AST/RO: A SUBMILLIMETRE-WAVE TELESCOPE FOR THE SOUTH POLE

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The Antarctic submillimetre Telescope and Remote Observatory (AST/RO), a 1.7 m offset Gregorian, is scheduled for installation at the South Pole in November 1993. It is a collaboration including the Smithsonian Astrophysical Observatory, AT&T Bell Laboratories, Boston University, the University of Illinois, the University of Colorado, and the University of Cologne. Observational tests (Pajot 1990; Dragovan *et al* 1990) and modeling (Bally 1990) of atmospheric transparency over the Pole indicate that it is the best accessible submillimetre-wave site in the world. The immediate scientific goals are heterodyne spectroscopy of galactic molecular clouds and molecular lines in the earth's stratosphere at wavelengths near 600 μm. Two early observational programs are a large-scale survey of the CI line at 609 μm and monitoring of the 2.8 mm O_3 line arising in the stratosphere. Under the newly-formed Center for Astrophysical Research in Antarctica (centred at Yerkes Observatory), AST/RO will become a general-purpose instrument for the millimetre, sub-millimetre and far-infrared.

A telescope aperture of 1.7 m yields a beamsize of 90″ (for $\lambda = 600$ μm). This beamsize is large enough to allow large-scale mapping programs, yet is small enough to map distant clouds in the Galaxy and to just resolve hundreds of external galaxies; it is not small enough, however, to study distant galaxies or to study protostellar regions of the centre of our Galaxy in any detail. All of the optics in AST/RO are offset, and have rms surface accuracy of 8 μm rms. The primary mirror was fabricated of carbon fibre reinforced polymer by Dornier GmbH. The primary reflector is small enough and light enough to be lifted and put into place by two people. The mount will be carried to the South Pole in a C130 aircraft without disassembly and unloaded and moved into place using a crane. This is considerably simpler than the heavy construction work, assembly and alignment of multiple panels that would be required for a larger telescope.

Diffraction-limited field-of-view is 3° in diameter at 3 mm wavelength and 30′ in diameter at 200 μm. The tertiary chopper makes use of this field-of-view, because it is located at the telescope's exit pupil and so does not change the illumination pattern on the primary while chopping. The telescope has both a Nasmyth focus for mounting array detectors, which is similar in its optical and mechanical properties to the bent Cassegrain focus on the Kuiper Airborne Observatory, and a coudé room under the mount, which is a spacious, shirt-sleeve environment for receivers. The laboratory underneath the antenna will hold racks of electronics, AOS spectrometers, computer terminal and printer, laboratory bench space, storage for tools, and room for the receiver. To improve the reliability of the system, there will be a two-fold redundancy of the receiver components, cryogenic systems, and spectrometer. The telescope control building will be connected to Amundsen-

Scott South Pole Station by a tunnel and the data acquisition computer will be connected to the base by optical fibre. Although the telescope will be manned at all times by at least one person, data acquisition will be remotely controlled using satellite links to transfer computer files.

References

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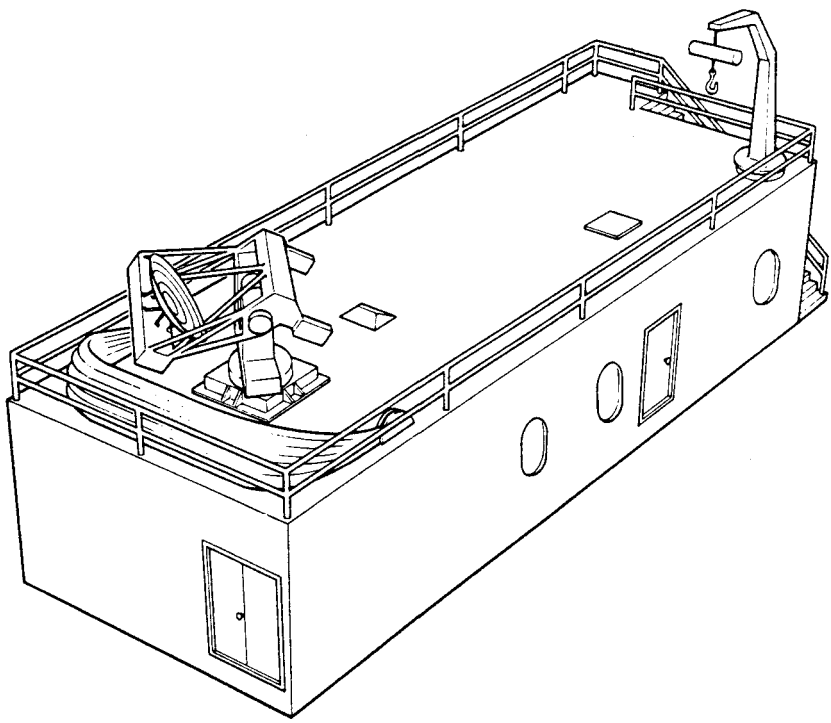

Figure 1. Artist's conception of the AST/RO telescope, support structure, and laboratory at the South Pole

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