

The Cornell Caltech Atacama Telescope (CCAT)

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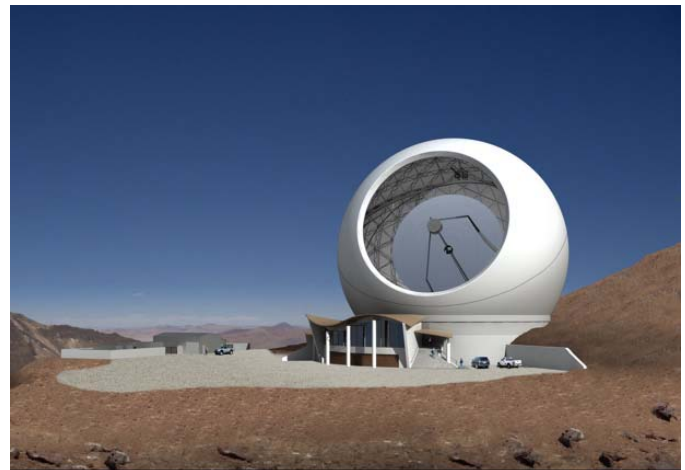
Abstract— The CCAT will be a 25 m telescope for submillimeter astronomy located at 5600 m altitude in northern Chile. An international consortium has formed to carry out the project. CCAT will combine high sensitivity, a wide field of view (20'), and a broad wavelength range (2 mm–200 μ m) to provide an unprecedented capability for deep, large area multi-color submillimeter surveys that complement narrow field, high resolution studies with ALMA. Science objectives include galaxy formation and evolution, star formation, protoplanetary and debris disks, and Kuiper belt objects. Instrumentation will include bolometer cameras, direct detection spectrometers, and heterodyne receiver arrays.

LED by pioneering research at the CSO, the JCMT, and other telescopes, submillimeter astronomy has made tremendous advances in the last twenty years. Two notable examples are the discovery of a population of optically inconspicuous but submillimeter luminous galaxies in the early universe and the recognition the integrated intensity of the far IR and submillimeter radiation in the universe equals the intensity at optical wavelengths. At the same time, the size of background limited bolometer arrays for submillimeter observations is increasing rapidly, doubling every couple of years. These cameras, which are well suited to high sensitivity, wide field surveys, will soon outstrip the capabilities of existing telescopes. Bolometer arrays are complementary to the heterodyne technology used in interferometers, such as ALMA. Finally, meteorological and radiometric studies in the high Andes of northern Chile have identified superb sites there, better than Mauna Kea, for ground based submillimeter astronomy.

These considerations have motivated the study of the construction of a new 25 m telescope, CCAT, for submillimeter astronomy on a high mountain in northern Chile. The CCAT consortium includes Cornell University, the California Institute for Technology (Caltech) and its Jet Propulsion Laboratory (JPL), the University of Colorado, the University of British Columbia and the University of Waterloo together, and the UK Astronomy Technology Centre on behalf of the UK community. CCAT will combine high sensitivity, a wide field of view, and a broad wavelength range to provide an unprecedented capability for deep, large area, multi-color submillimeter surveys. CCAT observations will address fundamental themes in contemporary astronomy, notably the formation and evolution of galaxies, the nature of the dark matter and dark energy that comprise most of the content of the universe, the formation of stars and planets, the conditions in circumstellar disks, and the conditions during the early history of the Solar system. By identifying an abundance of sources for later de-

tailed study, CCAT's large area surveys will complement the narrow field, high spectral and spatial resolution capabilities of ALMA. The high, dry candidate CCAT site, at 5600 m in northern Chile, enjoys superb observing conditions. Designed with a 20 arcmin field of view, the CCAT will emphasize sensitive wide field observations with large format cameras. To maintain a half wavefront error of 10 μ m rms or less, the telescope will incorporate closed loop active control of its segmented primary mirror. CCAT will provide a platform for instruments that take maximum advantage of rapidly developing detector technology. Instrumentation under consideration includes both short (650 μ m–200 μ m) and long (2 mm–750 μ m) wavelength, large format bolometer cameras, direct detection spectrometers, and heterodyne receiver arrays. The CCAT feasibility and concept design study was completed at the end of 2005 and the project received a strong endorsement from an independent review committee in 2006 January.

When complete early in the next decade, CCAT will be a significant new facility for submillimeter astronomy. It will be the largest and most sensitive facility of its class as well as the highest altitude astronomical facility on Earth.



CCAT at 5600 m on Cerro Chajnantor, Chile (concept view).