NASA SBIR 2004 Phase I Solicitation

S2.01  Sensors and Detectors for Astrophysics

Lead Center: JPL

Future NASA astrophysics missions like Sofia, Herschel, Planck, FAIR, MAXIM, EXIST, and ARISE (http://spacesei.nasa.gov/missions/index.htm) need improvements in sensors and detectors. Beyond 2007, expected advances in detectors and other technologies may allow the Filled Aperture Infrared instrument (FAIR) to extend HST observations into the mid- and far-infrared (40–500 micron) region; the Micro-Arcsecond X-ray Imaging Mission Pathfinder (MAXIM) will demonstrate the feasibility of x-ray interferometry with a resolution of 100 micro-arc seconds, which is 5000 times better than the Chandra observatory; the Energetic X-ray Imaging Survey Telescope (EXIST) will conduct the first high sensitivity, all-sky imaging survey at the predominantly thermal (x-ray) and non-thermal (gamma-ray) universe requiring a wide-field coded aperture telescope array; and the Advanced Radio Interferometry between Space and Earth (ARISE) mission will create an interferometer including radio telescopes in space and on Earth.

Space science sensor and detector technology innovations are sought in the following areas:

**Mid/Infrared, Far Infrared and Submillimeter**

Future space-based observatories in the 10-40 micron spectral regime will be passively cooled to about 30 K. They will make use of large sensitive detector arrays with low-power dissipation array readout electronics. Improvements in sensitivity, stability, array size, and power consumption are sought. In particular, novel doping approaches to extend wavelength response, lower dark current and readout noise, novel energy discrimination approaches, and low noise superconducting electronics are applicable areas. Future space observatories in the 40 micron to 1 mm spectral regime will be cooled to even lower temperatures, frequently 20 W Hz-1/2 over most of the spectral range in a 100x100 pixel detector array, with low-power dissipation array readout electronics. The ideal detector element would count individual photons and provide some energy discrimination. For detailed line mapping (e.g., C+ at 158 micron), heterodyne receiver arrays are desirable, operating in the same frequency range near the quantum limit.

**Space Very Long Baseline Interferometry (VLBI)**

The next generations of Very Long Baseline Interferometry (VLBI) missions in space will demand greatly improved sensitivity over current missions. These new missions will also operate at much higher frequencies (at first to 86 GHz and eventually to 600 GHz). These thrusts will require development of improved space-borne low-power ultra-low-noise amplifiers and mixers to serve as primary receiving instruments.