MEASUREMENTS OF ATMOSPHERIC TRANSPARENCY AT SUBMM WAVELENGTHS

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Since 1998 January, measurements of atmospheric transparency at submm wavelengths have been underway at three current or proposed sites for submillimeter wavelength astronomy: the South Pole (2835 m), Mauna Kea (CSO, 4070 m), and Chajnantor, Chile (5000 m). Identical broadband tipping photometers are deployed at the three sites. These determine the atmospheric transparency about four times per hour by measuring the increase in sky brightness with zenith angle. The instruments are based on ambient temperature pyroelectric detectors, with resonant metal mesh filters defining a 100 GHz passband (FWHM) matched to the 350 μm atmospheric window. Two internal loads at different temperatures are used to calibrate the detector response. Data from Mauna Kea are being cross calibrated against data from a 225 GHz tipping radiometer, from 808–846 GHz heterodyne measurements (CSO), from 350 μm broadband (SCUBA on JCMT) measurements, and from broadband spectroscopy (FTS on CSO). Data from Chajnantor are being cross calibrated against data from a 225 GHz tipping radiometer and from a broadband spectrometer (FTS). Data from both Chajnantor and the South Pole will be compared to radiosonde data. In 2000 June, another photometer was deployed to Chajnantor with additional filters at 200 and 260 μm.

Measurement of the atmospheric transparency in the 350 μm window directly assesses site quality for broadband astronomy. The relative shapes of the filter bandpass and the atmospheric window might, however, vary with site conditions, as might the relationship between the measured broadband transparency and the narrowband transparency at any particular frequency in the window. These effects were gauged with atmospheric models. Both effects show little or no dependence on site conditions or on model details. Hence broadband transparency measurements are good indicators of narrowband transparency. Sites may be compared on the basis of the measured broadband transparency without recourse to models of how the transparency depends on atmospheric water vapor, temperature, and pressure.

Cumulative distributions of the measured zenith transparency at the three sites will be discussed as well as seasonal and diurnal variations.

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