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A 2.3m Dual Band Radio Telescope for Power Mapping and Line Spectra Observations

The engineering objective of this project was to design and build a small radio telescope for observations in the 1650-1750 MHz band, to detect OH maser emissions, and in the 3100-4300 MHz band, to detect methylidyne maser emissions and synchrotron radiation. Such a telescope, intended for secondary and undergraduate use, has to be easily replicable, comparatively cheap (this project had a target cost of US \$2000), and relatively simple to use. To achieve this objective, a three part system, consisting of a parabolic antenna and pointing system, a receiver, and a control/interface software suite was designed and constructed. A commercial 2.3m satellite dish was coupled with a ham radio antenna rotator using a mobile steel assembly to allow for pointing control in both azimuth and elevation. The dish was then fitted with dual circular feedhorn (the C-band feedhorn off-focus) with probes corresponding to right and left circular polarizations in each. The signal from the waveguide probes was then amplified and transmitted to a receiver assembly which included a spectrum analyzer, a quadrature (branchline) coupler, and a multi-channel radiometer. A software suite was then written to allow both the telescope mount and the receiver to be controlled remotely, and for the absolute position of the telescope to be coupled with corresponding data from the radiometer. The telescope was completed and tested with the software suite in controlled conditions. Initial calibration tests using the lower band feedhorn have demonstrated that the telescope is able to observe OH maser frequencies at actual intensities. Sky tests are forthcoming.