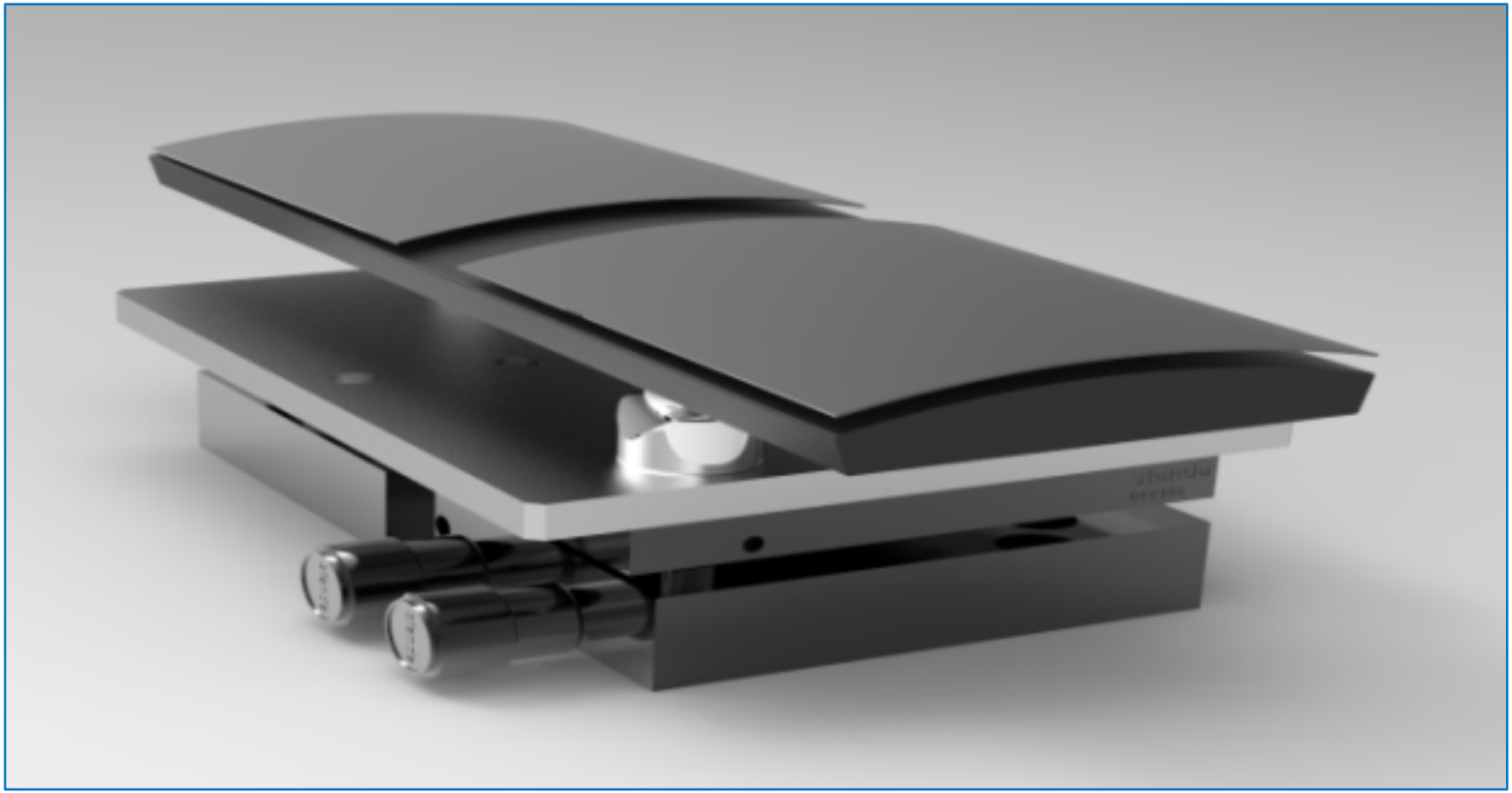
2019 Hardware Images

PCOS and COR Strategic Technology Portfolio

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



Technology Development Module with a pair of parabolic-hyperbolic X-ray mirror segments

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

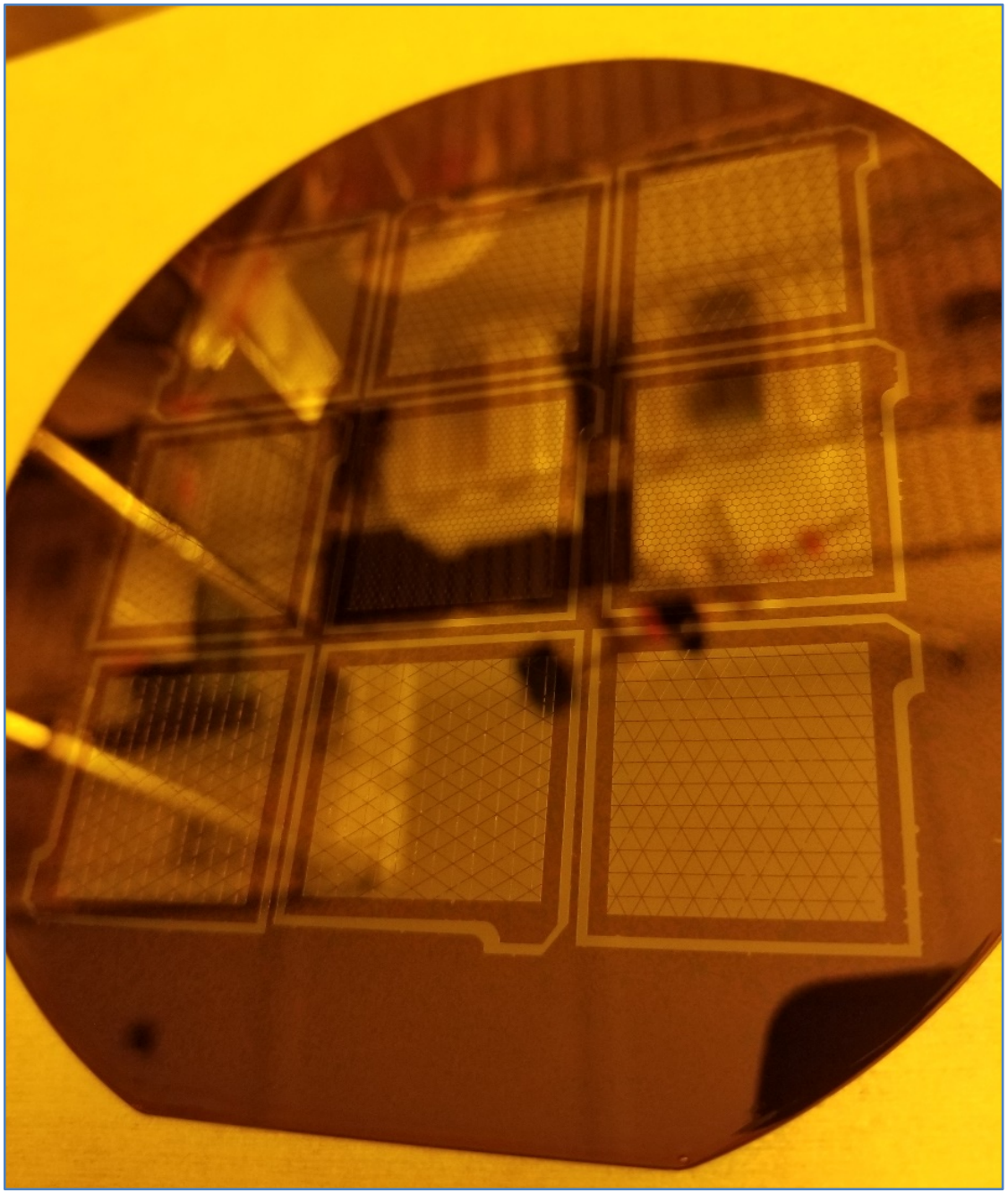
PI: Zhang, William (GSFC)

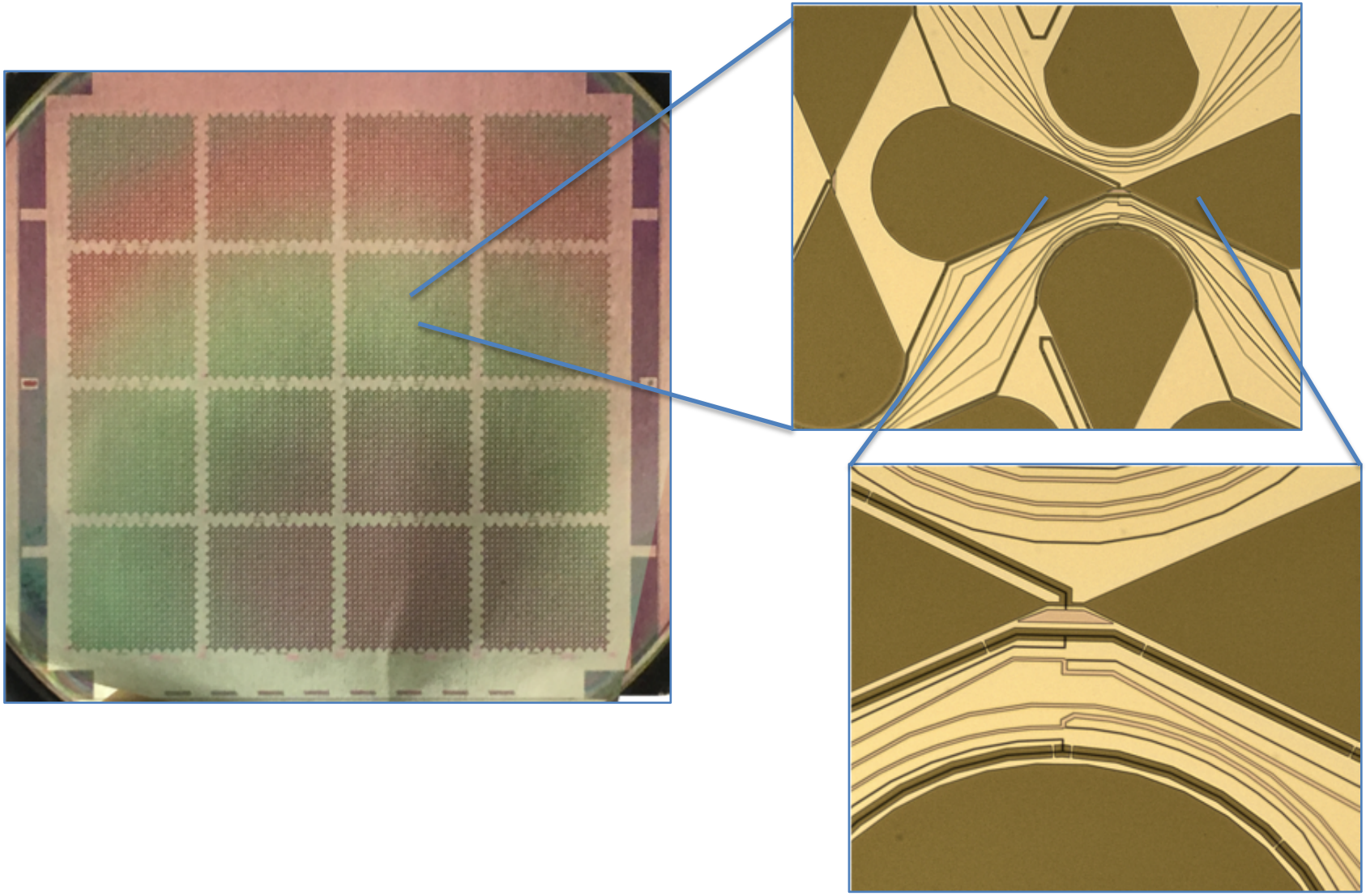
150-mm X-ray grating wafer patterned with nine samples of experimental Level-2 backside structures

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

Project Title: High Resolution and High Efficiency X-ray Transmission Grating Spectrometer

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



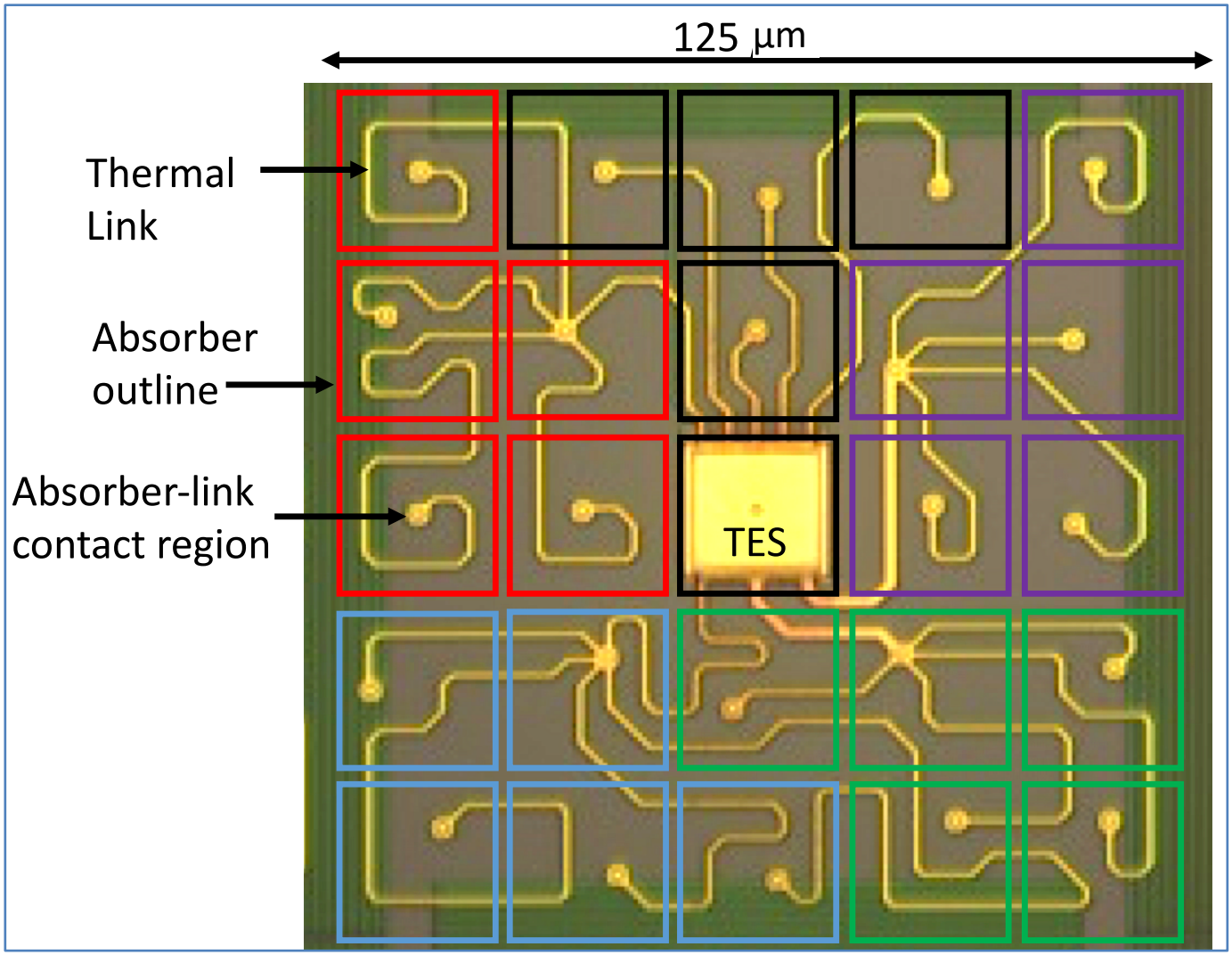


30/40-GHz bowtie planar antenna design for Cosmic Microwave Background (CMB) polarimetry

Significance: CMB polarimetry is crucial for identifying echoes of the Big Bang

Project Title: Superconducting Detectors for Cosmic Microwave Background (CMB) Polarimetry in PICO

PI: Roger O'Brient (JPL/Caltech)

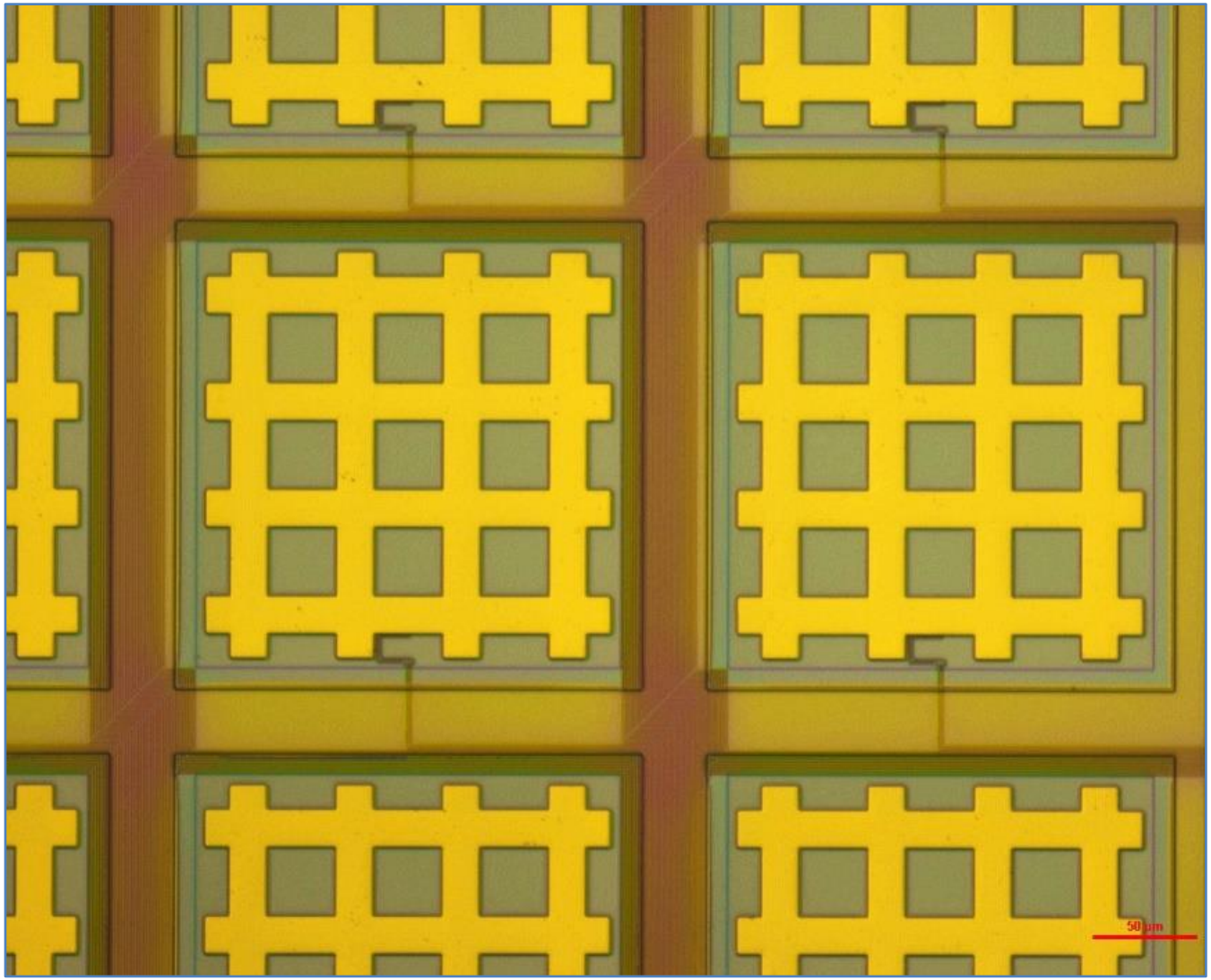


25-pixel Hydra readout before absorber deposition for X-ray microcalorimeters

Significance: Transition-Edge Sensor (TES) superconducting microcalorimeters offer energy resolution that enables the European Space Agency (ESA) ATHENA X-ray observatory, and 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)



Gold:Erbium (Au:Er) “waffle” sensor targeting Lynx main array requirements

Significance: Magnetically-Coupled Microcalorimeters (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

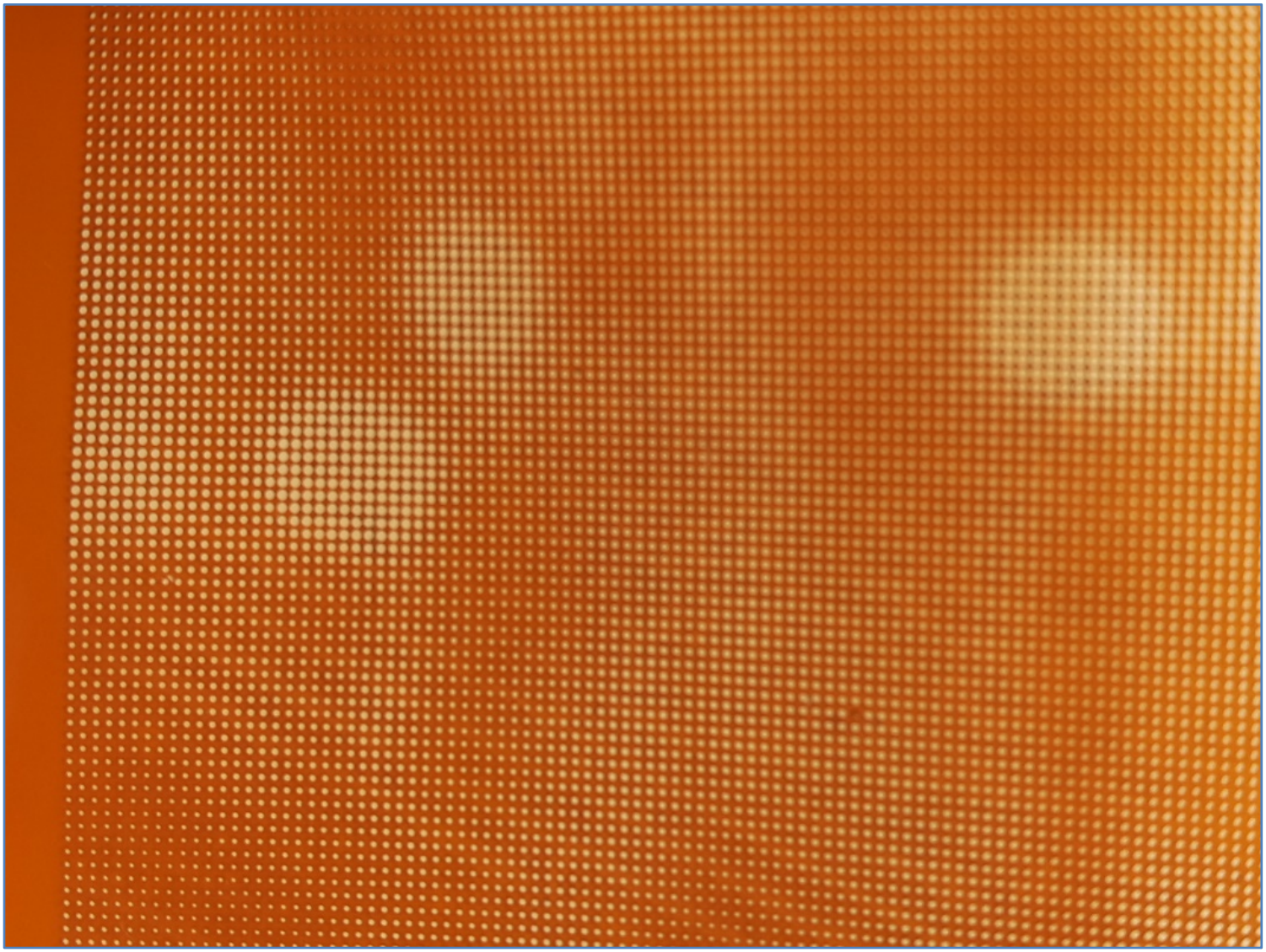
PI: Simon Bandler (GSFC)

Deterministic polishing of X-ray optics mandrel in Zeeko machine

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)



Custom coating mask with varying holes corrects entire X-ray optic in one exposure

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

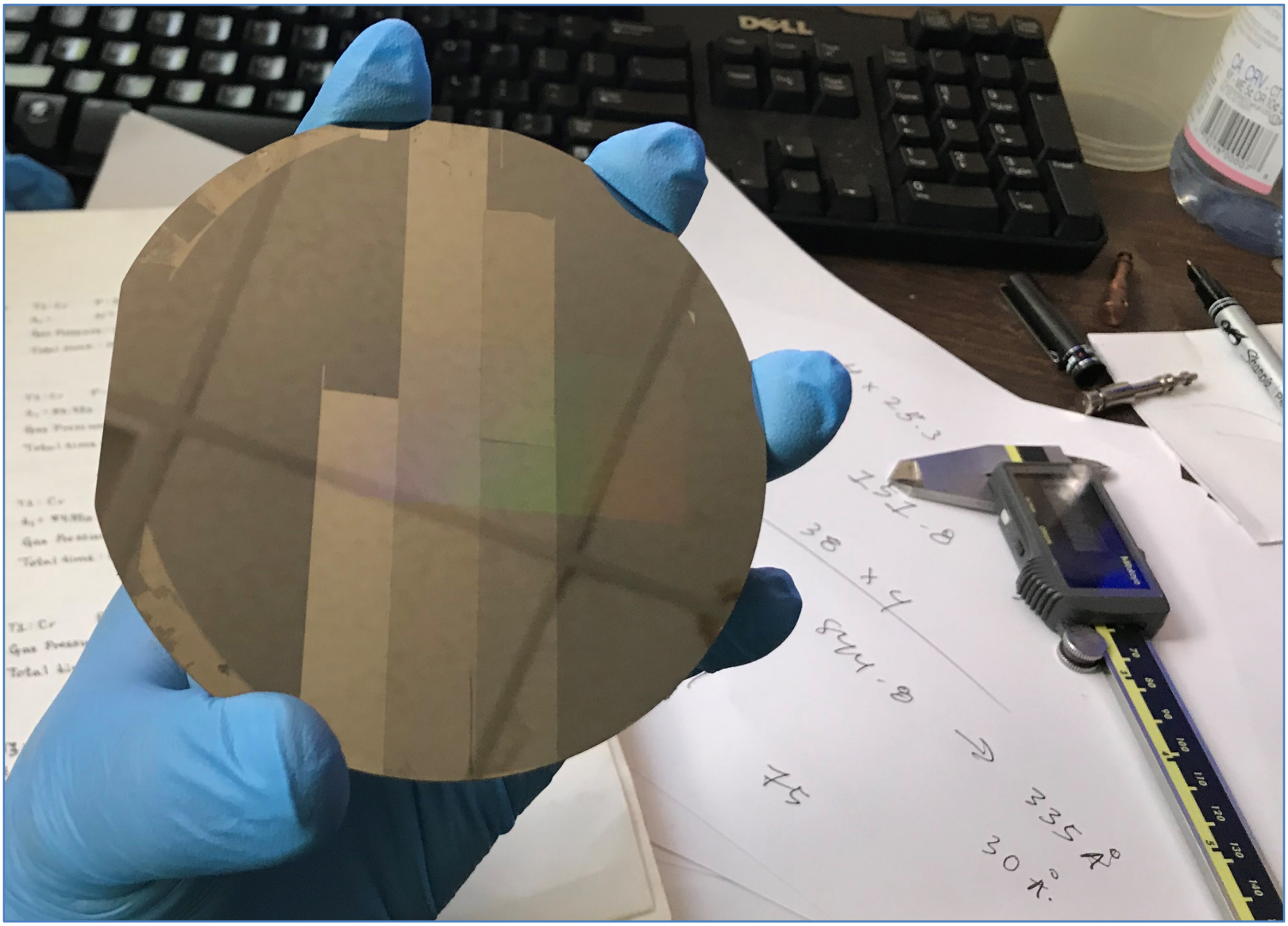
PI: Kiranmayee Kilaru (MSFC)

Support structure for X-ray mirror shell

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)

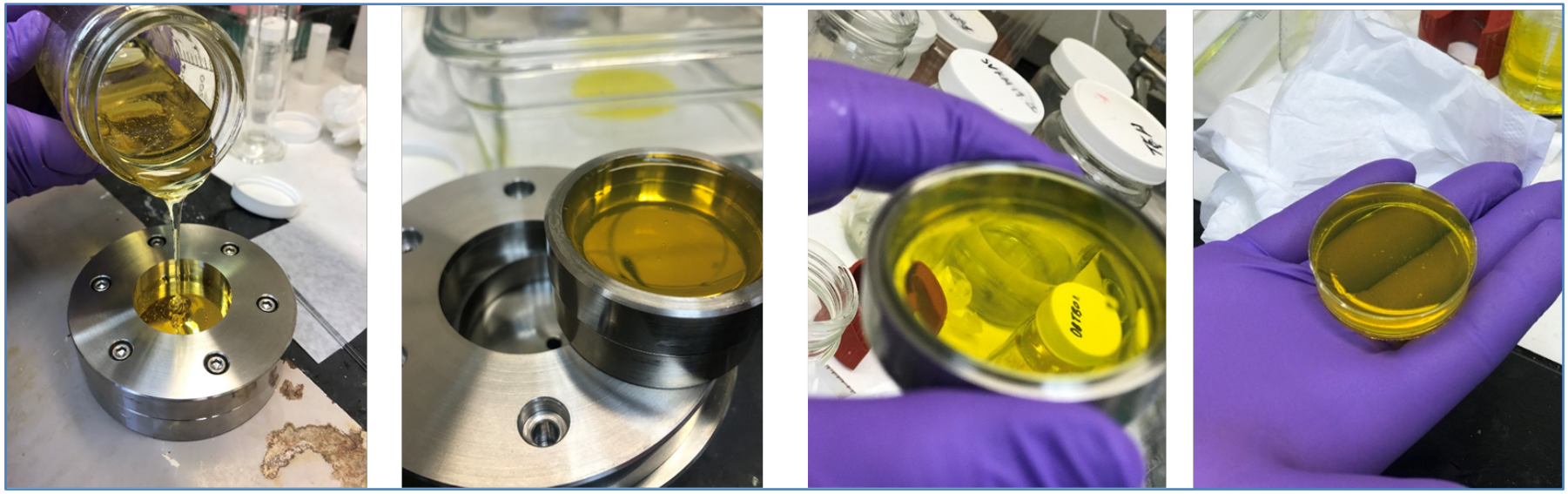


Marshall Grazing Incidence X-ray Spectrometer (MaGIXS) grating coated

Significance: High-quality X-ray optics such as gratings enable future missions

Project Title: Advanced X-ray Optics: Mirror Coatings

PI: David Broadway (MSFC)

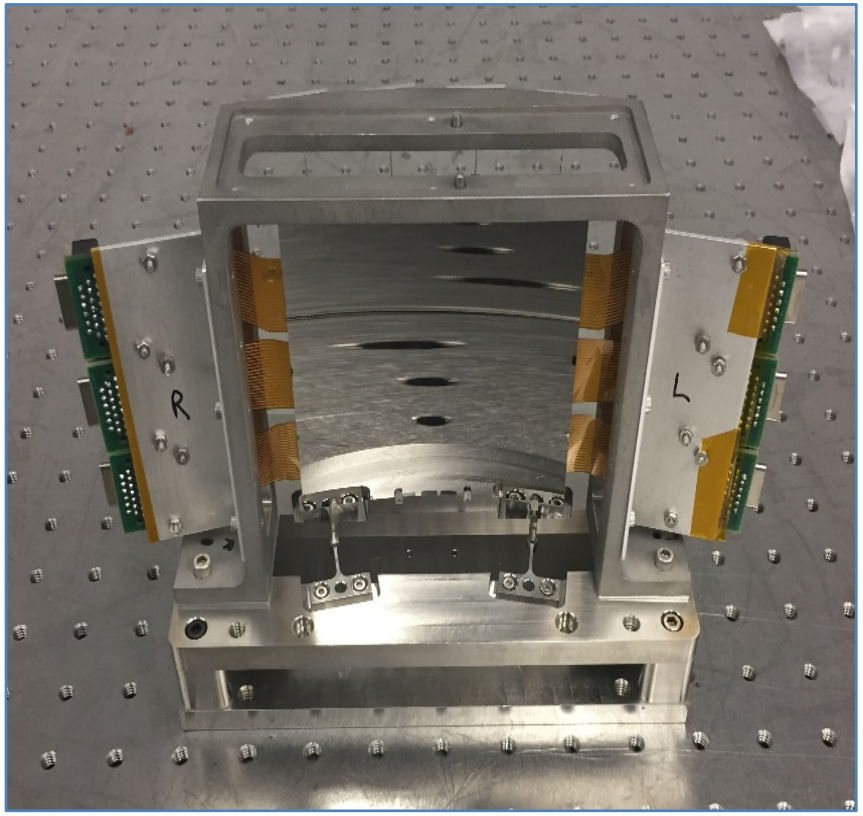


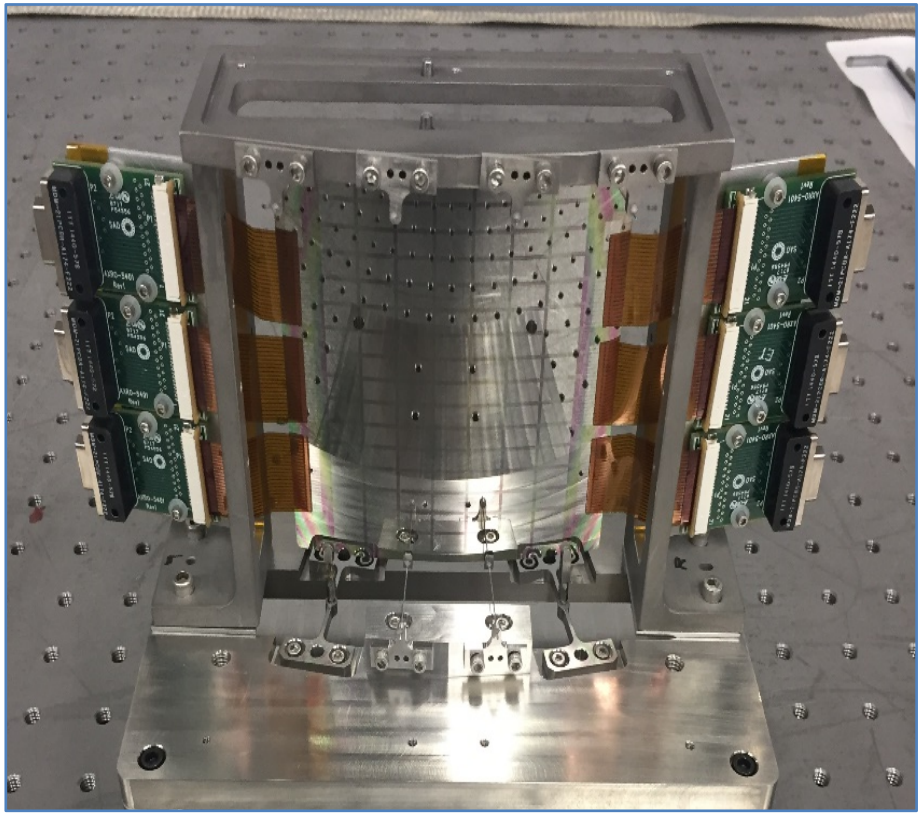
Innovative methods of fabricating lightweight, high-resolution, low-cost space-borne optics, e.g. using polyimide aerogel

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)



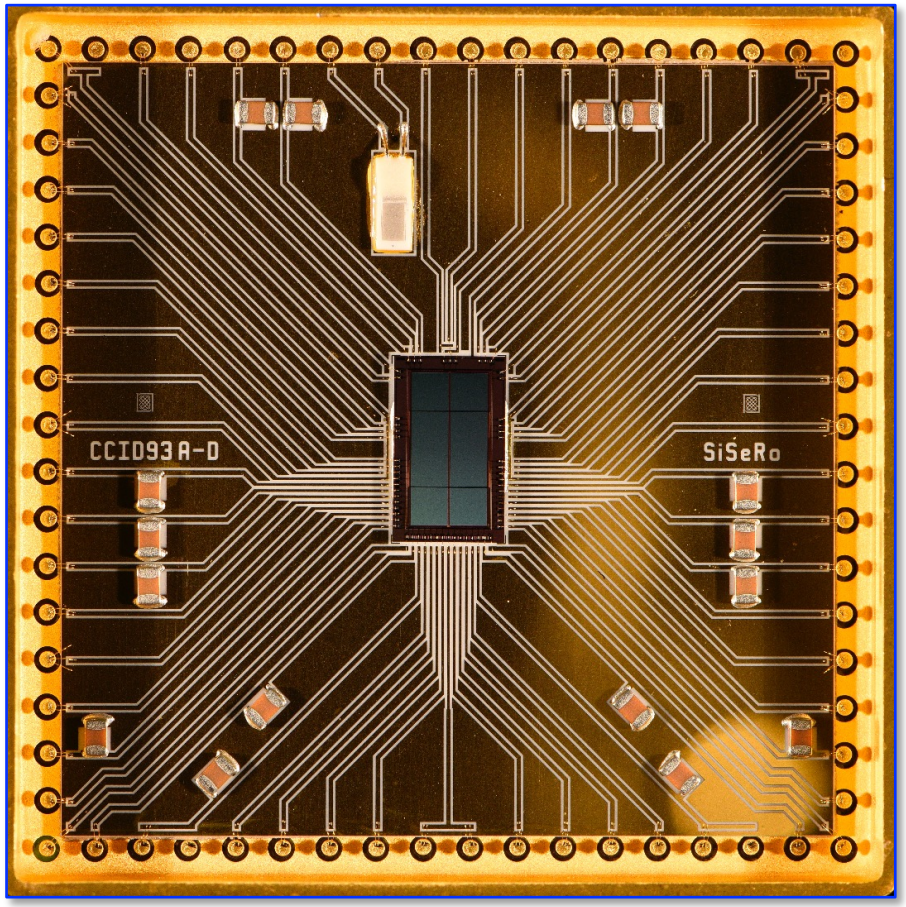


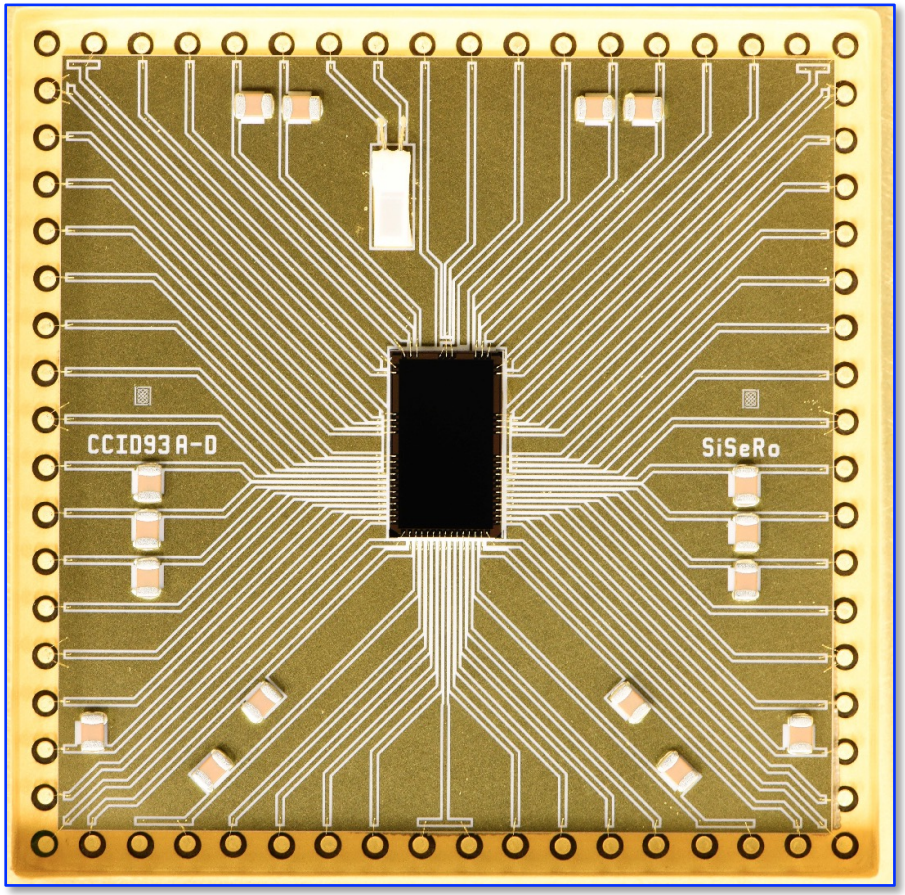
Adjustable X-ray mirror sample, with front reflective surface shown on left, and electrode control side on right

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)



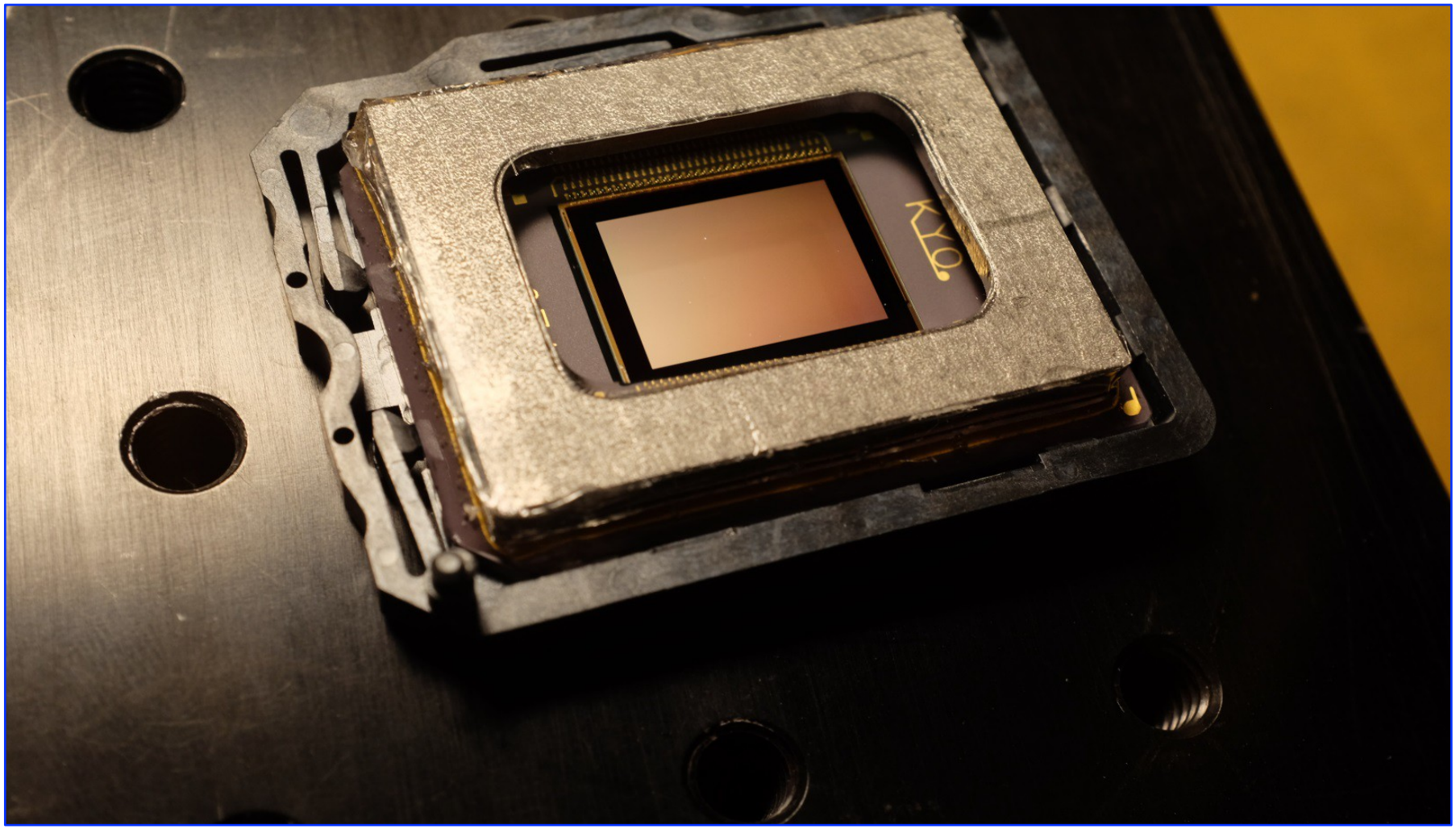


0.5-megapixel X-ray CCDs, front-illuminated (left) and back-illuminated (right); back-illuminated offers better low-energy response

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)



Digital Micro-mirror Device (DMD) window replaced with 2-µm-thick nitrocellulose membrane

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

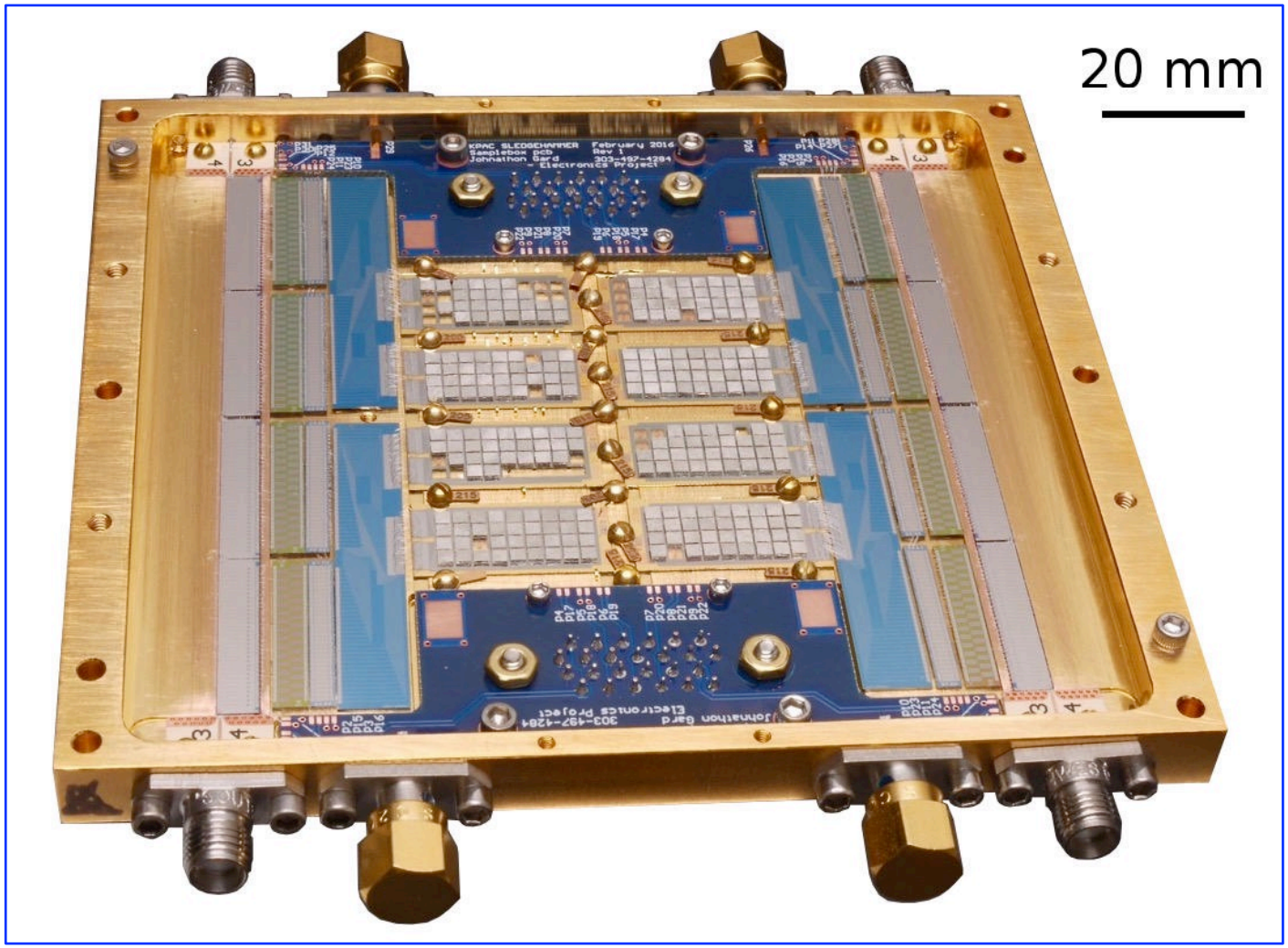
PI: Zoran Ninkov (RIT)

µMUX/SMuRF readout deployed on Keck telescope at South Pole

Significance: High-density readout may enable large focal planes in future space missions

Project Title: Advancing High-Density Readout Technology for Superconducting Sensor Arrays for Spaceflight

PI: Josef Frisch (SLAC)



Sample electronics box with Transition Edge Sensor (TES) microcalorimeter detectors, microwave multiplexers, and support electronics

Significance: High-multiplexing-factor readouts may enable missions such as Lynx

Project Title: Technology development for Microwave Superconducting QUantum Interference Device (SQUID) multiplexing for the Lynx X-ray Observatory

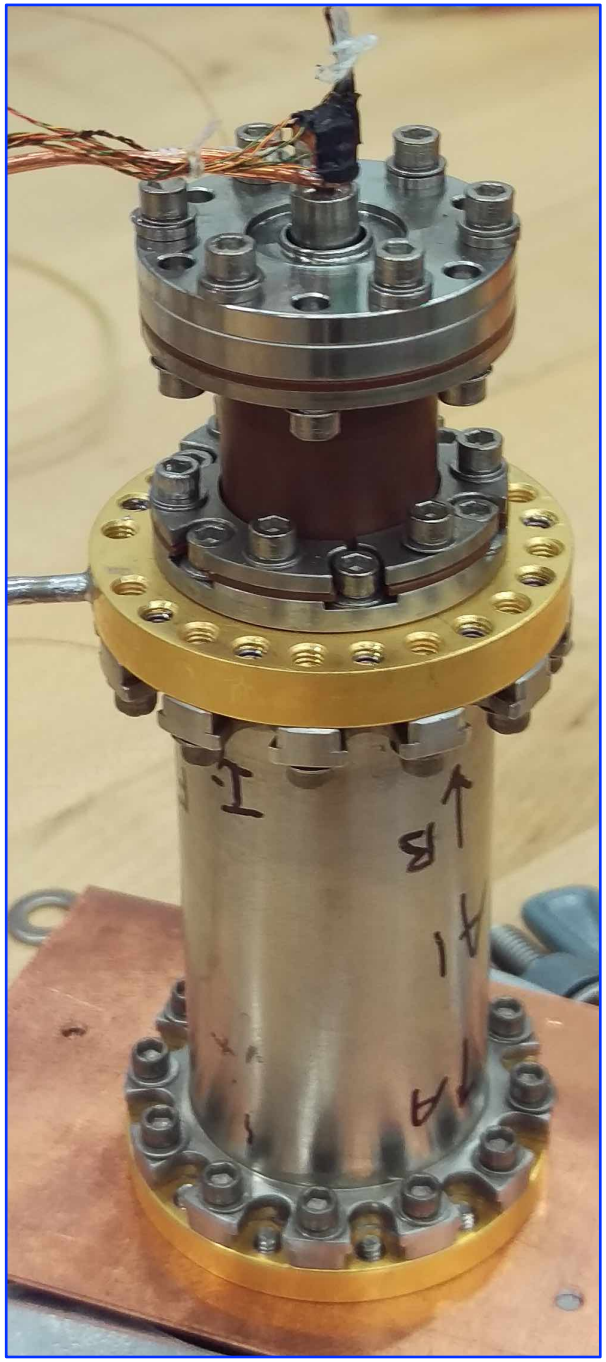
PI: Douglas Bennett (NIST)

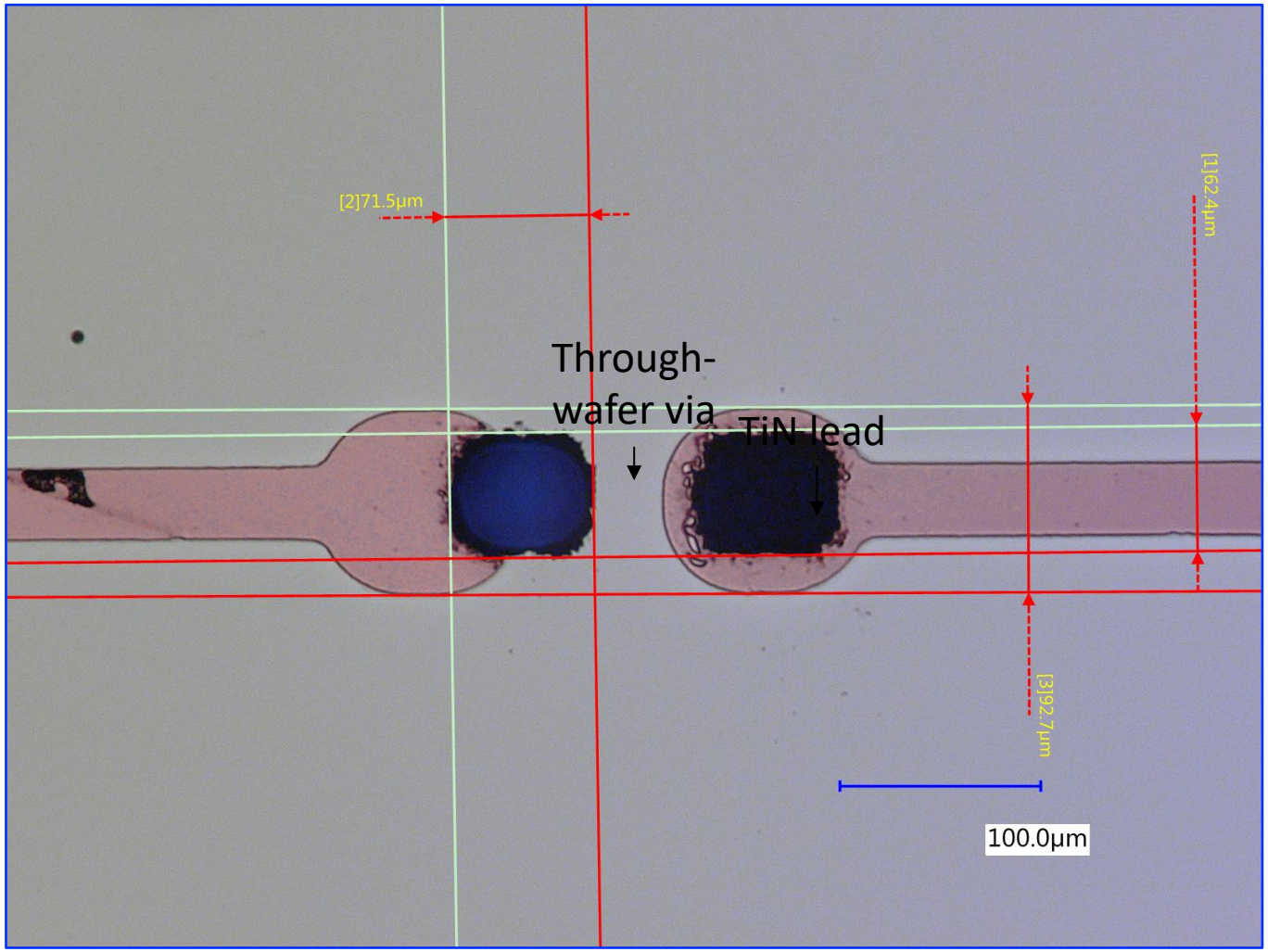
Active gasp-gap heat switches used in continuous adiabatic demagnetization refrigerator (CADR) cooling system

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)



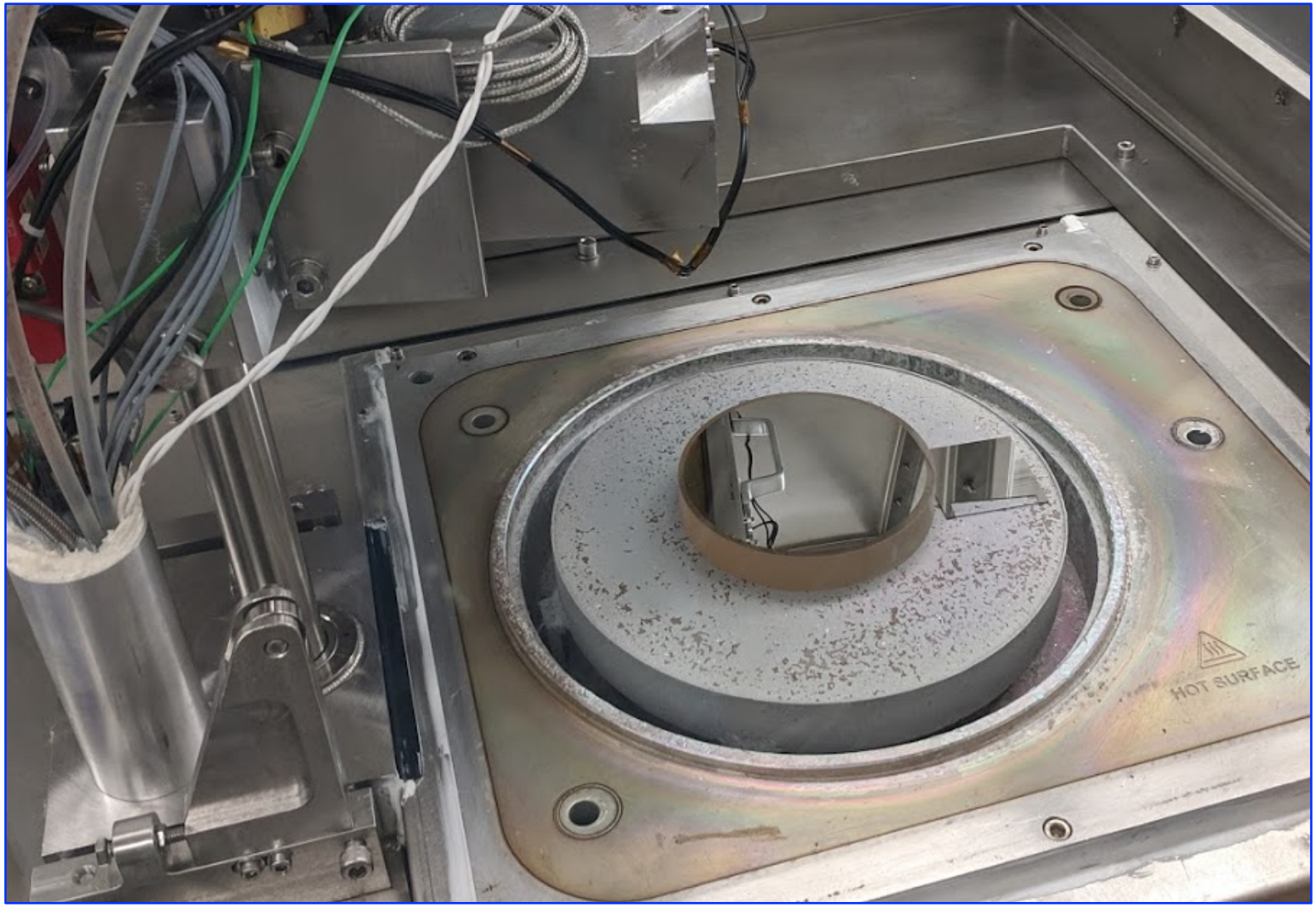


Through-wafer via allowing connection of 2D superconducting detectors to cold readout electronics

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)

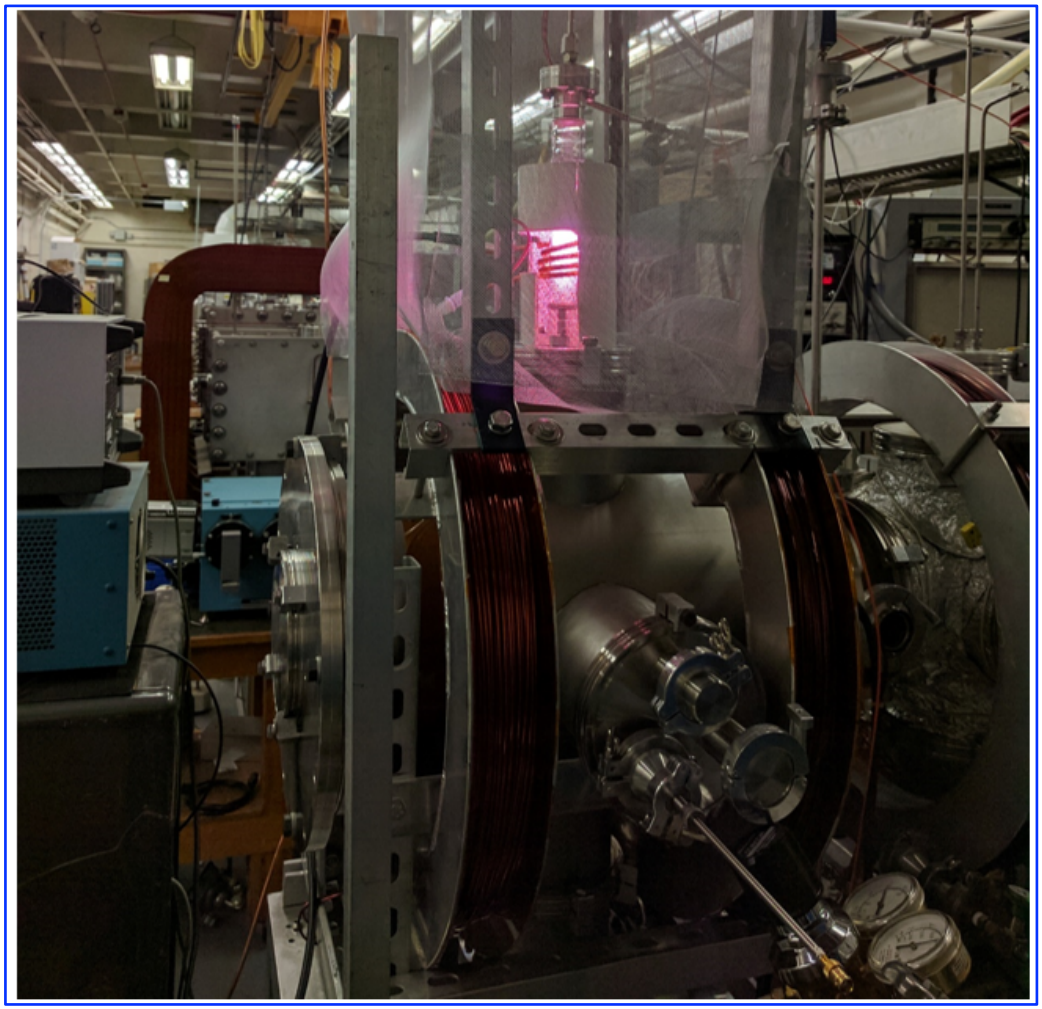


100-mm convex SISTINE secondary mirror over-coated at JPL

Significance: May enable or enhance future far-UV missions

Project Title: High-Performance, Stable, and Scalable UV Aluminum Mirror Coatings Using Atomic Layer Deposition (ALD)

PI: John Hennessy (JPL)

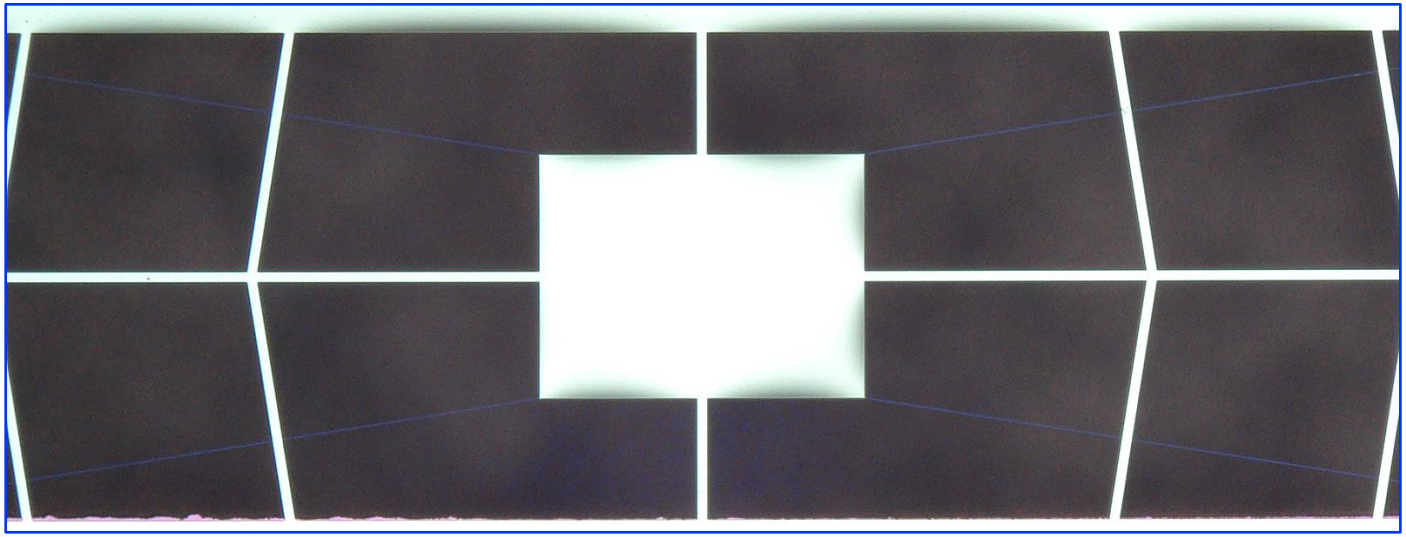


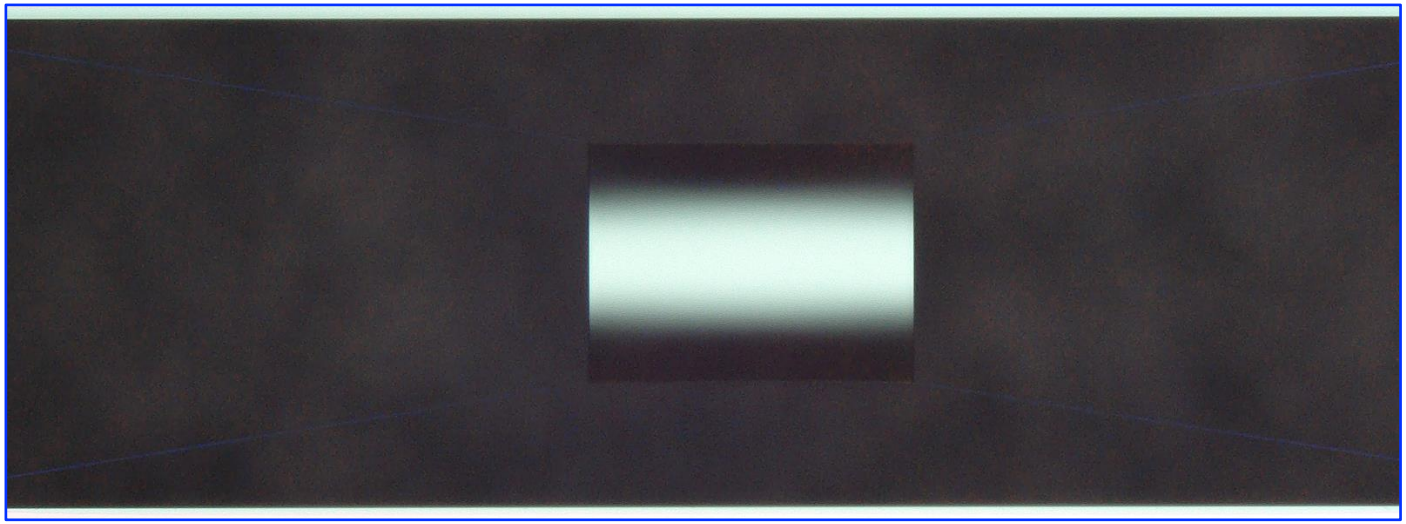
Large Area Plasma Processing System (LAPPS) reactor at NRL, used for removing oxidation from aluminum optics prior to coating

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)



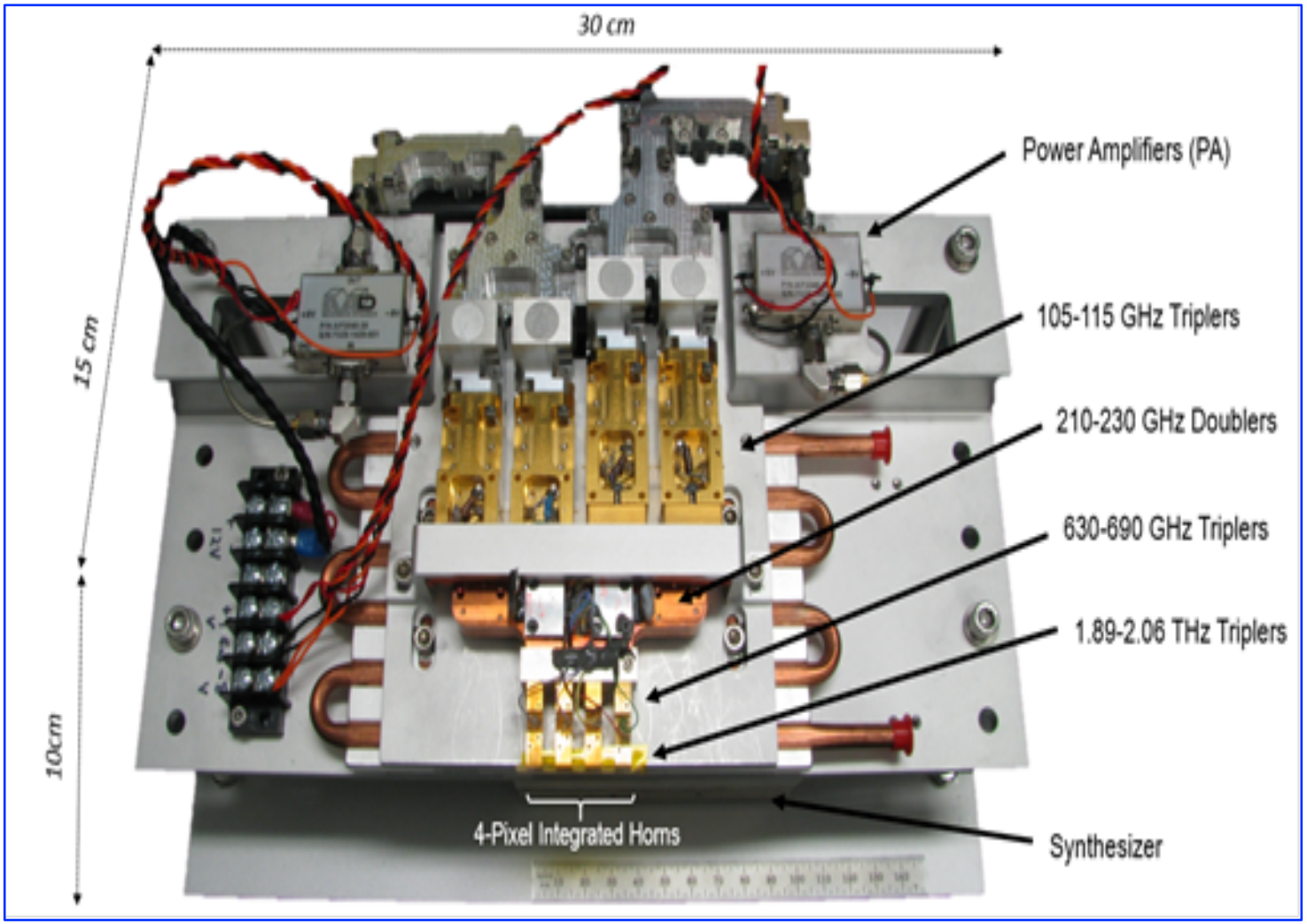


Buttressed (top) and unbuttressed Transition-Edge-Sensor (TES) bolometer devices

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)

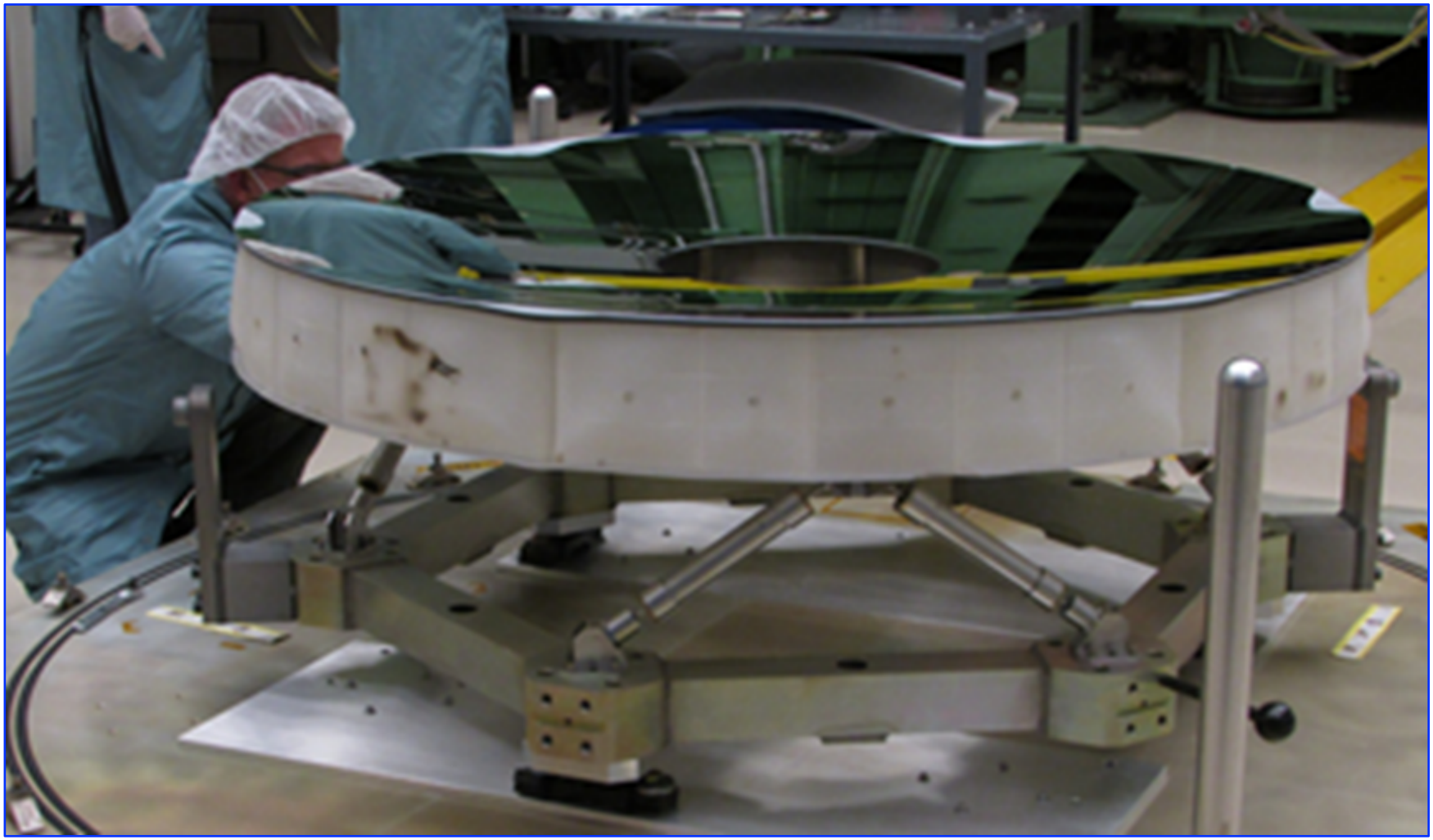


1.9-THz 4-pixel frequency-multiplied chain for Stratospheric Terahertz Observatory 2 (STO-2, launched Dec 2016)

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)



Harris 1.5-m ULE® Advanced Mirror Technology Development (AMTD) mirror

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

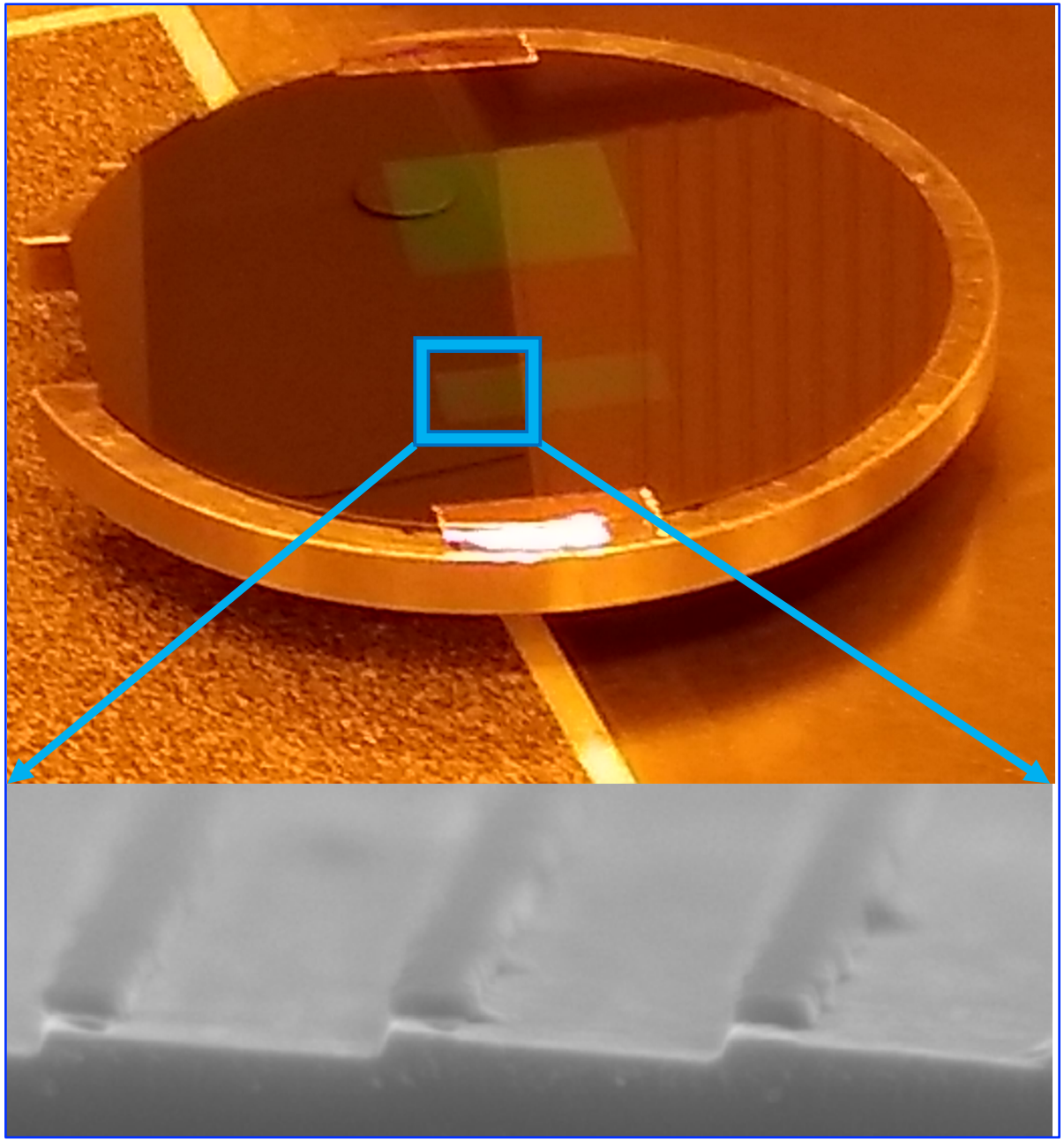
PI: H. Philip Stahl (MSFC)

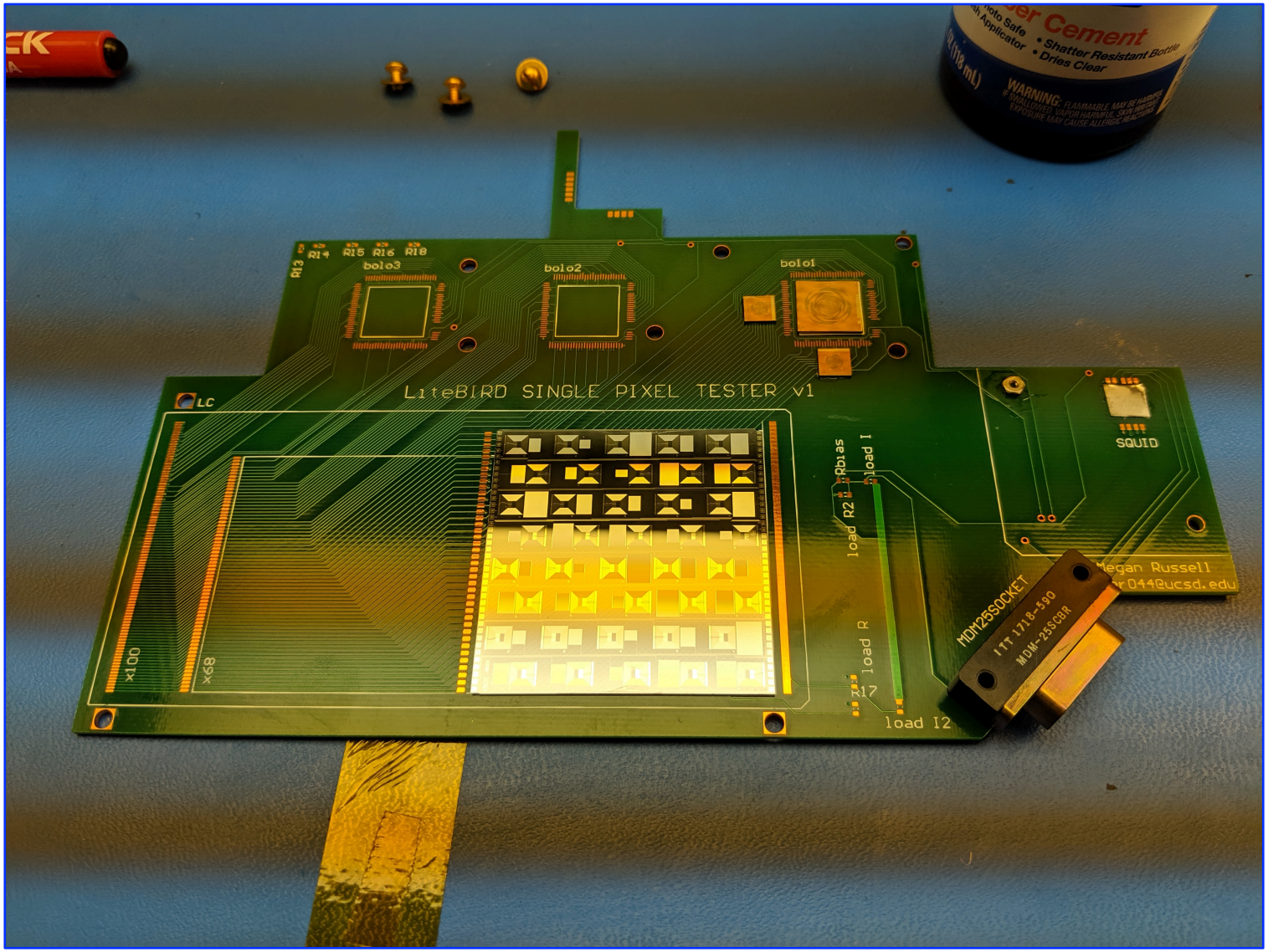
Curved grooves with 4° blaze ruled on flat grating (top) with EUV measurement (bottom)

Significance: May enable future UV/optical spectroscopic missions; enables current UV suborbital missions

Project Title: Electron-Beam-Lithography Ruled Gratings for Future UV/Optical Missions: High Efficiency and Low Scatter in the Vacuum UV

PI: Brian Fleming (U. of Colorado)



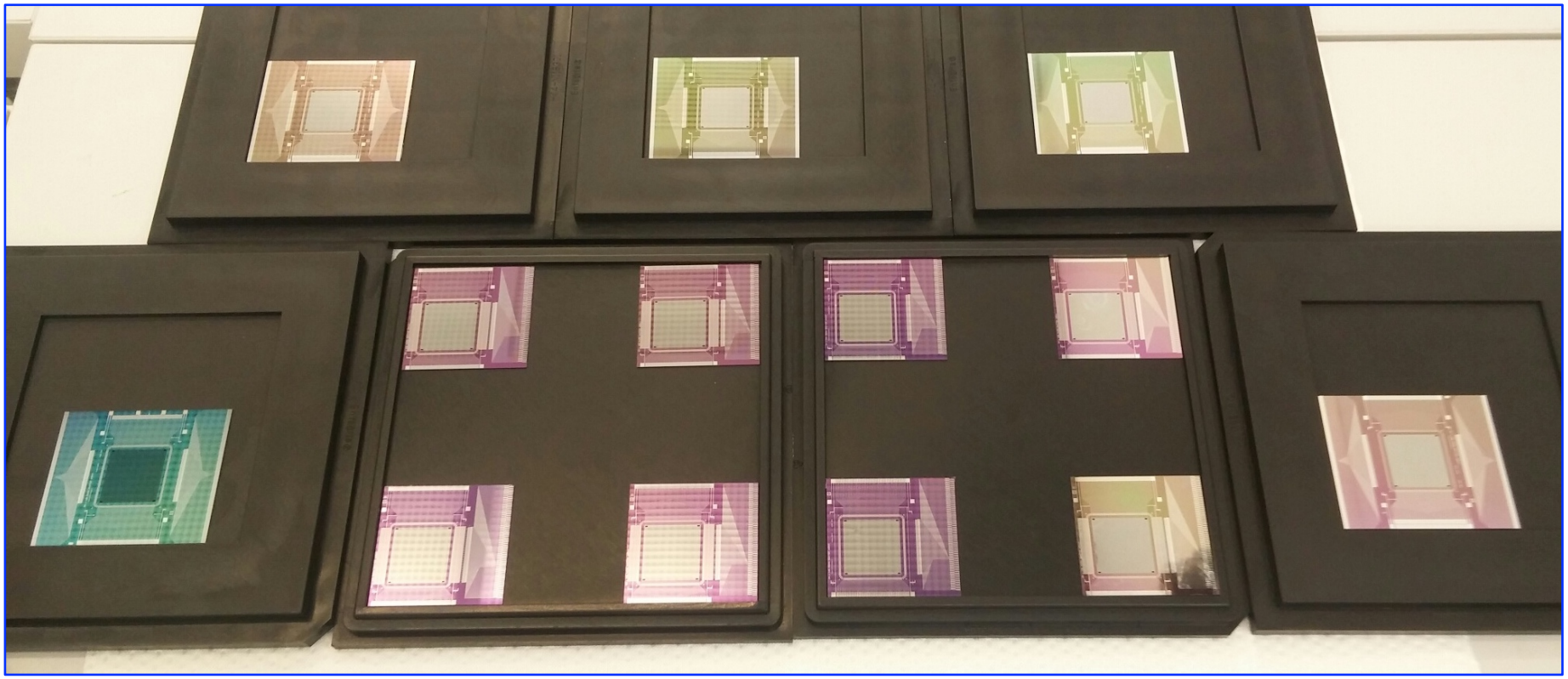


Superconducting QUantum Interference Device (SQUID) amplifier for 100-mK test

Significance: 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)



Substrates with light shields for next-generation electrostatically activated microshutter arrays

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

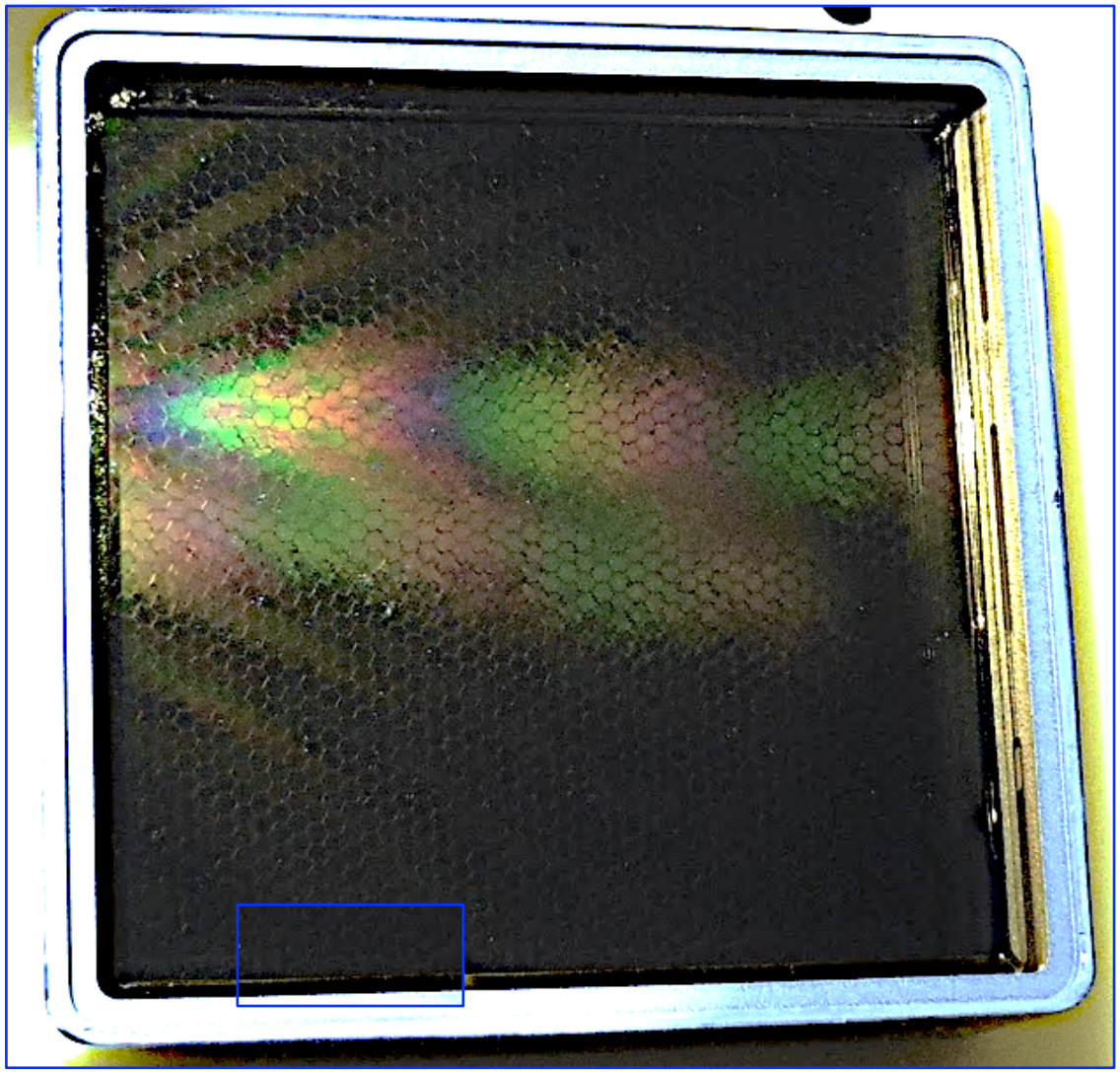
PI: Matt Greenhouse (GSFC)

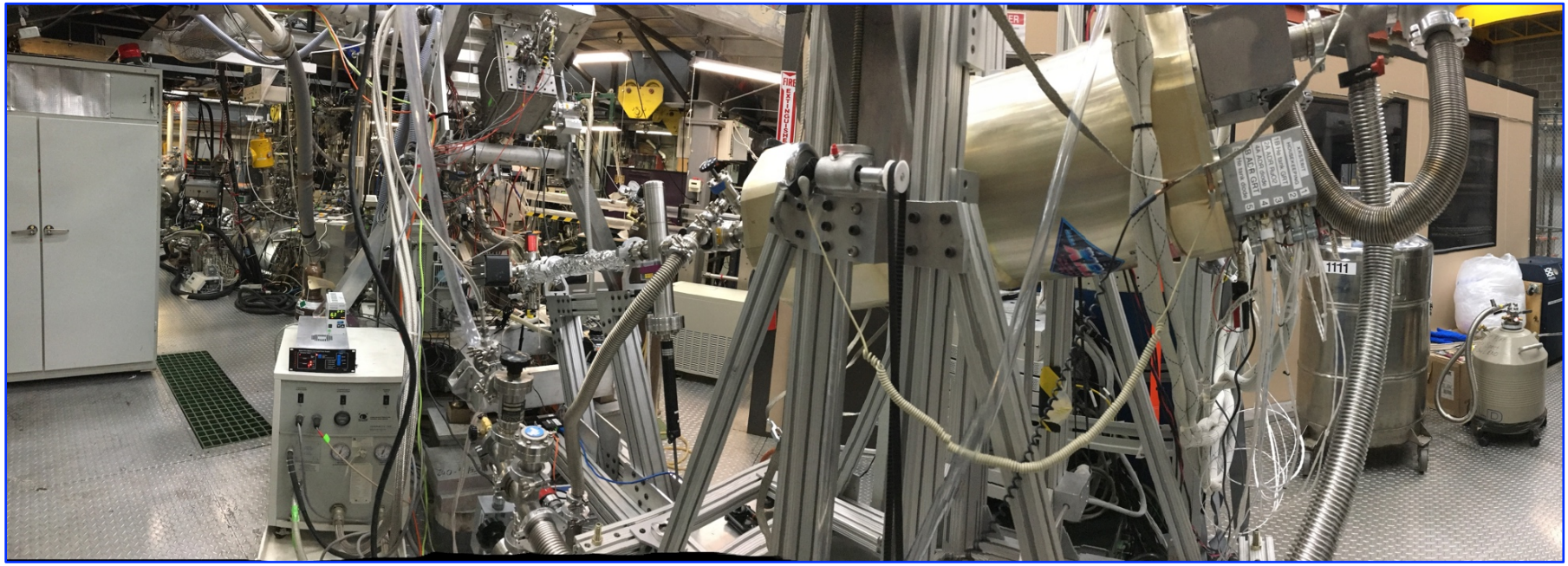
Planacon 50-mm detector with sapphire input window, bialkali cathode, and pair of 54-mm, 20-µm-pore ALD borosilicate Multi-Channel Plates (MCP)

Significance: 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)





Portable X-ray Spectrometer/Electron Beam Ion Trap (XRS/EBIT) for specialized experiments

Significance: 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

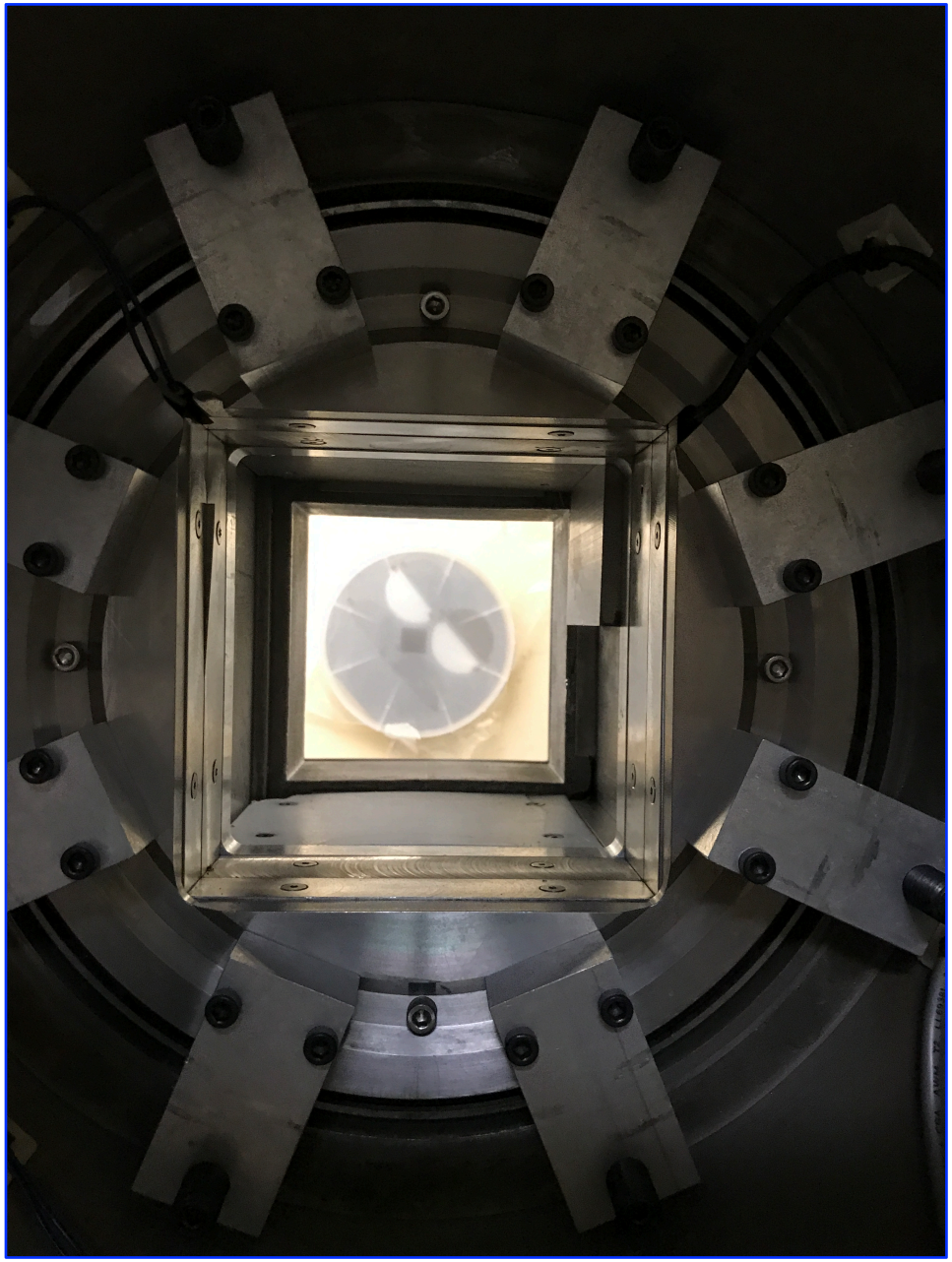
PI: F. Scott Porter (GSFC)

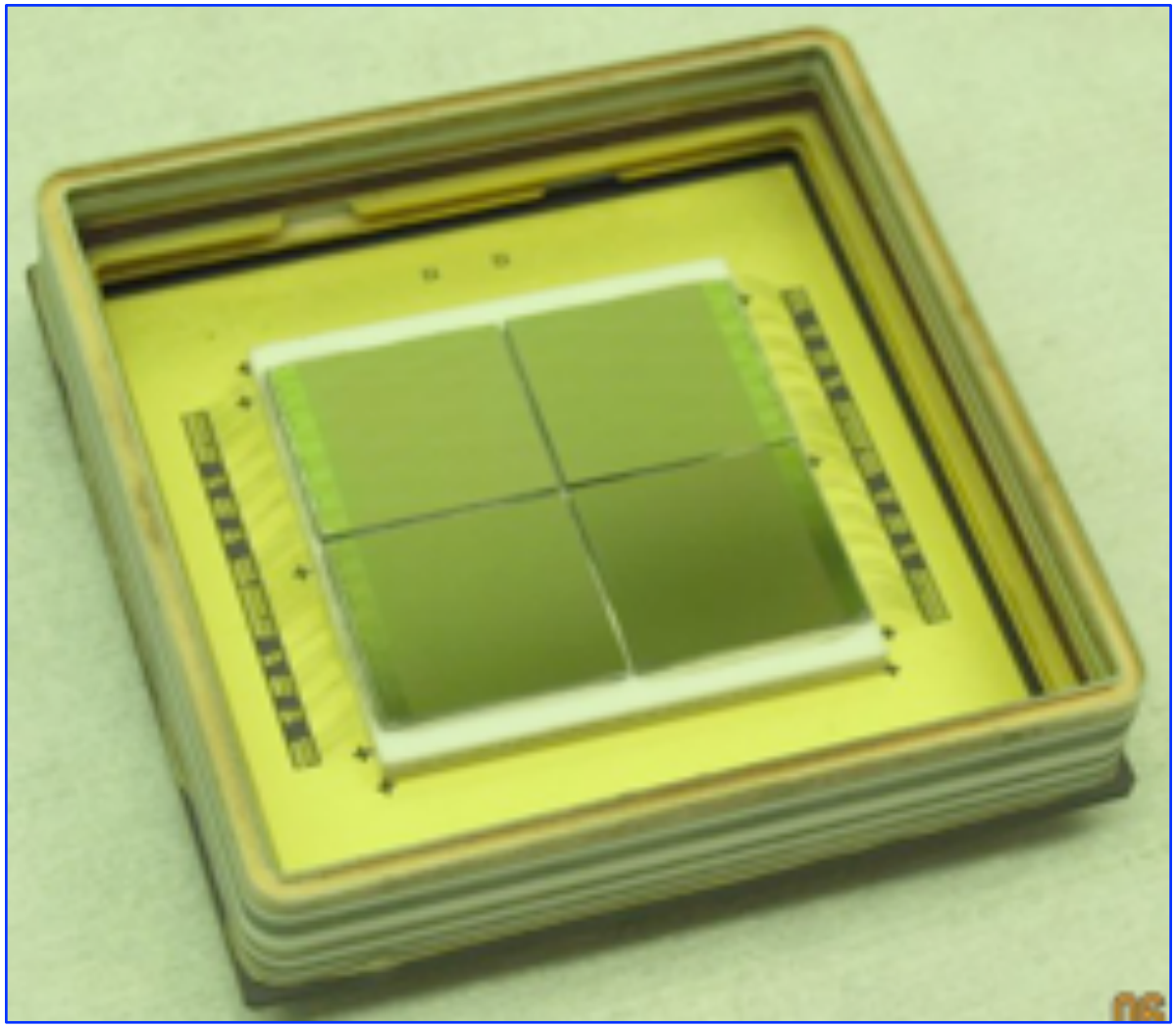
Radiation-testing Atomic Layer Deposition (ALD) coatings

Significance: Detectors baselined by SHIELDS, HabEx, LUVOIR, and ground facilities are fabricated using ALD coatings

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

PI: Shouleh Nikzad (JPL/Caltech)



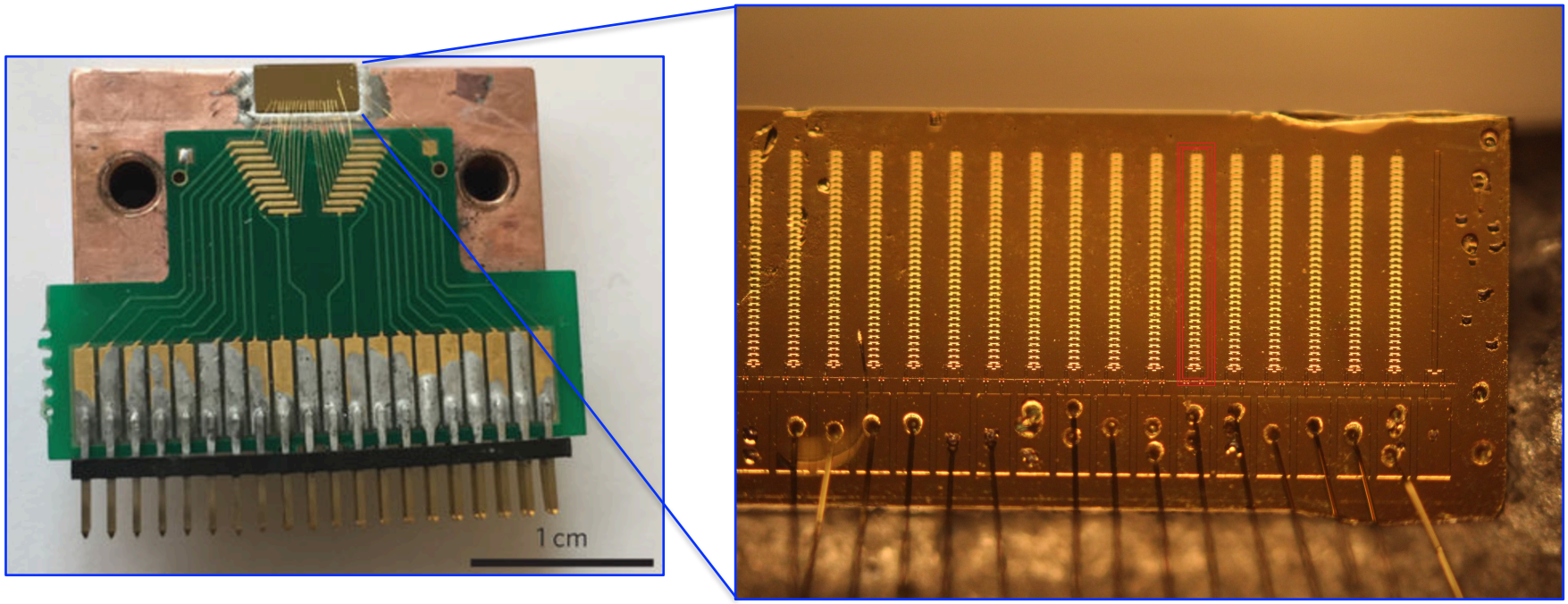


2×2 array of Timepix readout chips for Multi-Channel Plate detectors

Significance: Four-side-buttable low-power readout chips may enable future far-UV missions with large focal planes

Project Title: Large-Format, High-Dynamic-Range UV detector using Multi-Channel Plates (MCPs) and Timepix4 readouts

PI: John Vallerga (UC Berkeley)

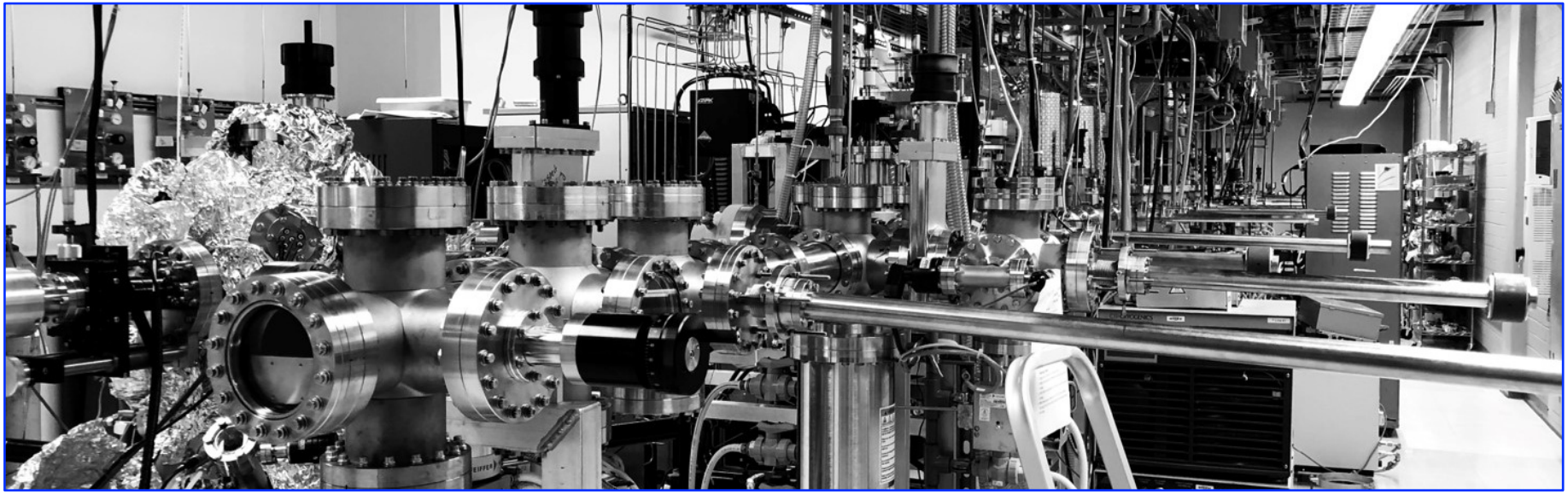


Chip carrier with printed circuit board for wiring (left), and die of 20 DFB devices indium die-bonded to copper chip carrier (right)

Significance: This technology provides 4.7-THz local oscillators (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)



UHV system built at ASU for fluoride Plasma-Enhanced Atomic Layer Deposition (PEALD) 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)