Far-infrared Spectroscopy at the Background Limit with a Cryogenic Space Telescope

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The combination of a 3+ meter cryogenic space telescope with sensitive direct detectors can provide 3–5 orders of magnitude improvement over existing platforms for moderate resolution spectroscopy from 40 to 400 microns. The capability will enable new astrophysics – namely the first routine spectroscopic observations of large and diverse samples of high-redshift galaxies. The broadband far-IR spectra will provide a critical complement to optical and far-IR continuum studies by measuring the conditions in the bulk of the material, measuring redshifts, and overcoming spatial confusion. While the 3+ meter cryogenic observatories and SAFIR are under development, the sensitive, broadband spectroscopy capability presents technical challenges, in particular the detector sensitivity and the spectrometer architecture. Bolometer and photoconductor arrays at the current state of the art are a good match to an imaging Fourier-transform type instrument. The ultimate sensitivity is possible only with a dispersive system and will require some advances in detector sensitivity. I outline these potential approaches and their scientific capability.

From Spitzer to Herschel and Beyond Pasadena, California, June 2004 Conference Program and Abstracts