Strategic Astrophysics Technology Gap Priorities

Following a three-month prioritization process involving managers, technologists, scientists, and subject-matter experts from APD and the Program Offices, as well as independent reviewers, the following is the joint Astrophysics Technology Gap Priority List. This list will inform APD technology development planning as well as decisions on what technologies to solicit, and will be considered when making funding decisions. Tiers are in descending priority order. The gaps within any given tier are to be considered as equally prioritized (which is why the gaps are arranged alphabetically within each tier).

Tier 1 Technology Gaps
Angular Resolution (UV/Vis/NIR)
Coronagraph Contrast
Coronagraph Contrast Stability
Cryogenic Readouts for Large-Format Far-IR Detectors
Fast, Low-Noise, Megapixel X-Ray Imaging Arrays with Moderate Spectral Resolution
High-Efficiency X-Ray Grating Arrays for High-Resolution Spectroscopy
High-Resolution, Large-Area, Lightweight X-Ray Optics
Large-Format, High-Resolution, UV/Vis Focal Plane Arrays
Large-Format, High-Spectral-Resolution, Small-Pixel X-Ray Focal-Plane Arrays
Large-Format, Low-Noise and Ultralow-Noise Far-IR Direct Detectors
Large-Format, Low-Noise, High-QE Far-UV Detectors
Next-Generation, Large-Format, Object Selection Technology for Multi-Object Spectrometers for LUVOIR
Vis/NIR Detection Sensitivity

Tier 2 Technology Gaps
Advanced Millimeter-Wave Focal-Plane Arrays for CMB Polarimetry
Detection Stability in Mid-IR
Heterodyne FIR Detector Arrays and Related Technologies
High-Efficiency Object Selection Technology for UV Multi-Object Spectrometers
High-Performance Spectral Dispersion Component/Device
High-Reflectivity Broadband FUV-to-NIR Mirror Coatings
High-Throughput Bandpass Selection for UV/VIS
Large-Format Object Selection Technology for Multi-Object Spectrometers for HabEx
Starshade Deployment and Shape Stability
Starshade Starlight Suppression and Model Validation
Stellar Reflex Motion Sensitivity – Astrometry
Stellar Reflex Motion Sensitivity – Extreme Precision Radial Velocity

Tier 3 Technology Gaps
Advanced Cryocoolers
High-Performance, Sub-Kelvin Coolers
Large Cryogenic Optics for the Mid-IR to Far-IR
Long-Wavelength-Blocking Filters for X-Ray Micro-Calorimeters
Low-Noise, High-QE UV Detectors
Low-Stress, Highly Stable X-Ray Reflective Coatings
Photon-Counting, Large-Format UV Detectors
Polarization-Preserving Millimeter-Wave Optical Elements
UV Coatings
UV Detection Sensitivity
UV/Vis/NIR Tunable Narrow-Band Imaging Capability
Warm Readout Electronics for Large-Format Far-IR Detectors

Tier 4 Technology Gaps
Compact, Integrated Spectrometers for 100 to 1000 μm
Optical-Blocking Filters
Rapid Readout Electronics for X-Ray Detectors
Short-Wave UV Coatings

Tier 5 Technology Gaps
Advancement of X-Ray Polarimeter Sensitivity
Far-IR Spatio-Spectral Interferometry
High-Precision Low-Frequency Radio Spectrometers and Interferometers
Mid-IR Coronagraph Contrast
Ultra-High-Resolution Focusing X-Ray Observatory Telescope
Very-Wide-Field Focusing Instrument for Time-Domain X-Ray Astronomy
Wide-Bandwidth, High-Spectral-Dynamic-Range Receiving System for Low-Radio-Frequency Observations on the Lunar Far Side