Technology Roadmap for the Far-IR

Dave Leisawitz, NASA GSFC
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To: Joe Alexander, Staff Officer
NASA Technology Roadmap: Instruments and Computing Panel

From: FIR Community organizing group

Dear Joe:

The NASA Space Technology areas roadmap presents a plan for future agency investment strategy that will meet established goals. As representatives of the far infrared astronomy community, we would like to contribute suggestions to enhance the *Science Instrument, Observatories, and Sensor Systems (SI OSS, Technology Area 08)* roadmap, now under review by the NRC. This input has been requested by the NRC.

- Detectors
- Large, cold telescopes
- Passive cooling
- Active cooling
# Technology Roadmap for SPIRIT

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<td>Handoff from SCOTT testbed</td>
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<td>Continuous ADR/Cryocooler Demo</td>
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<td><strong>Continuous ADR/Cryocooler Demo</strong></td>
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**Technology Readiness Level (TRL)**
Detectors

- **Enables:** astrophysical background-limited sensitivity
- **Requirements:** 14x14 pixels, NEP $\sim 10^{-19}$ W/Hz$^{1/2}$, 200 µsec time constant
- **Most promising:** TES bolometers and MKIDs
- **Requires:** $T \sim 30 – 50$ mK focal plane
- **Current TRL:** 3
- **Time to TRL 6:** 4 years
- **Cost to TRL 6**
- **Funding external to AD** International (e.g., SRON)
- **Key infrastructure:** GSFC, JPL, NIST facilities
- **Stretch goal:** photon-counting detectors
Cryocoolers

- **Enables**: background-limited sensitivity; lower launch mass; longer lifetime
- **Requirements**: 72 mW at 4 K, 180 mW at 18 K; 5 μW at 50 mK, 1 μW at 30 mK
- **Most promising**: JWST MIRI cooler w/ $^3$He; C-ADR
- **Requires**: 4 K optics; ~30 mK focal plane
- **Current TRL**: 4
- **Time to TRL 6**: 3 years
- **Cost to TRL 6**: TBD
Cryo-thermal System

- Integrate cryocoolers into subscale Engineering Test Unit with solar simulator
- Verify understanding of system thermal performance with computational model
Wide-field Spatio-Spectral Interferometry

- Present TRL: 4
- Time to TRL 6: 3 years
- Cost to reach TRL 6: $0.5M
Spectrometers

• Compact architectures (e.g., Bradford’s BLISS, Moseley’s $\mu$Spec)