2021 Hardware Images

PCOS and COR Strategic Technology Portfolio

For more information about these technologies visit our Technology Database (http://www.astrostrategictech.us)
Thin grazing-angle X-Ray Mirrors Ready for X-Ray Testing

Significance: World-class thin grazing-angle X-ray mirror technology that may enable the next X-ray Great Observatory

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

PI: Zhang, William (GSFC)
Critical-Angle Transmission (CAT) gratings at PANTER X-Ray Beam

Significance: Highest-resolution X-ray transmission grating technology that could fly on the next X-ray Great Observatory

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

PI: Mark Schattenburg (MIT Kavli Institute for Astrophysics and Space Research)
200-mm wafer patterned with 16 ARCUS-style Critical-Angle Transmission (CAT) gratings

**Significance:** Enhances manufacturability of highest-resolution X-ray transmission grating technology that could fly on the next X-ray Great Observatory

**Project Title:** Readying X-ray Gratings and Optics for Space Applications: Manufacturability and Alignment

**PI:** Randall Smith (SAO)
RFSoC Enclosure for Balloon Missions, with Thermal Management

**Significance:** Fast readouts are crucial for large focal plane arrays in future missions

**Project Title:** Development of Low-Power FPGA-based Readout Electronics for Superconducting Detector Arrays

**PI:** Philip Mauskopf (ASU)
Dewar with Assembled Electronics

**Significance:** Low-noise detectors are crucial for future missions

**Project Title:** A Single-Photon-Sensing and Photon-Number-Resolving Detector for NASA Missions

**PI:** Don Figer (RIT)
Scanning Electron Microscope (SEM) Image of Part of a Thermal Kinetic Inductance Detector (TKID)

**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)
Lynx-Style Transition-Edge-Sensor (TES) X-Ray Detector Array on Wafer

Significance: High-resolution TES microcalorimeters may enable the next X-ray Great Observatory

Project Title: Advanced X-ray Microcalorimeters: TES Microcalorimeters

PI: Caroline Kilbourne (GSFC)
GSFC Package for Lynx-Style LXM Large-Format Arrays

**Significance:** MMCs offer energy resolution that may enable the next X-ray Great Observatory

**Project Title:** MMC Arrays for X-ray Astrophysics

**PI:** Simon Bandler (GSFC)
High-Precision Mandrel Polishing

**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)
Mandrel with Optimized Gasket

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

Project Title: Advanced X-ray Optics: Mirror Fabrication – Replication Studies and Direct Polishing

PI: Stephen Bongiorno (MSFC)
Custom Stress Sensor

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

Project Title: Advanced X-ray Optics: Mirror Coatings

PI: David Broadway (MSFC)
Adjustable Thin X-ray Mirror

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

**Project Title:** Adjustable X-Ray Optics

**PI:** Paul Reid (SAO)
X-Ray CCD Packaging with Shielding

**Significance:** Advanced X-ray detectors may enable the next X-ray Great Observatory

**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 Micromirror Device (DMDs) with Daughterboard

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

**Project Title:** Development of DMDs for Far-UV Applications

**PI:** Zoran Ninkov (RIT)
Radio Frequency System-on-Chip (RFSoC) Brassboard Readout

**Significance:** High-density readout may enable large focal planes needed for future missions

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

**PI:** Josef Frisch (SLAC)
Microscopic Image of Indium Bump Field for Use with Transition-Edge Sensors (TESs)

**Significance:** High-multiplexing-factor readouts may enable missions such as the next X-ray Great Observatory

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

**PI:** Douglas Bennett (NIST)
Assembly Fit-Check of a 6-Stage Continuous Adiabatic Demagnetization Refrigerator (CADR)

Significance: This advanced sub-Kelvin cooling technology may enable multiple future strategic missions

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

PI: James Tuttle (GSFC)
ULE® Mirror Substrate with Thermal Sensors

Significance: Ultra-stability and -precision (~10 pm) may enable the next IR/optical/UV Great Observatory

Project Title: Ultra-Stable Structures

PI: Babak Saif (GSFC)
Hybridized Far-IR Detector

**Significance:** Advanced far-IR detectors may enable the next Far-IR Great Observatory

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

**PI:** Johannes Staguhn (JHU & GSFC)
Measuring Lyman-UV Reflectance of Al+LiF Capped by AlF$_3$ and MgF$_2$

**Significance:** Advanced coatings may enable future far-UV missions

**Project Title:** High-Performance, Stable, and Scalable UV Aluminum Mirror Coatings Using ALD

**PI:** John Hennessy (JPL)
600-mm Dummy Primary Mirror with Coated Mirror Coupons

**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-Ultraviolet Astronomical Instrument Applications

**PI:** Manuel Quijada (GSFC)
**Ti-Au Thermistor**

**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)
RF Amplifier Detail

**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)
Readout Integrated Circuit Chip Mounted in Ultra-Low-Background Camera ULBCam

**Significance:** Ultra-low-noise detectors may enable spectroscopy of extrasolar planets

**Project Title:** Photon counting NIR LmAPD Arrays for Ultra-low Background Space Observations

**PI:** Michael Bottom (U. of Hawaii)
1.2-m Al Mirror Prepared for Cryo Testing

**Significance:** This technology may enable required ultra-stability (~10 pm) for the next IR/Optical/UV Great Observatory

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

**PI:** H. Philip Stahl (MSFC)
CHESS echelle grating

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)
First LiteBIRD-Style MF Detectors

**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)
Keystone Array of Microshutters after DRIE (Dry Reactive Ion Etching)

**Significance:** May enable sparse-field multi-object spectroscopy for future strategic and other missions

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

**PI:** Matt Greenhouse (GSFC)
127-mm Atomic Layer Deposition (ALD) Multi-Channel Plate (MCP) Detector

Significance: Baseline 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)
Timepix4v2 Wafers

**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 MCPs and Timepix4 readouts

**PI:** John Vallerga (UC Berkeley)
Detector Used in Lab Astrophysics

**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)