PROJECT SUMMARY

Pre-HEAT: First Submillimeter Site Testing & Astronomical Spectra from Dome A

We propose to construct Pre-HEAT, a 450 μm tipping radiometer and digital FFT spectrometer to be installed at Dome A, the summit of the Antarctic ice plateau. Dome A is receiving international acclaim as the best site for ground based THz astronomy in the world, on the basis of the exceptionally cold, dry and stable conditions which prevail there.

An exciting and timely opportunity has arisen that allows us to perform important, pathfinding research *immediately* at Dome A. Our Chinese and Australian partners will be installing the first base Plateau Observatory (PLATO) on Dome A this coming Austral summer (2007-8). They have given us the opportunity to field a submillimeter radiometer as part of this expedition. This instrument, Pre-HEAT, is a 450 μm (660 GHz) tipping radiometer coupled with a digital FFT spectrometer. The goals of Pre-HEAT are to (1) Measure the submillimeter sky opacity as a quantitative demonstration of the exceptional conditions of Dome A, (2) Perform strip maps of the Galactic Plane in the ^{13}CO J=6-5 line at 661 GHz, constituting the first astrophysical measurements from Dome A, and (3) Field-test many of the key technologies for a successor mission, entitled HEAT, the High Elevation Antarctic (Terahertz) Telescope, to be deployed in 2008-9 pending funding from NSF/MRI. Pre-HEAT will pioneer new capabilities for ground-based astronomy and is an opportunity for the US to play a major role in a landmark International Polar Year (IPY) project.

What is the intellectual merit of the proposed activity?

Pre-HEAT and its successor, HEAT (the High Elevation Antarctic Terahertz Telescope) will forge entirely new capabilities for ground based infrared and submillimeter astronomy which otherwise would be unachievable except via expensive airborne or space-based platforms. Pre-HEAT represents a new generation of polar instrumentation that permits the excellent conditions available from remote sites like Dome A to be harnessed without the costs and hazards associated with manned operations. In addition to quantifying the transmission characteristics of the atmosphere over Dome A, Pre-HEAT will establish the first large-scale submillimeter map of the Galactic Plane in ^{13}CO J=6-5 which will help answer timely and fundamental questions about the evolution of the interstellar medium and star formation. It will significantly enhance the interpretation of previous millimeter wave surveys of comparable quality, and will complement the THz surveys to be later performed by HEAT. If HEAT is deployed, Pre-HEAT will continue to operate as a tipping radiometer to provide simultaneous cross-calibration of HEAT's Terahertz spectrometers.

What are the broader impacts of the proposed activity?

Pre-HEAT is a pioneering mission which will pave the way for all future far-infrared astronomical investigations from Dome A. It will map the Southern Galactic Plane in the spectral light of ^{13}CO J=6-5, a key measure of the warm, dense gas that participates in star formation and stellar-interstellar feedback. Definitive and comprehensive science products from the survey and its many synergistic collaborations will be made available to the astronomical community via the Web in a timely manner. These products will enhance the value of numerous contemporary surveys. Beneficiaries include the GLIMPSE Legacy program from the Spitzer Space Telescope, IRAS, the CfA/Columbia CO J=1-0 surveys of the Galactic Plane, the most recent HI and CO surveys of the Galactic Plane, and the 2MASS infrared sky survey. Pre-HEAT will serve both as a scientific and technological pathfinder for future suborbital and space-based missions. Finally, the design and fabrication of Pre-HEAT will be an interdisciplinary team effort involving students from astronomy and optical sciences. Astronomical instrumentation is becoming ever more complex, requiring the talents of many individuals to bring them to fruition. Providing students with both technical training and team-work experience increases their probability of of success not only within astronomy, but society as a whole.