With this combination of sensitive detectors, high-angular resolution, and broad frequency coverage, ACBAR will be used to advance cosmology research on several fronts. Observations of the CMB provide a glimpse of the Universe at the time when it was only about 300,000 years old. Also, only recently have technological advances made observations of the SZE possible. To separate the thermal and kinematic components of the SZE, observations must be made at several mm-wavelength frequencies. Other experiments are producing detections of the SZE in x-ray-discovered distant clusters. ACBAR will significantly advance these efforts.

This second season of observation will see the analysis and publishing of the results of two previous years of observation. (AO-378-O; NSF/OPP 00-91840)

Wide-field imaging spectroscopy in the submillimeter: Deploying SPIFI on the Antarctic Submillimeter Telescope and Remote Observatory (AST/RO).
Gordon Stacey, Cornell University.

SPIFI (the South Pole imaging Fabry-Perot interferometer) is the first direct detection imaging spectrometer for use in the submillimeter band and was designed for use on the 1.7-meter Antarctic Submillimeter Telescope and Remote Observatory (AST/RO) at the South Pole in the far-infrared and submillimeter windows. After having developed and extensively field-tested SPIFI, our primary scientific goals are to

- image the inner regions of the galaxy, in particular submillimeter lines that characterize excitation conditions in the Central Molecular Zone (CMZ), and trace the dynamics of the gas. Questions to be answered are, among others, Can we trace neutral gas flowing through the CMZ? Are there shocks from cloud-cloud collisions in this flow? What is the connection between the CMZ molecular clouds and the circumnuclear ring?

- map the Large Magellanic Cloud and Small Magellanic Cloud in these lines. The low metalicity environment in these dwarf galaxies may mimic that of protogalaxies, so that investigating the interaction between star formation and the interstellar matter in these galaxies is key to understanding the star formation process in the early Universe.

- characterize and map the physical conditions of the interstellar matter in nearby galaxies. These data are unique and will be key to understanding the relationships between density waves, bar potentials, and galaxy-wide star formation.

These projects can be undertaken only with the high sensitivity and mapping capabilities of the SPIFI AST/RO combination. SPIFI is much more sensitive than the best heterodyne receivers, which do not have the sensitivity, or (often) the bandwidth, to detect the broad, weak lines from galaxies, or the spatial multiplexing capability necessary for wide-field mapping projects. We plan to gradually upgrade SPIFI by a factor of 10. We will also make modest optical and cryogenic modifications to SPIFI to improve it in ways important to successful polar operations. The result will be better spatial resolution, with a wider field of view, and a large improvement in system sensitivity. Moreover, the new cryogenic system will require servicing only every 5 days instead of the current 40 hours. This is helpful for outdoor polar operations. This new system also reduces helium consumption (by a factor of 2) and therefore reduces cost. (AO-377-O; NSF/OPP 00-94605)