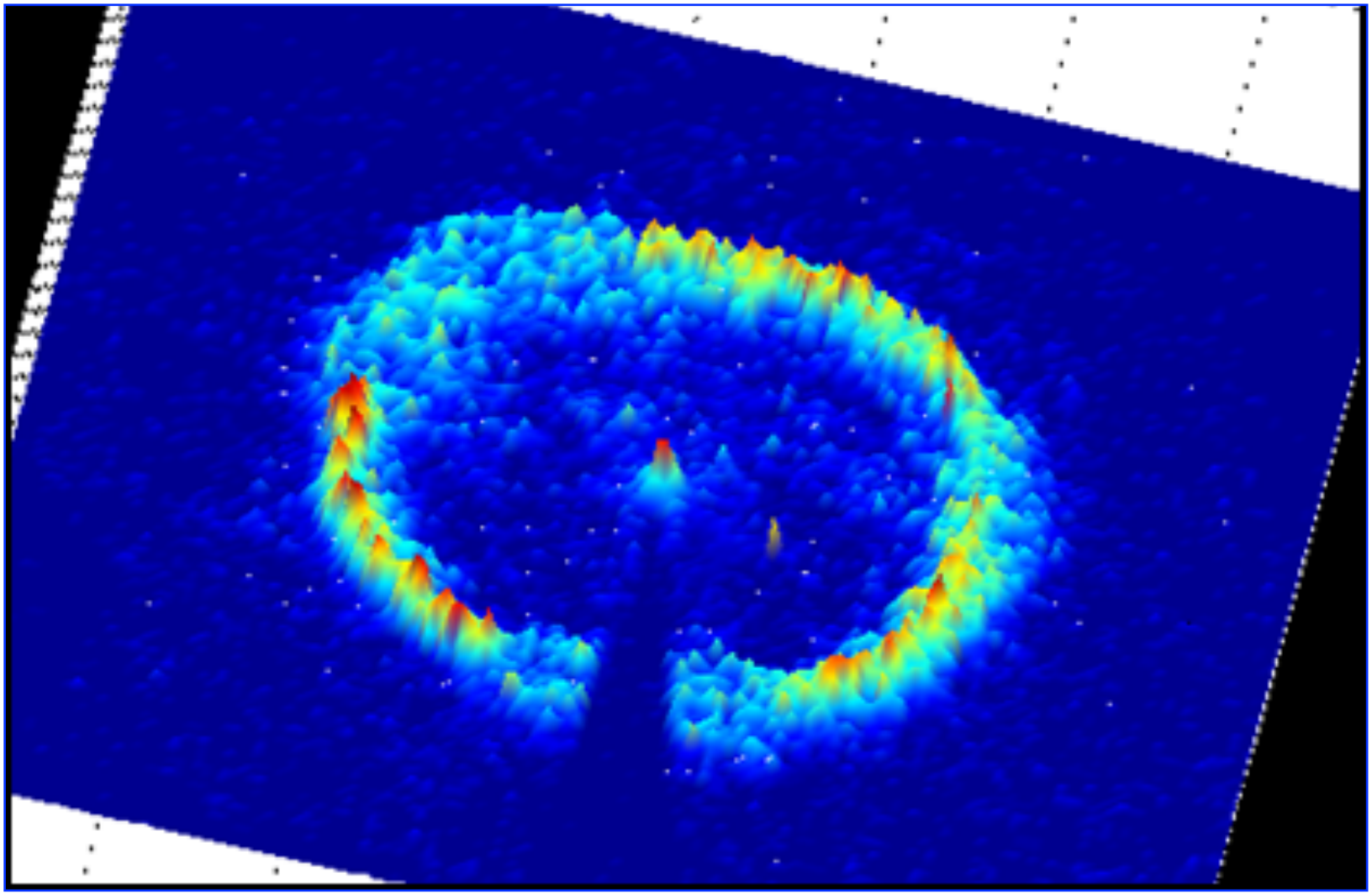


X-ray testing of Marshall Grazing Incidence X-ray Spectrometer (MaGIXS) replicated shell shows improved results in polished area

Significance: High-quality X-ray optics may enable or enhance future Astrophysics missions

Project Title: Advanced X-ray Optics: Computer-Controlled Polishing of High-Quality Mandrels

PI: Jacqueline Davis (MSFC)

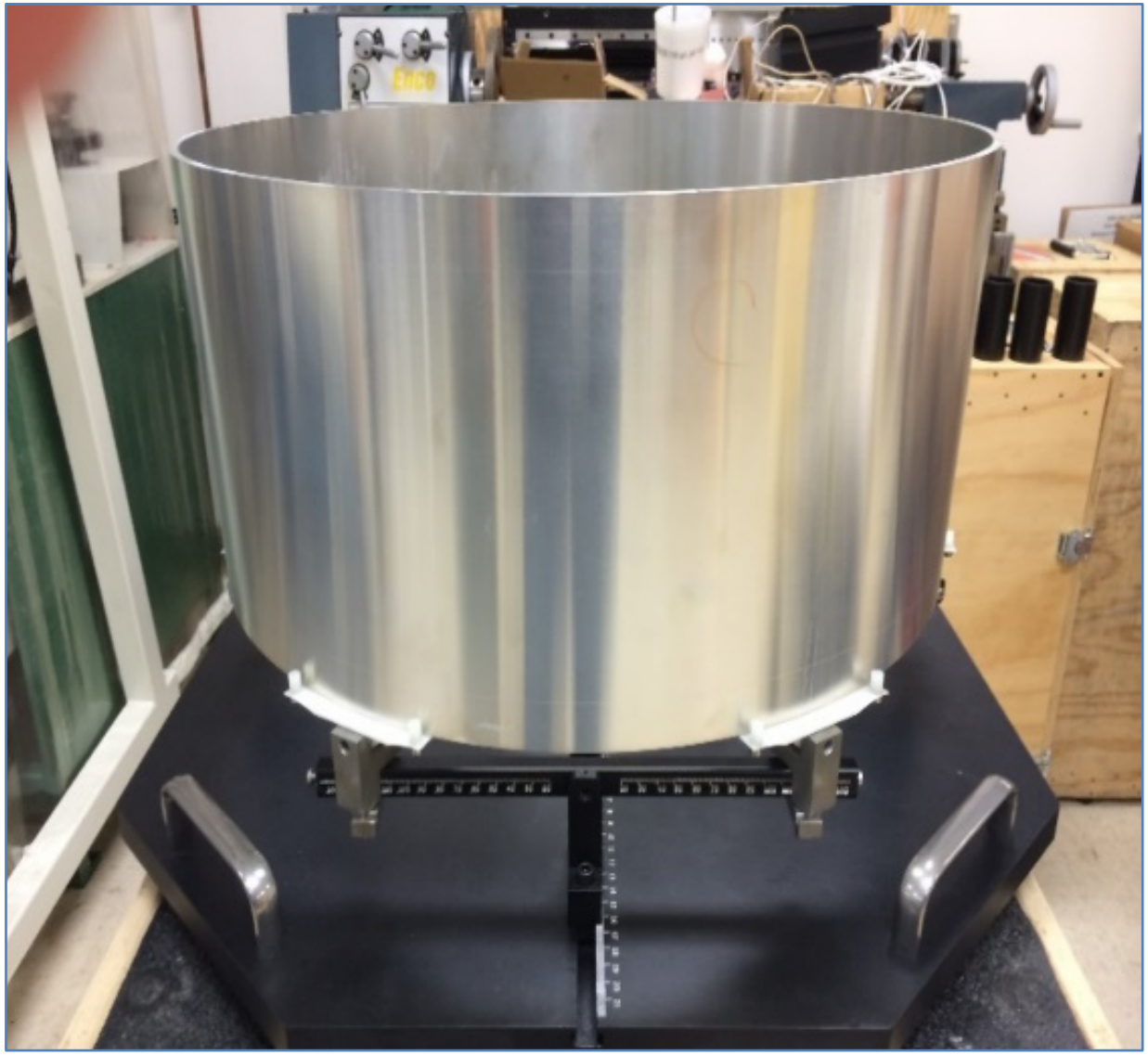


CCD image demonstrating improvement in performance after optics figure corrected using differential deposition

Significance: High-quality X-ray optics may enable or enhance future Astrophysics missions

Project Title: Advanced X-ray Optics: Differential Deposition for Figure Correction in X-Ray Optics

PI: Kiranmayee Kilaru (MSFC)

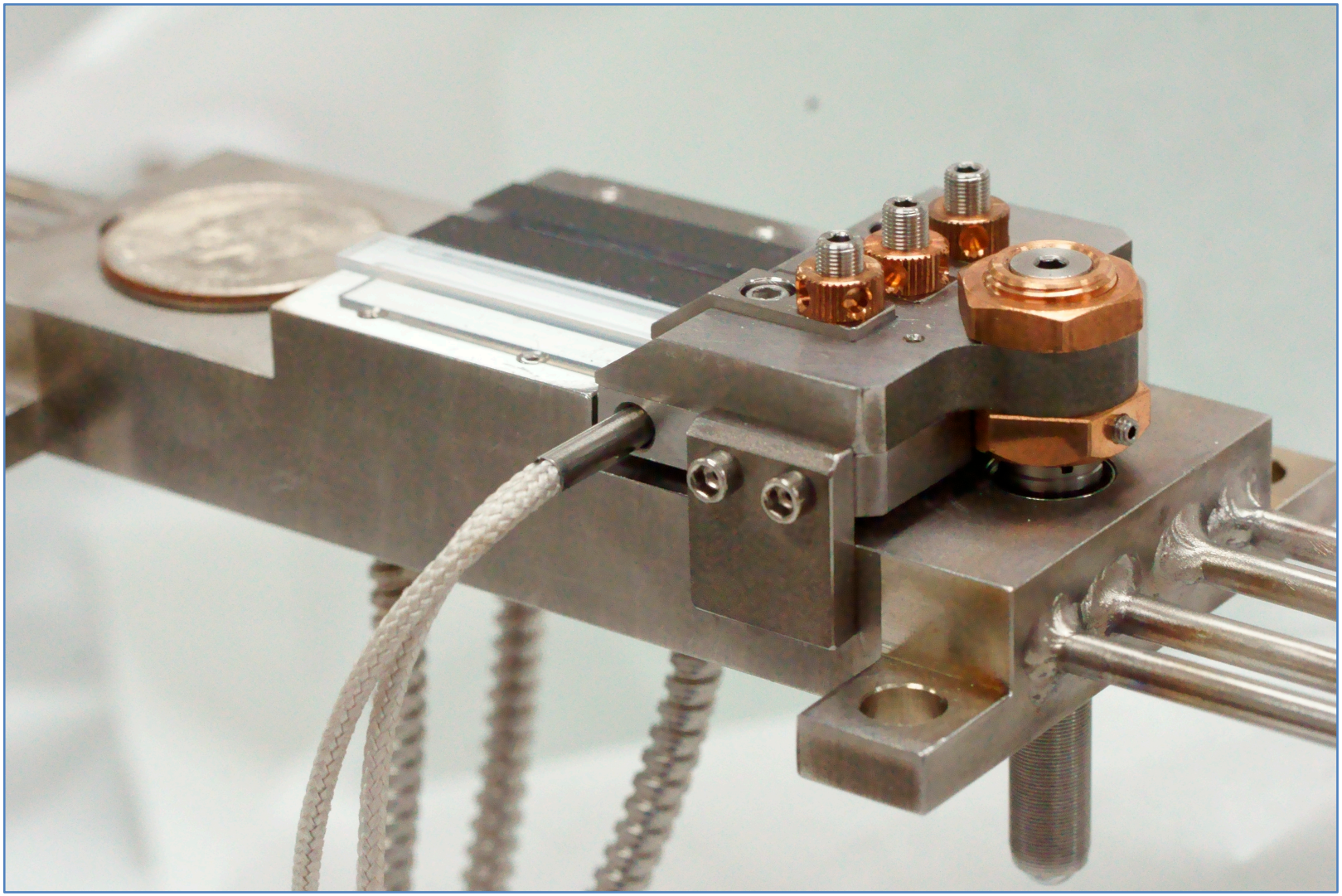


Aluminum surrogate shell for testing full-shell direct polishing method

Significance: High-quality X-ray optics may enable future X-ray missions

Project Title: Advanced X-ray Optics: Full-Shell Direct Polishing

PI: Stephen Bongiorno (MSFC)

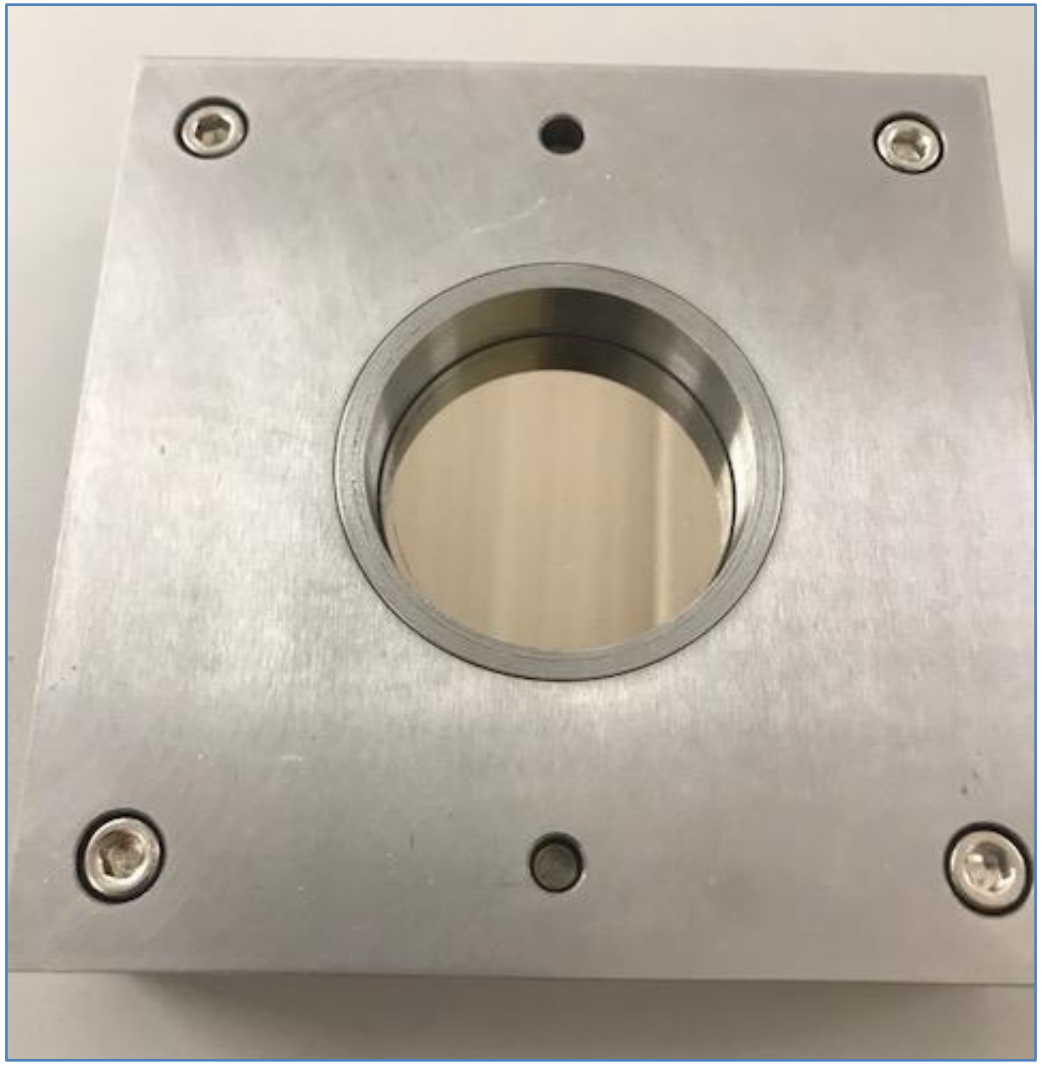


MSFC's novel in-situ stress measurement device to be adapted for measuring stress in coatings deposited on curved X-ray mirror segments

Significance: High-quality X-ray optics may enable future missions

Project Title: Advanced X-ray Optics: Mirror Coatings

PI: David Broadway (MSFC)

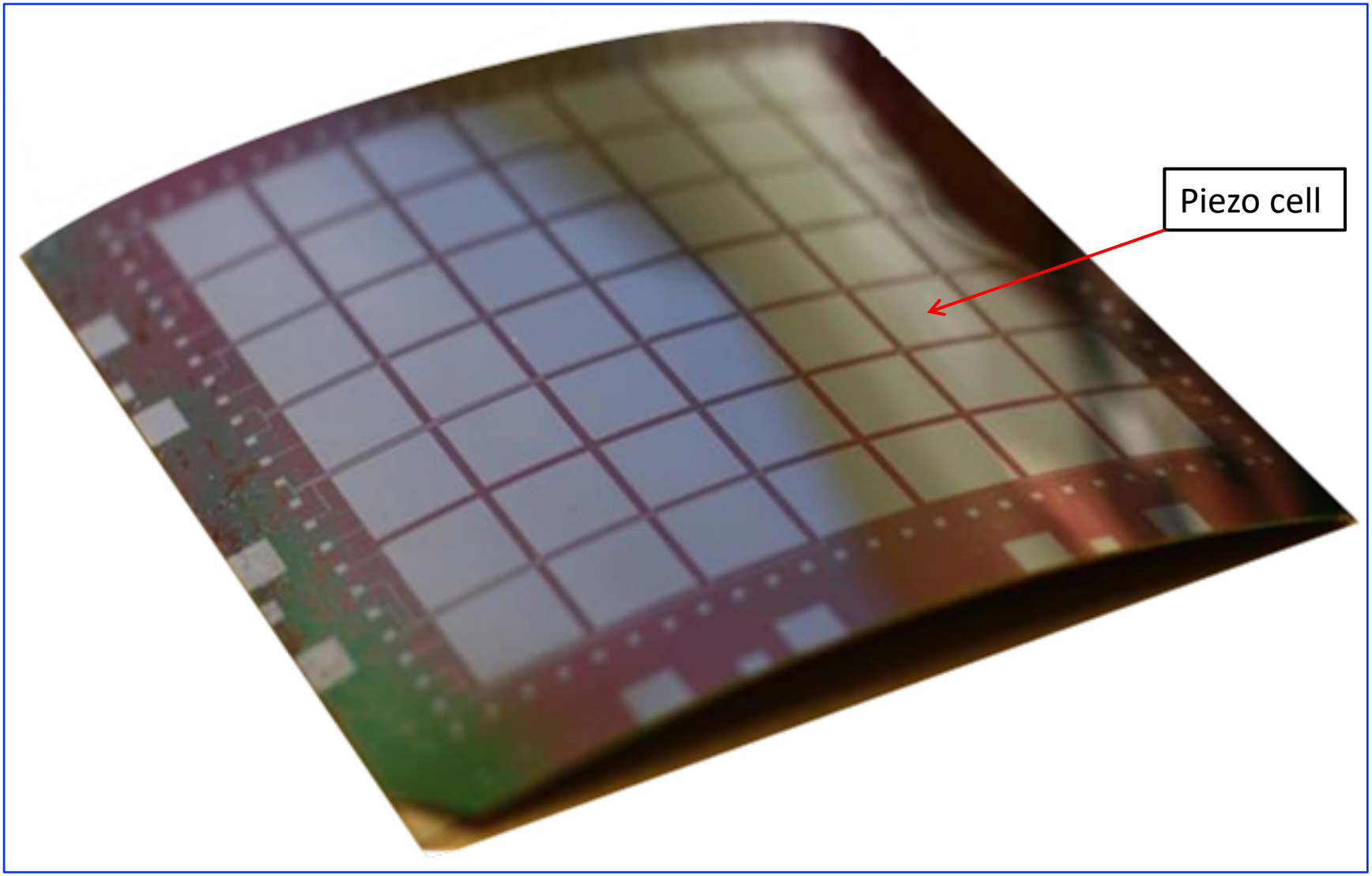


Mold for X-ray optics derived from highly figured and polished mandrels traditionally used for electroforming full-shell X-ray optics

Significance: Low-cost, lightweight, high-quality X-ray optics may enable many future missions

Project Title: Advanced X-ray Optics: Hybrid X-Ray Optics by Additive Manufacturing

PI: David Broadway (MSFC)

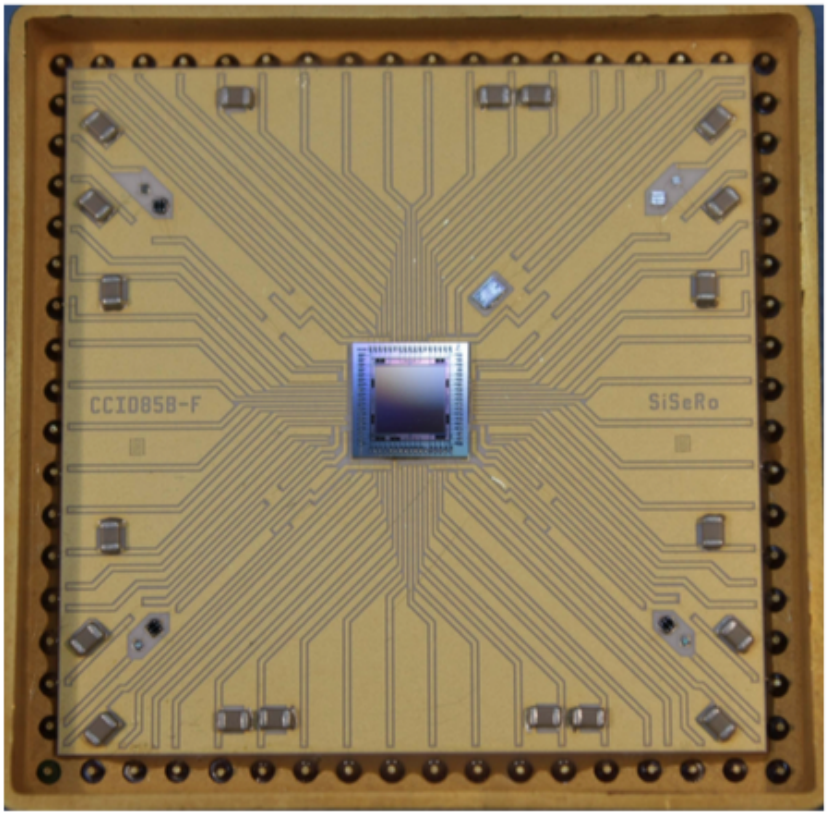


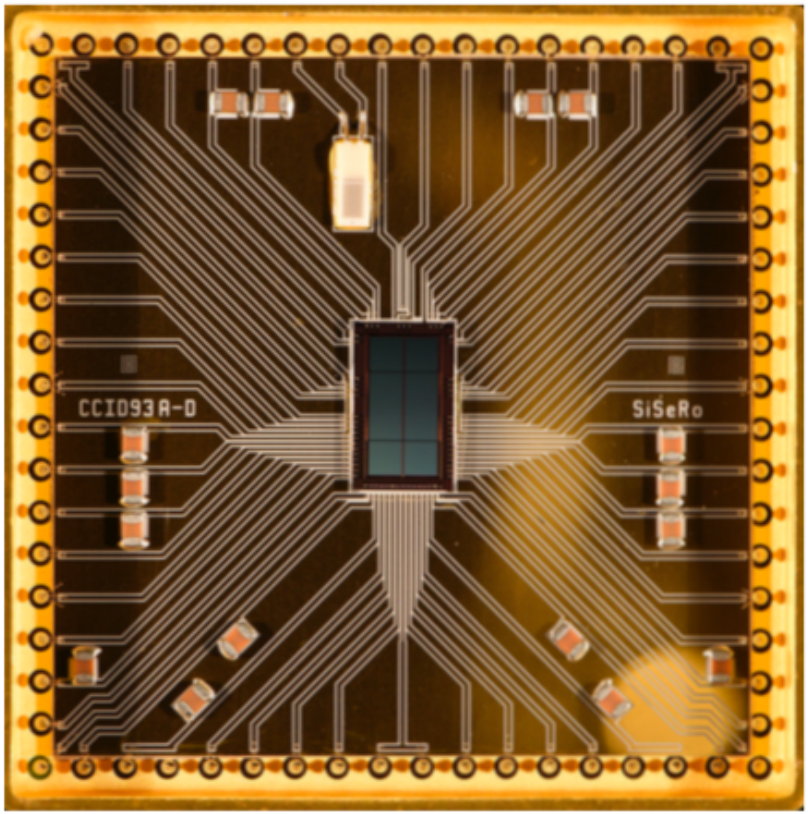
Curved 10×10 cm^2 0.4-mm-thick X-ray mirror sample, with piezo cells mounted on back

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

Project Title: Adjustable X-Ray Optics

PI: Paul Reid (SAO)



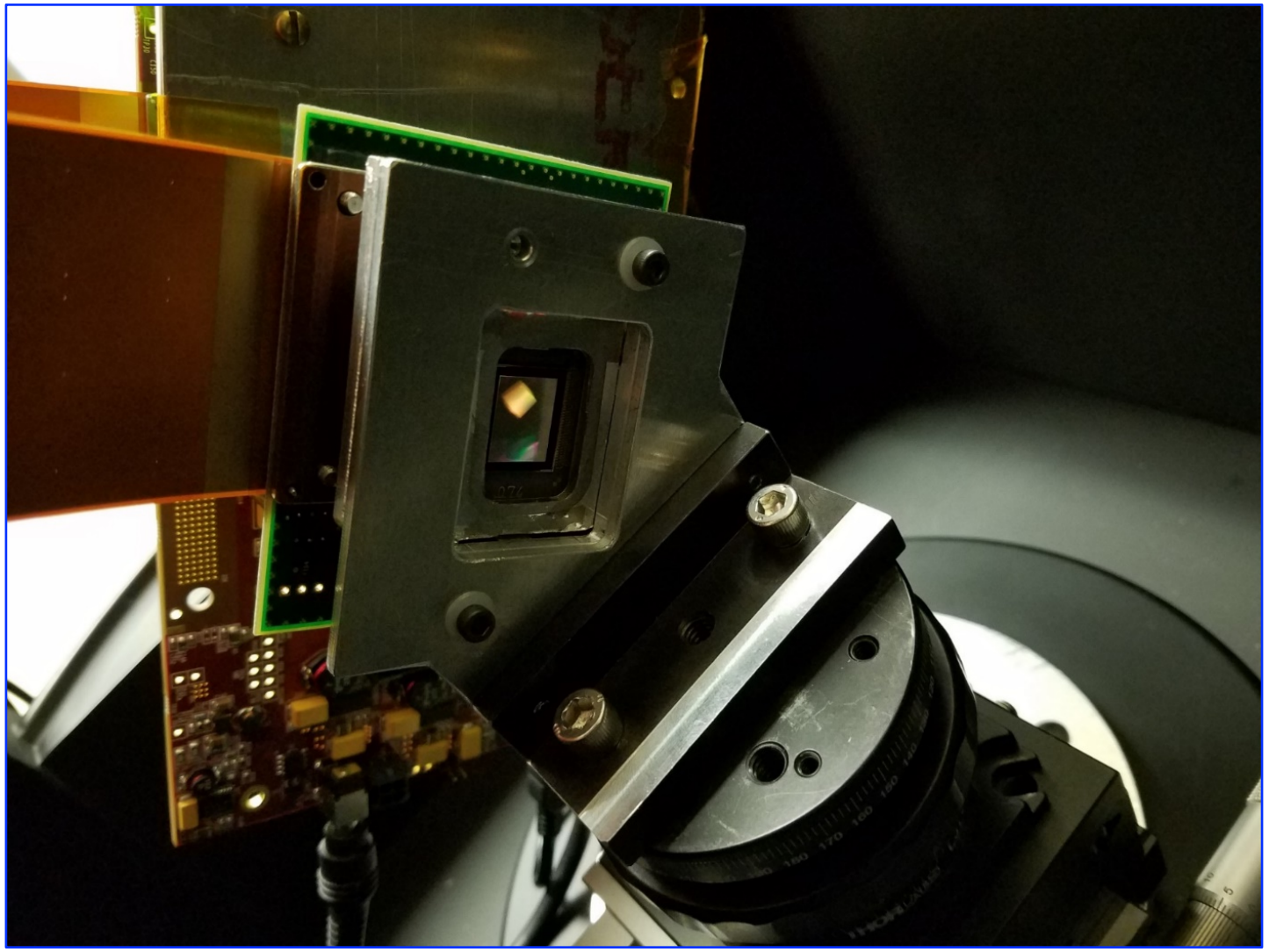


Pre-project 0.25-megapixel front-illuminated (FI) X-ray CCD (left) and 0.5-megapixel FI X-ray CCD designed for the project (right)

Significance: Advanced X-ray detectors may enable the Lynx large mission concept

Project Title: Toward Fast, Low-Noise, Radiation Tolerant X-ray Imaging Arrays for Lynx: Raising Technology Readiness Further

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

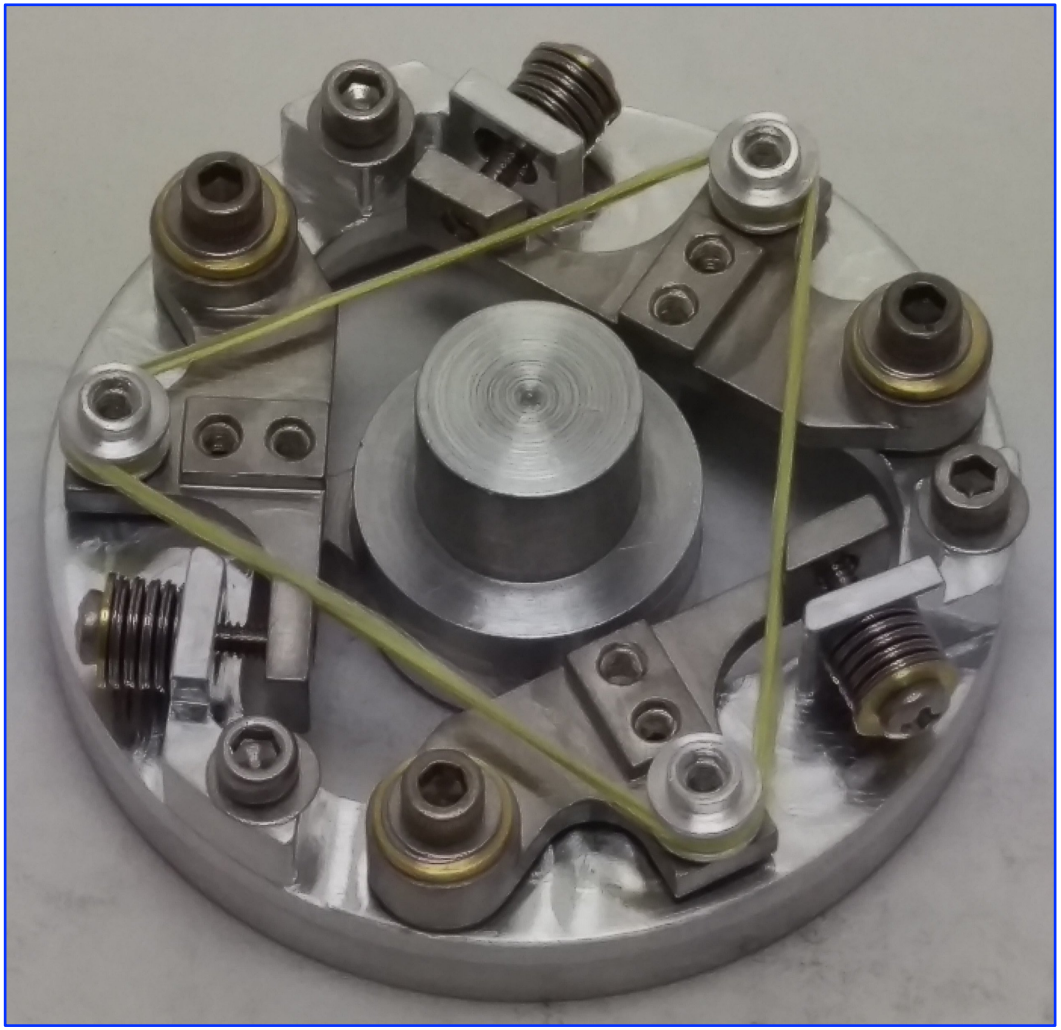


Measuring Digital Micro-mirror Device (DMD) Reflectance

Significance: Replacing windows of commercially available DMDs may enable far-UV multi-object spectrometry in future missions

Project Title: Development of DMDs for Far-UV Applications

PI: Zoran Ninkov (RIT)



Kevlar suspension system designed for Continuous Adiabatic Demagnetization Refrigerator (CADR) cooling system

Significance: This advanced sub-Kelvin cooling technology has been baselined by Lynx, Origins, PICO, and GEP

Project Title: High-Efficiency Continuous Cooling for Cryogenic Instruments and sub-Kelvin Detectors

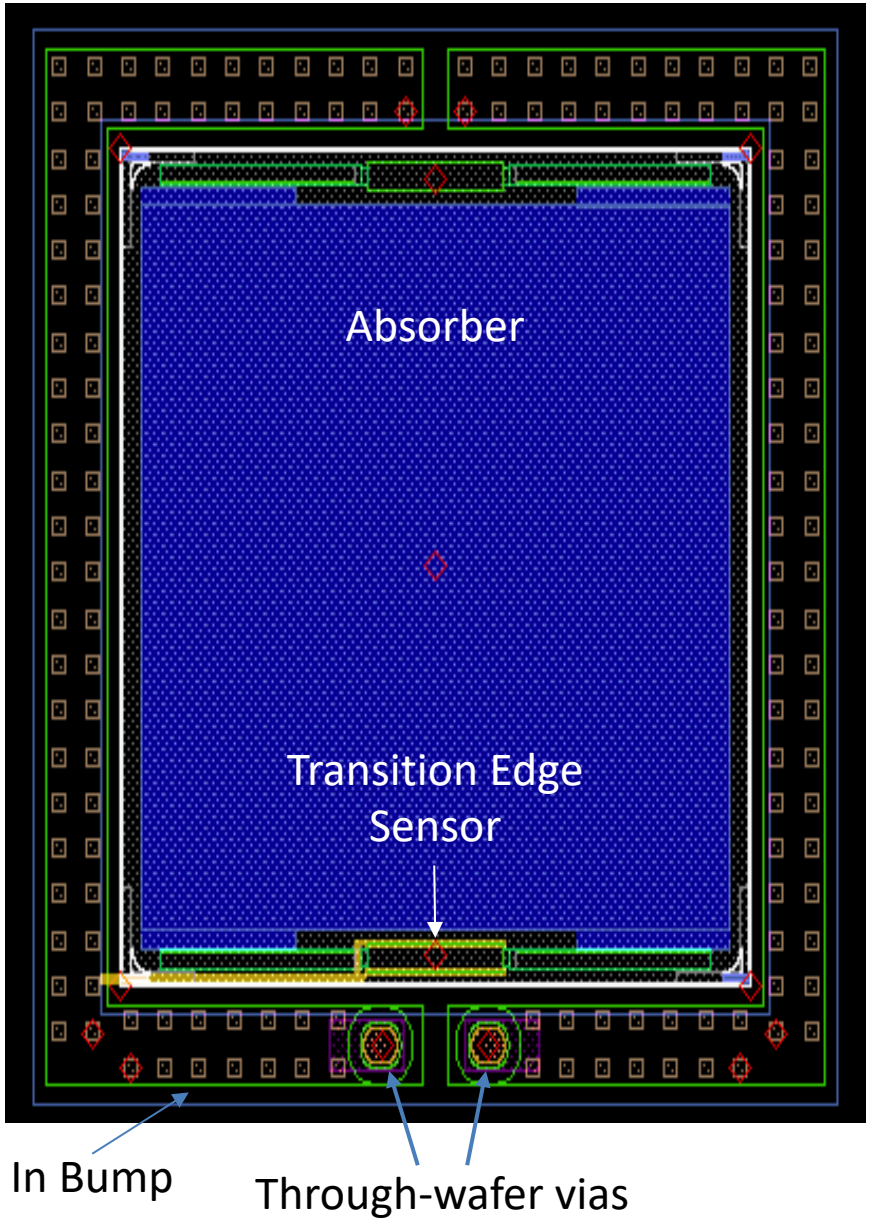
PI: James Tuttle (GSFC)

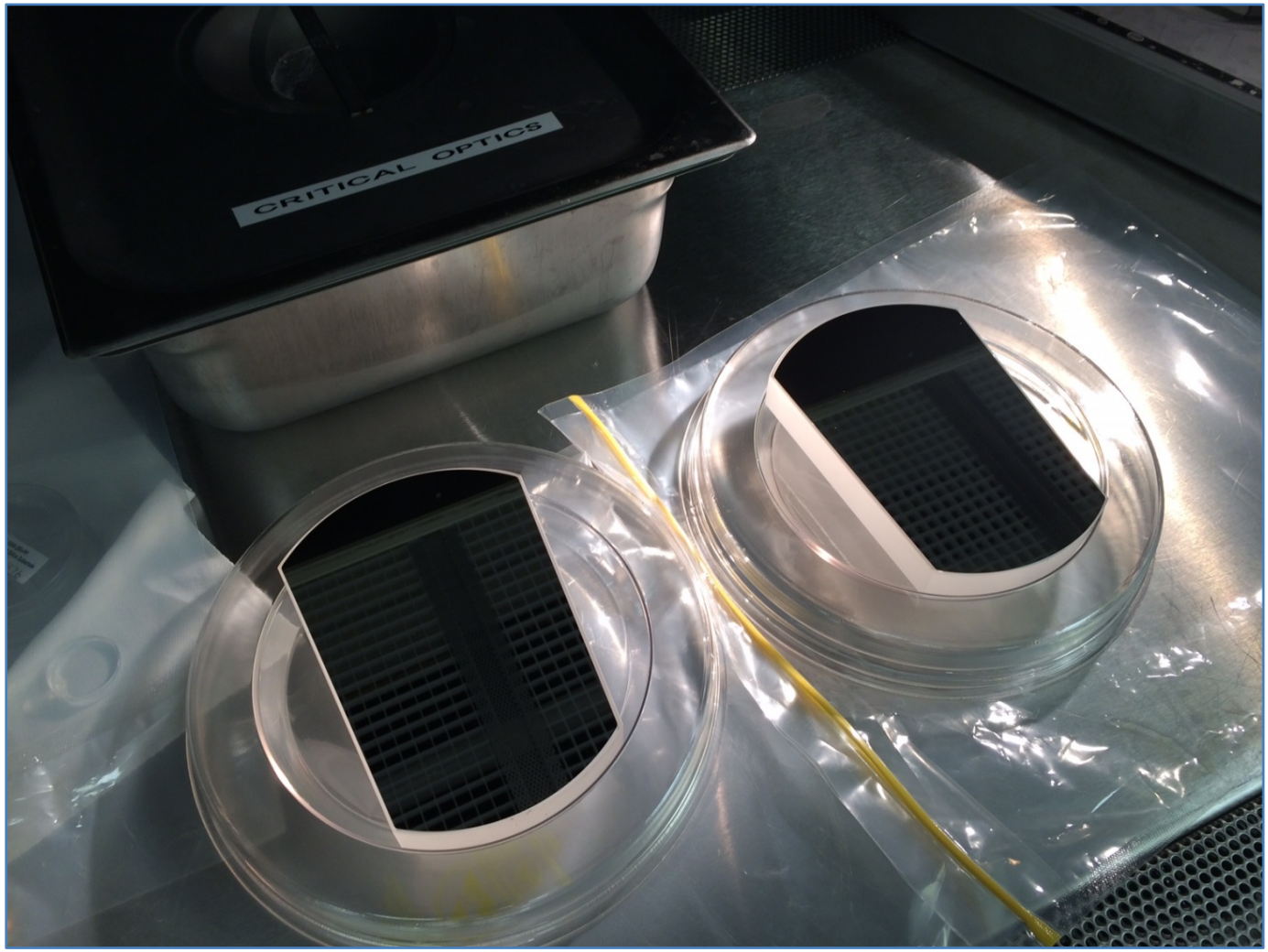
Detector unit cell design of interposer substrate with through-wafer vias for connecting 2D superconducting detectors to cold readout electronics

Significance: This new technique may enable the Origins large mission concept

Project Title: Development of a Robust, Efficient Process to Produce Scalable, Superconducting Kilopixel Far-IR Detector Arrays

PI: Johannes Staguhn (JHU & GSFC)



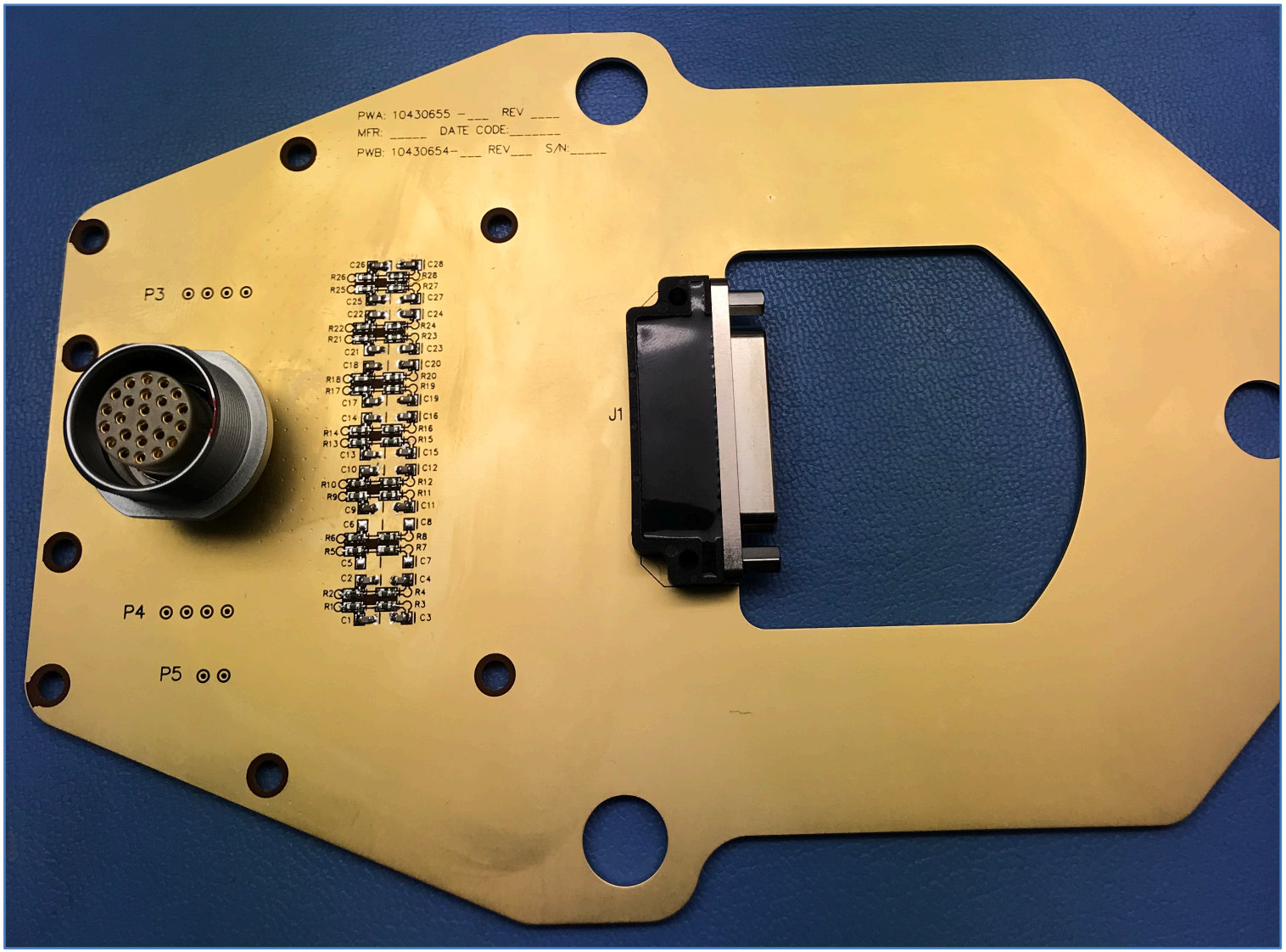


Ionospheric Connection (ICON) Explorer UV optics coated by this GSFC group

Significance: High far-UV reflectance is prevented by oxidation of aluminum mirrors; removing it may enable future far-UV missions

Project Title: E-Beam-Generated Plasma Etching for Developing High-Reflectance Mirrors for Far-UV Astronomical Instrument Applications

PI: Manuel Quijada (GSFC)

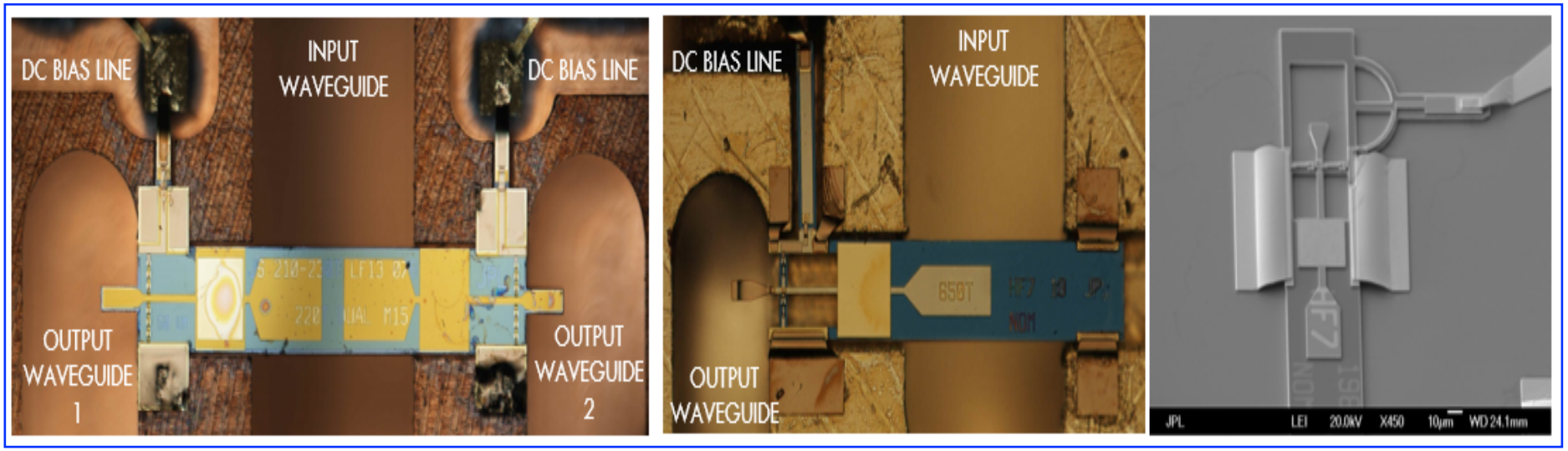


Hermetic and RF seals for testing Transition-Edge-Sensor (TES) bolometers

Significance: Extremely sensitive far-IR detectors may enable future missions

Project Title: Ultra-Sensitive Bolometers for Far-IR Space Spectroscopy at the Background Limit

PI: C. Matt Bradford (JPL)



Optimized device designs needed for 16-pixel 1.9-THz heterodyne detector

Significance: Further development of this high-resolution far-IR detector technology to higher pixel numbers may enable or enhance future missions

Project Title: Development of High-Resolution Far-IR Arrays

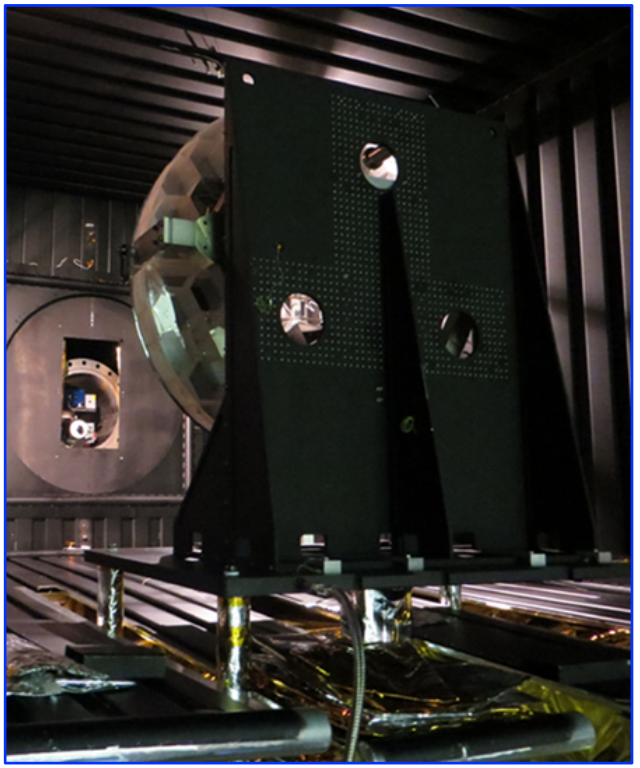
PI: Imran Mehdi (JPL)

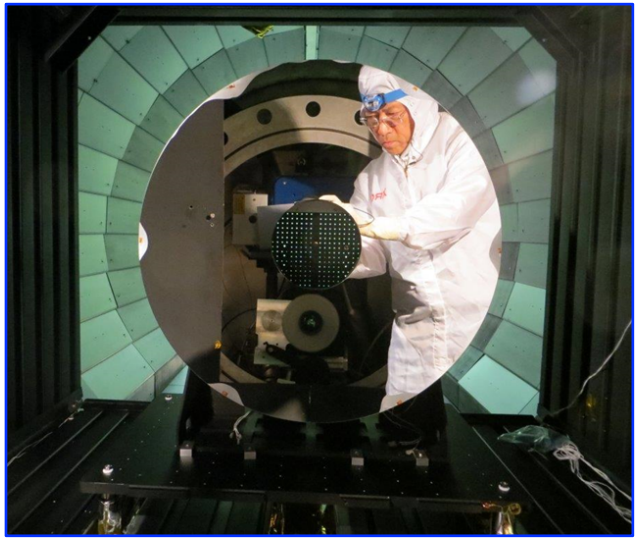
Thermal optical test of ULE® mirror at MSFC X-Ray & Cryogenic Facility (XRCF)

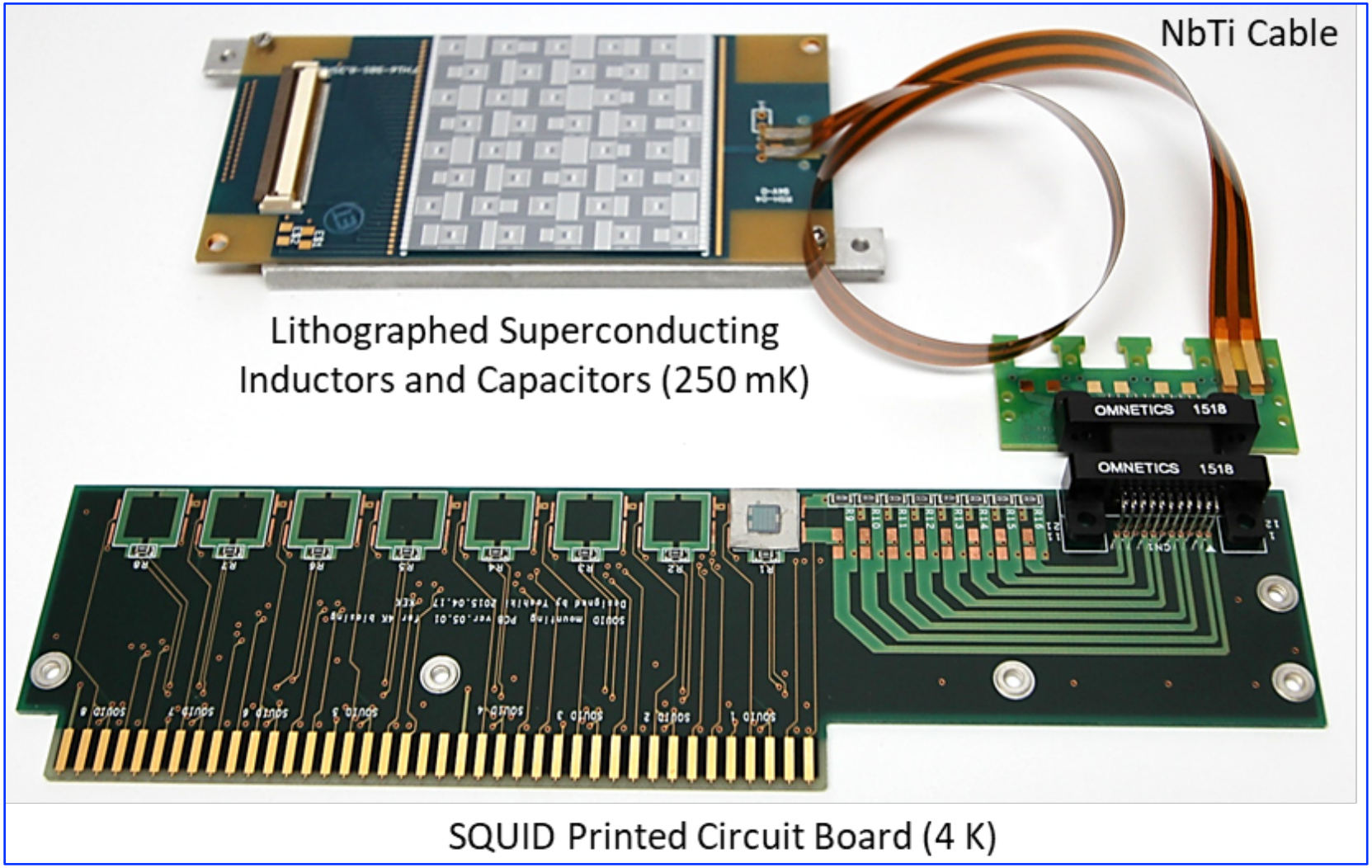
Significance: This technology may enable required ultra-stability (~10 pm) for HabEx and LUVOIR missions

Project Title: Predictive Thermal Control (PTC) Technology to enable Thermally Stable Telescopes

PI: H. Philip Stahl (MSFC)





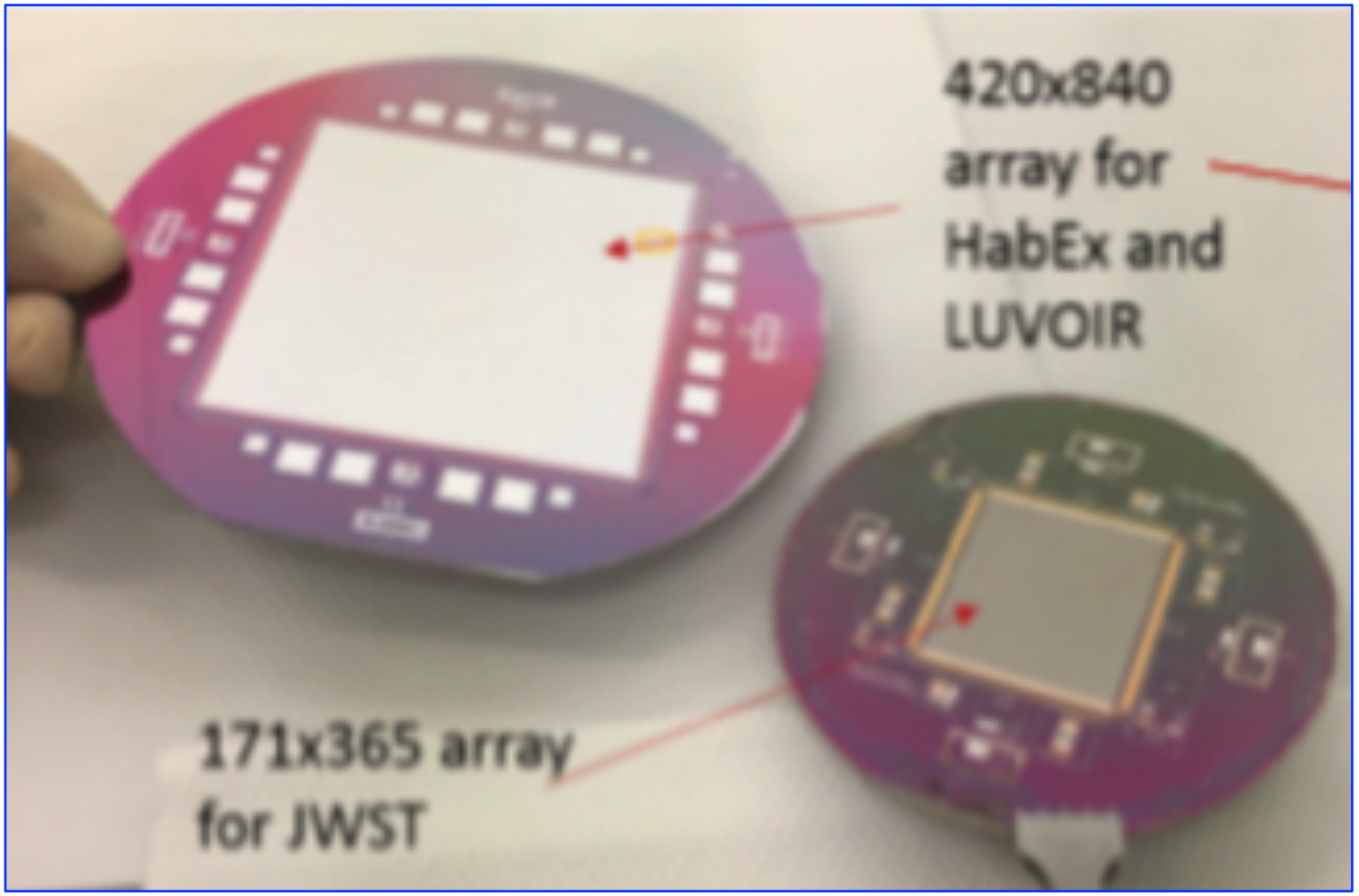


Frequency-Domain Multiplexing (FDM) bolometer readout (SQUID, Superconducting QUantum Interference Device)

Significance: This and related technologies may enable future Cosmic Microwave Background (CMB) missions, e.g. LiteBIRD

Project Title: Technology Development for LiteBIRD and other CMB Missions

PI: Adrian T. Lee (UC Berkeley)

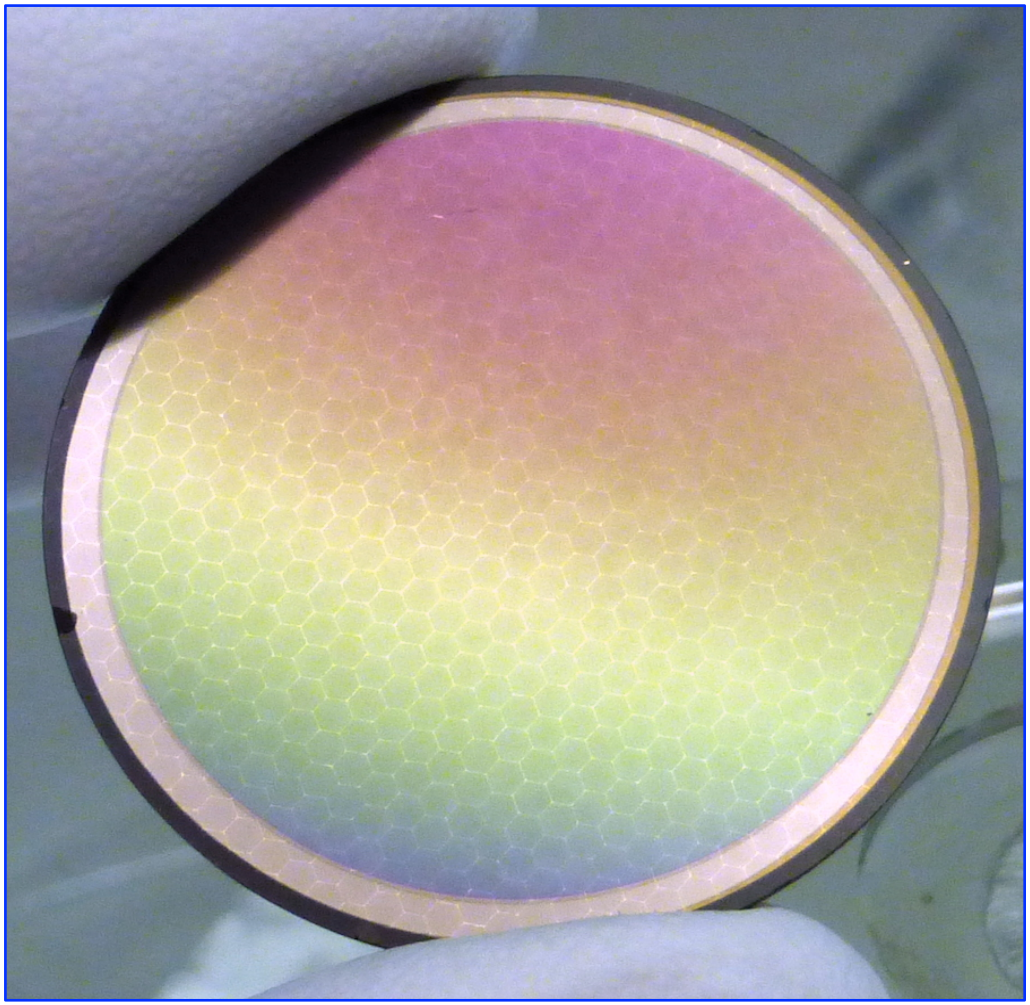


First large-format array of electrostatically activated microshutter arrays on a 6” wafer process (top left) compared to array developed for JWST (bottom right)

Significance: May enable sparse-field multi-object spectroscopy for e.g. LUVOIR, HabEx, CETUS, and/or AERIE

Project Title: Scalable Microshutter Systems for UV, Visible, and IR Spectroscopy

PI: Matt Greenhouse (GSFC)

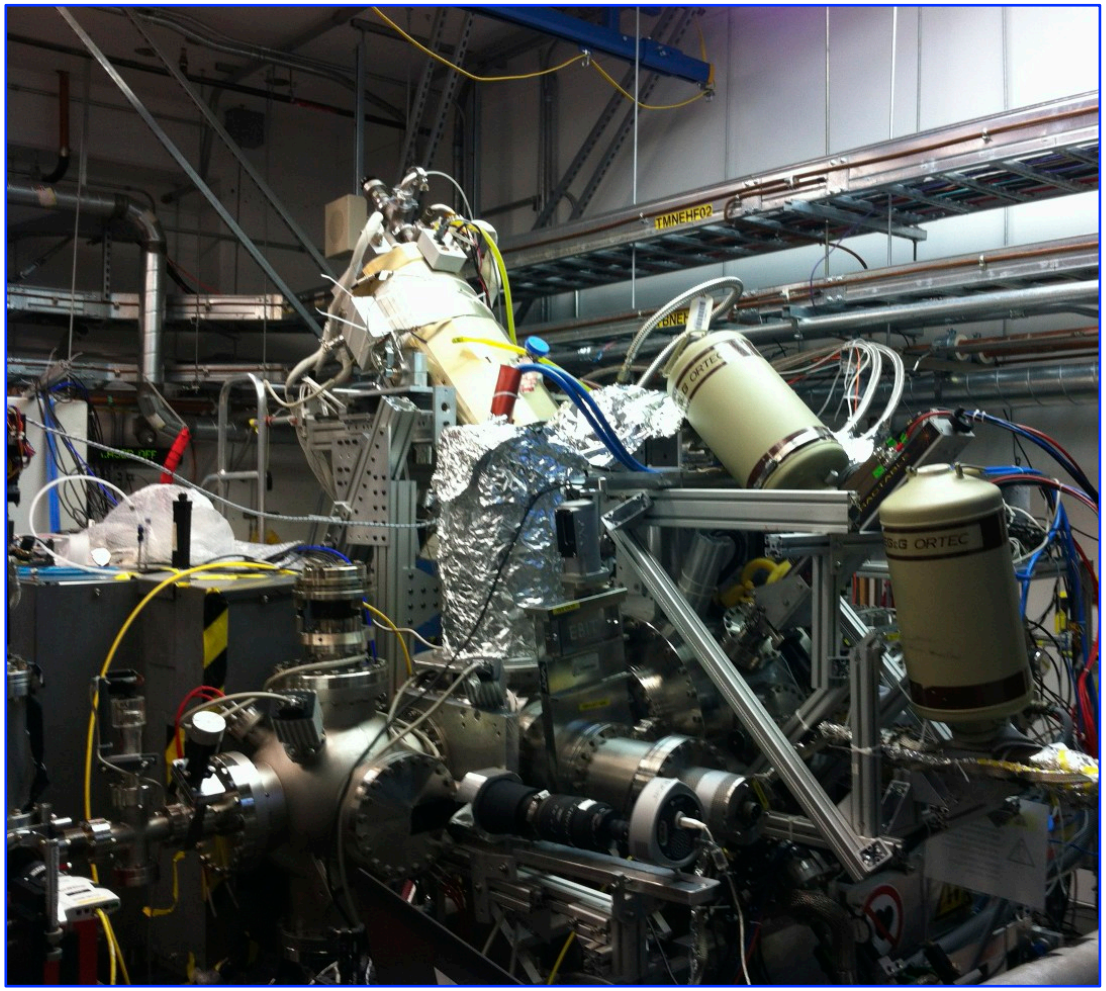


CsI opaque photocathode deposited onto a 20-µm-pore, 33-mm, 60:1 L/d, Atomic Layer Deposition (ALD) Multi-Channel Plate (MCP) with MgO and 13^{o}-pore-bias

Significance: This detector technology is baselined by HabEx, LUVOIR, and CETUS for UV/Visible light detection

Project Title: High-Performance Sealed-Tube Cross-Strip (XS) Photon-Counting Sensors for UV-Vis Astrophysics Instruments

PI: Oswald Siegmund (UC Berkeley)



X-ray Raman spectroscopy (XRS)/ Electron Beam Ion Trap (EBIT) experiment on the Flash EBIT at the Linac Coherent Light Source (LCLS) X-ray laser (Nature, 12/2012)

Significance: The project supports NASA X-ray observatories by developing similar instruments in ground-based labs, replicating conditions in astrophysical sources observed by spaceflight instruments, and observing them parametrically to help interpret space-based data

Project Title: Advanced X-ray Microcalorimeters: Lab Spectroscopy for Space Atomic Physics

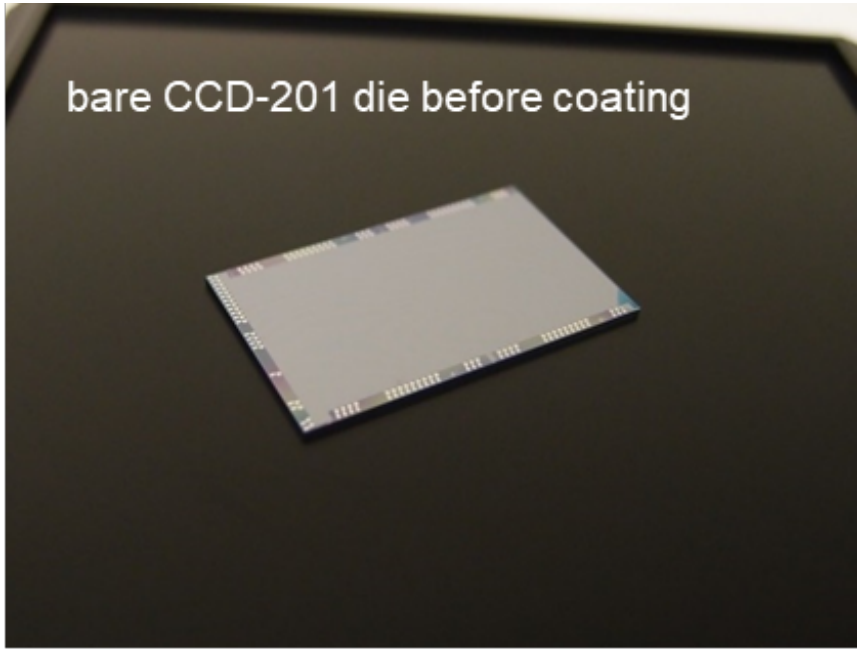
PI: F. Scott Porter (GSFC)

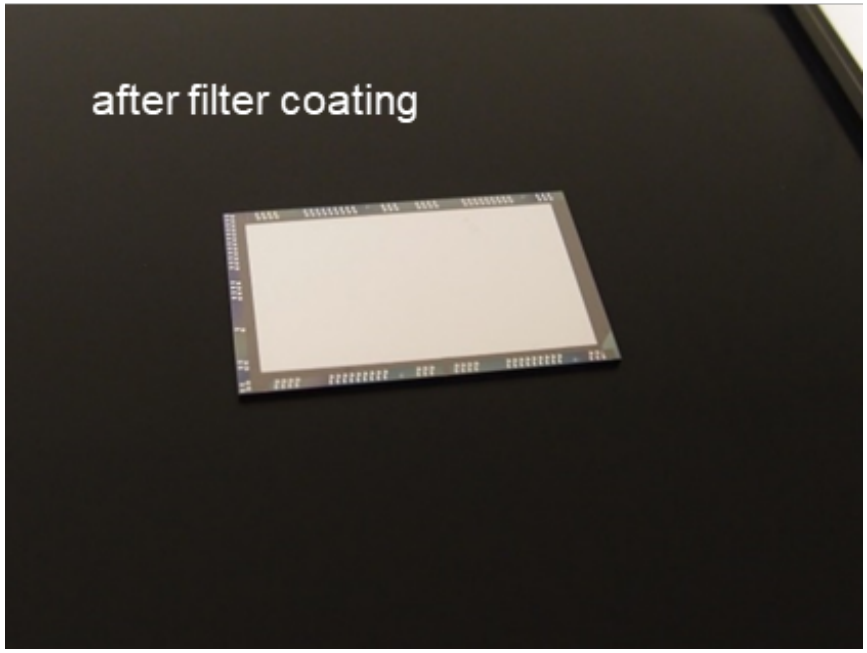
Detector-integrated multilayer AlF_3 /Al filters

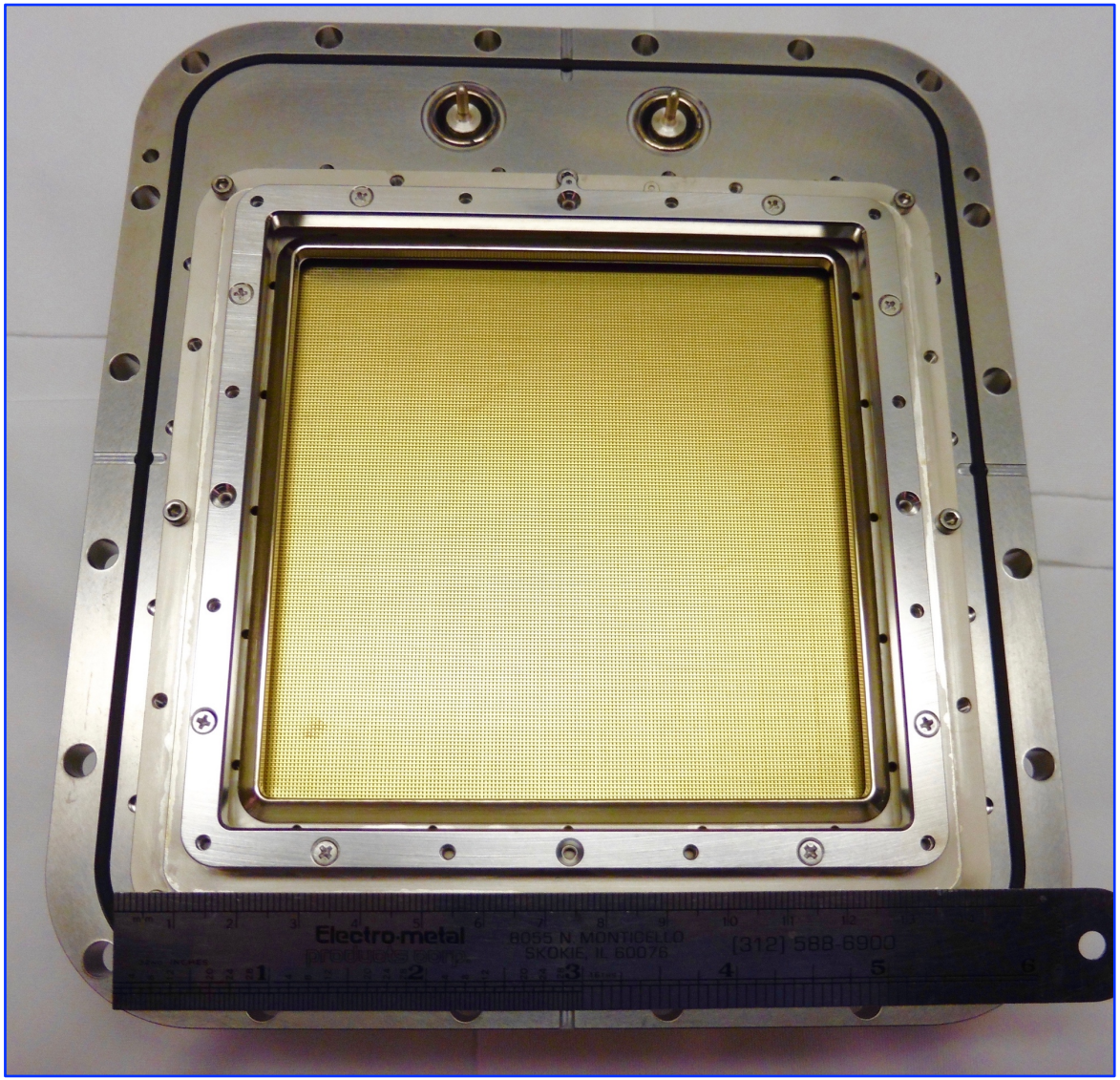
Significance: Advanced detectors developed by this project are baselined by SHIELDS, HabEx, LUVOIR, and ground facilities are fabricated using Atomic Layer Deposition (ALD) coatings

Project Title: Advanced FUV/UV/Visible Photon-Counting and Ultralow-Noise Detectors

PI: Shouleh Nikzad (JPL/Caltech)





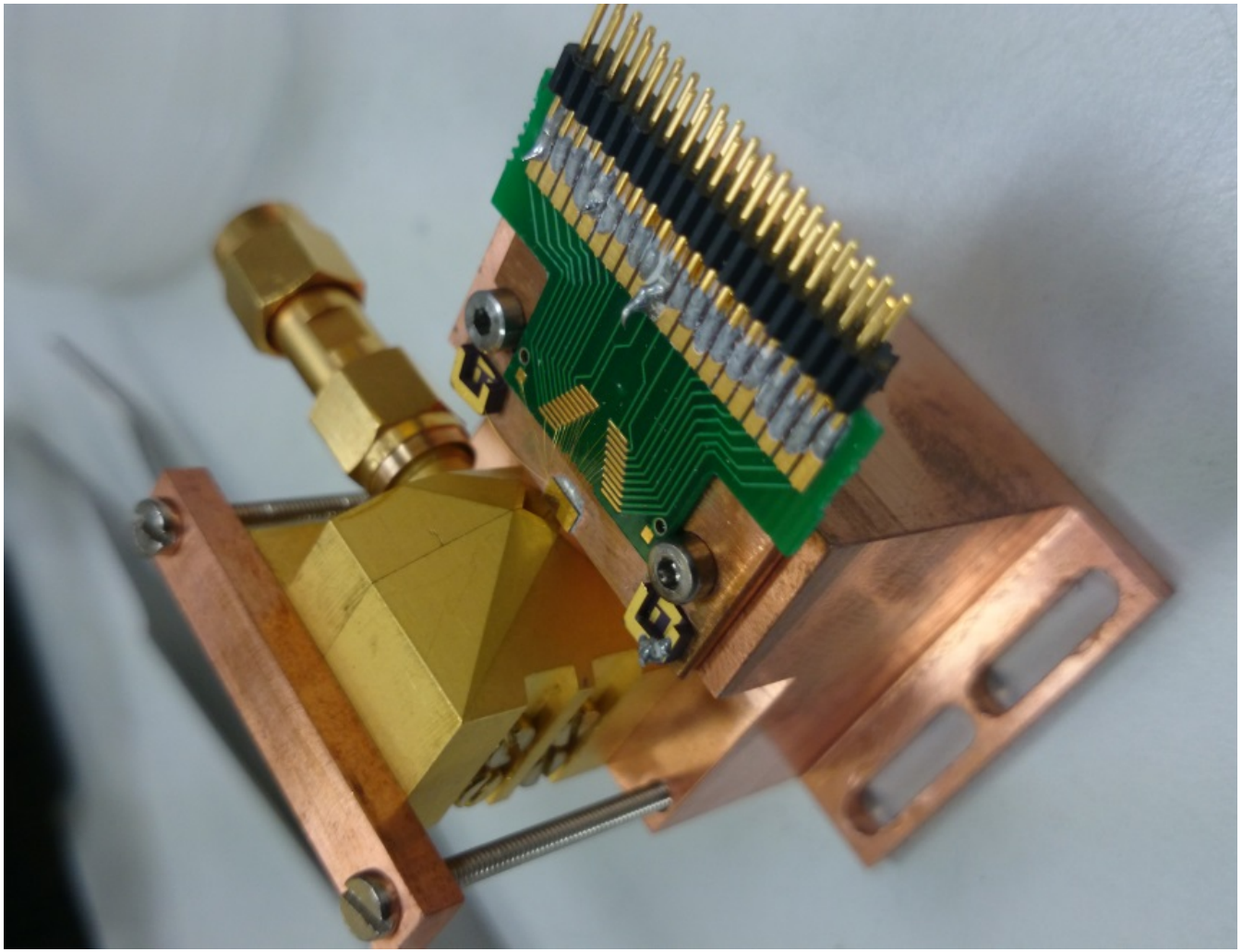


100×100 mm^2 Multi-Channel Plate (MCP) detector with ASIC electronics qualified for flight

Significance: Large-format low-noise detectors may enable future far-UV missions

Project Title: Development of 100×100 mm^2 photon-counting UV detectors

PI: John Vallerga (UC Berkeley)

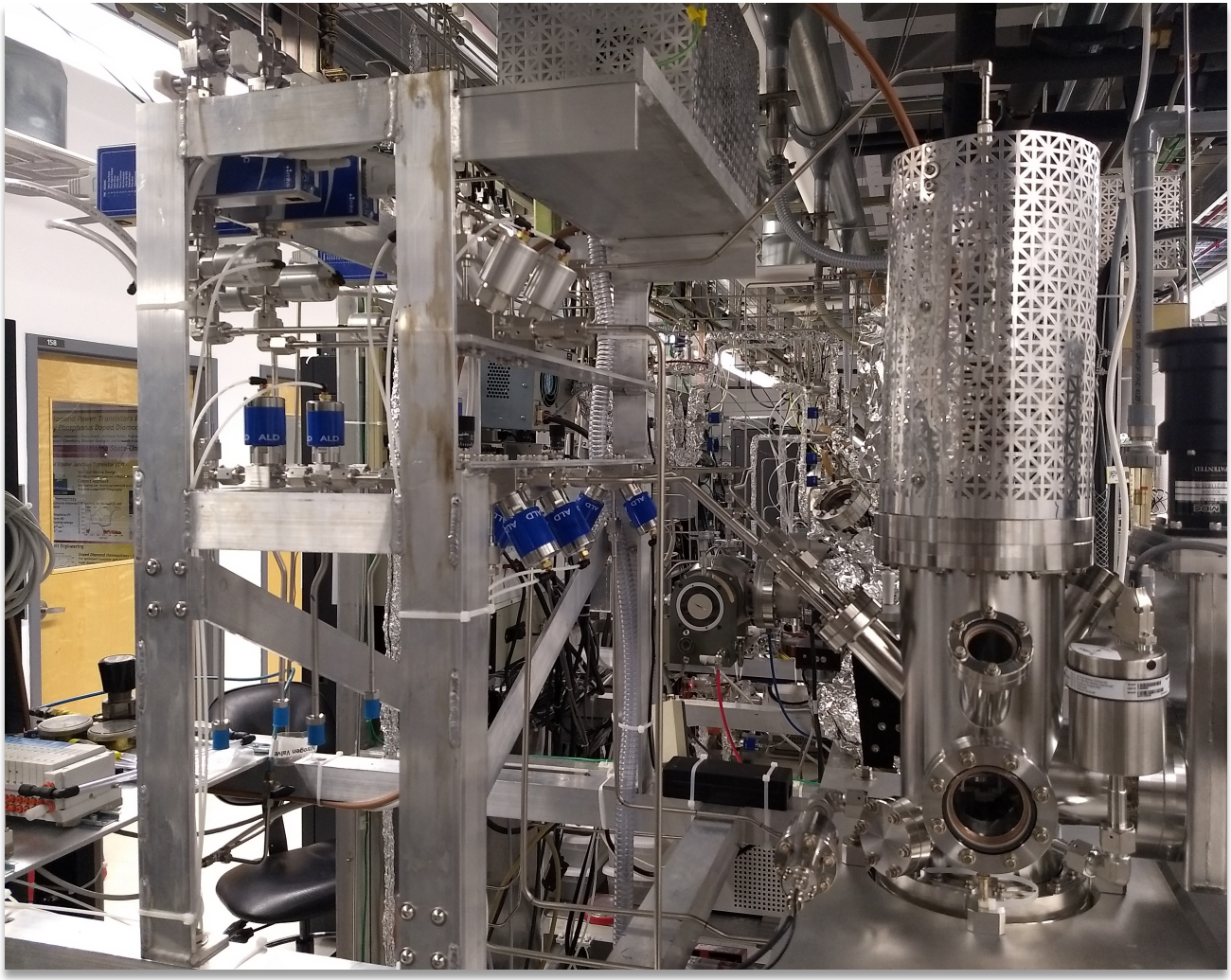


Array of Distributed Feedback (DFB) lasers at ~4.7 THz; the harmonic mixer is used to phase-lock the Quantum Cascade Laser (QCL) Local Oscillator (LO)

Significance: This technology provides 4.7-THz LOs, enabling far-IR/sub-mm missions such as the balloon-borne Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory (GUSTO)

Project Title: Raising the Technology Readiness of 4.7-THz local oscillators

PI: Qing Hu (MIT)

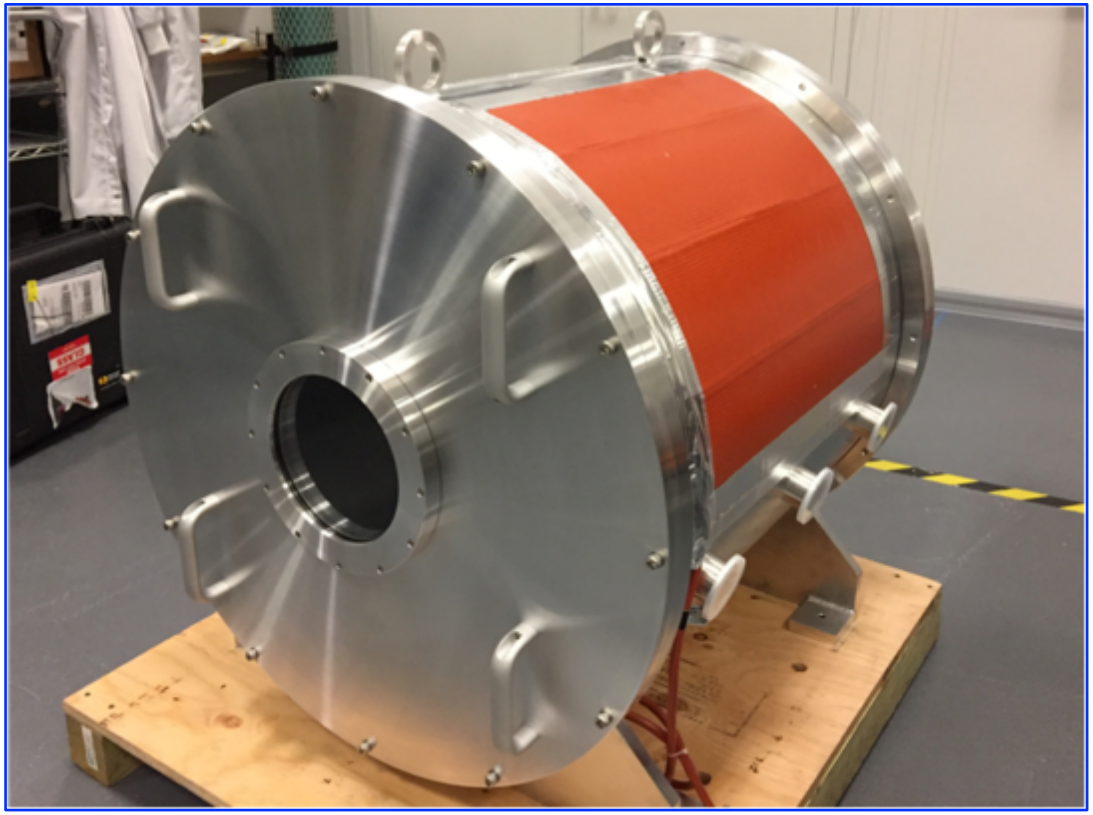


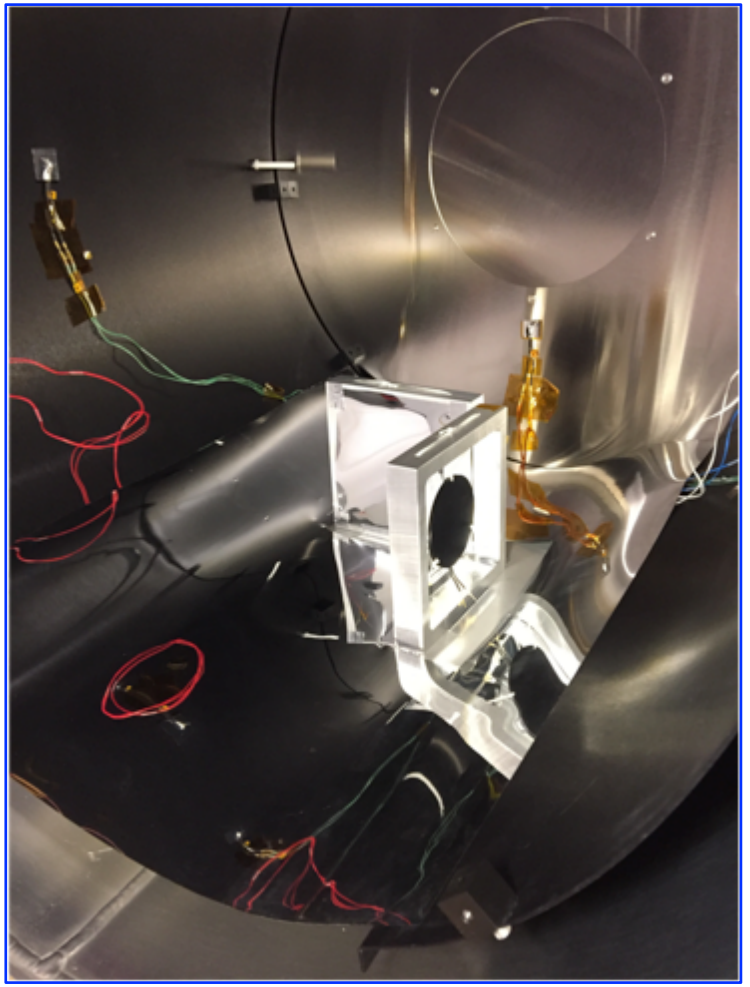
ASU Plasma-Enhanced Atomic Layer Deposition (PEALD) system for fluoride mirror coatings

Significance: High-reflectance UV coatings would vastly improve system throughput for photon-starved UV astronomy; this system attempted to develop advanced technique for depositing high-reflectance UV coatings

Project Title: Improving UV Coatings and Filters using Innovative Materials Deposited by ALD

PI: Paul Scowen (ASU)





Ultra-stable chamber built to test few-picometer-level metrology technology

Significance: Ultra-stability and -precision (~10 pm) may enable the HabEx and LUVOIR missions

Project Title: Ultra-Stable Structures

PI: Babak Saif (GSFC)