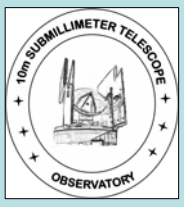
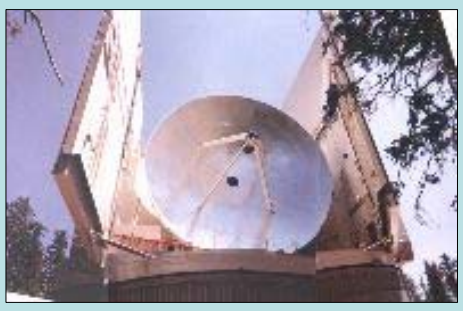


Welcome to the 10 meter Submillimeter Telescope (SMT) on Mt. Graham, AZ



Astronomy 101

The purpose of any telescope is to collect as much "light" as possible from very faint and distant objects in the sky. Therefore the bigger the telescope the more light it can collect. Astronomers and engineers build instruments that are capable of taking that collected light and use their knowledge of how light behaves in order to analyze their objects.

The surface of a telescope is also important for the range of "light" the telescope is designed to collect. For example "optical" telescopes collect the range of "visible" light that the human eye can see. The optical range of light requires a highly polished and perfect parabolic mirror surface to collect that light. On Mt. Graham the Vatican Advanced Technologies Telescope (VATT) and the Large Binocular Telescope (LBT) are design to collect the entire range of not only visible light but also a portion of infrared light (the portion of light that is more red than the reddest color the human eye can see). The 10 meter Submillimeter Telescope (SMT) is designed to collect radio light which are much longer in wavelength and much less energetic than our optical neighboring telescopes. The longer the wavelength the less perfect the telescope surface has to be. However this also means that we need a much larger dish to collect the very faint millimeter wavelength of light.

Arizona Radio Observatory (ARO)

The SMT is the most accurate submillimeter astronomical telescope in the world (15 microns rms). It is designed specifically to operate in the submillimeter wavelength region of the spectrum, 205GHz to 490GHz (less than 2mm wavelength!).

The major areas of millimeter/sub-millimeter science pursued at Steward Observatory include studies of the structure and dynamics of late-type stars and planetary nebulae, molecular cloud morphology, star formation, as well as astrochemistry of interstellar and circumstellar material. These investigations require instruments called heterodyne receivers. These receivers are sensitive enough for molecular line searches and large-scale mapping of molecular emission.

Our sister scope located 1 hour west of Tucson on Kitt Peak, is called The 12m. The 12m heterodyne receivers cover the 65-183 GHz range (2 and 3 mm windows), and the SMT supports 200-490 GHz receivers. Future instrumentation is planned to operate up to 800GHz. Many of these receivers are dual polarization and single sideband. The ARO also supports array receivers, at present, the 345 GHz, the seven-pixel Desert Star array, to be followed by SuperCam. ARO is also actively involved in millimeter-wave VLBI, in collaboration with M.I.T. Haystack.

SMT Structure

Geometry

Main reflector: paraboloid D=10 m F/D=0.35.
Subreflector: hyperboloid d=0.69 m Fe/D=13.8.
Focus: Nasmyth or bent Cassegrain foci (2-outside each elevation bearing).

Reflector

Spaceframe support:
Carbon fiber reinforced plastic (CFRP)
Tubes with invar steel joints (3040 kg weight).
Panels:
CFRP skin with aluminum honeycomb sandwich core (110 Kg weight).
Subreflector support:
CFRP tube quadrupod (110 kg weight).
Surface accuracy is measured by holography observations.

Secondary

Single mirror: CFRP aluminum honeycomb sandwich.
Chopping mechanism:
at 80% duty cycle:
10 Hz with 4 arcminute throw.
25 Hz with 25 arcsecond throw.
16 mirror positions possible for raster scanning.

Mount

Altitude/Azimuth : steel with thermal insulation.
Absolute pointing accuracy: 1 arcsecond rms.
Tracking precision: 0.2 arcsecond rms.
Azimuth range: +/-270 degrees.
Elevation range: -2 degrees to 91 degrees.
Slew speed: 60 degrees/min.
Weight: 41500 kg

Forefront Scientific Research Programs

The unique capabilities of the ARO telescopes include a broad frequency coverage and many stable, sensitive receiver systems and back-ends that allow for deep line searches, complemented by an active supporting laboratory spectroscopy group that focuses on potential interstellar molecules - a prime combination for astrochemical studies; also an innovative instrument lab. Routine remote observing has allowed for 24-hrs a day operations from October – June from Asia, Europe and South Africa.