PROJECT SUMMARY

HEAT: the High Elevation Antarctic Terahertz Telescope

We propose to develop an automated, 0.5-meter THz observatory for remote operation at the summit of Dome A, the highest point on the Antarctic plateau. The High Elevation Antarctic TeraHertz Telescope (HEAT) will operate from 158 to 370 μm, and observe the brightest and most diagnostic spectral lines from the Galaxy. The HEAT telescope will be mounted atop a University of New South Wales AASTINO, and after an initial testing period at the South Pole, be transported to Dome A. At Dome A, HEAT will have excellent transmission at 200+ μm during most of the winter, and good transmission in the pivotal 160 μm window for $\sim$20% of the winter. The HEAT heterodyne instrument package will utilize leading-edge mixer, local oscillator, amplifier, cryogenic, and digital signal processing technologies.

What is the intellectual merit of the proposed activity?

HEAT will forge entirely new capabilities for ground based infrared and submillimeter astronomy, providing capabilities which otherwise would be unachievable except via expensive airborne or space-based platforms. The unparalleled stability, exceptional dryness, low wind and extreme cold make Dome A a ground-based site without equal for astronomy at infrared and submillimeter wavelengths. HEAT will operate in the atmospheric windows between 158 and 370 μm, in which the most crucial astrophysical spectral diagnostics of the formation of galaxies, stars, planets, and life are found. HEAT will answer timely and fundamental questions about the evolution of the interstellar medium and star formation. In particular, through large-scale Galactic surveys, the measurement and **impact of the Galactic environment** on the **life cycles of interstellar clouds** and their **relation to star formation** will finally be realized. The receiver system itself serves as a valuable testbed for heterodyne Terahertz components, using leading-edge mixer, local oscillator, low-noise amplifier, cryogenic, and digital signal processing technologies that will play essential roles in future Terahertz observatories. The proposed study will pave the way for future astronomical investigations from Dome A.

What are the broader impacts of the proposed activity?

HEAT's key project is to map with great sensitivity and precision, the Southern Galactic Plane in the spectral light of the dominant coolants of the interstellar medium. 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 survey products will enhance the value of numerous contemporary surveys. Beneficiaries include the GLIMPSE and "C2D" Legacy programs from the Spitzer Space Telescope, the most recent HI and CO surveys of the Galactic Plane, and the 2MASS infrared sky survey. Finally, the design and fabrication of HEAT will be an interdisciplinary team effort involving students from astronomy, optical sciences, and electrical engineering. 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.