THE COMBINED ARRAY FOR RESEARCH INTO MILLIMETER-WAVE ASTRONOMY

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The Combined Array for Research in Millimeter-wave Astronomy (CARMA) comprises the millimeter-wave antennas of the Owens Valley Radio Observatory (OVRO), the Berkeley-Illinois-Maryland Association (BIMA) Array, and the new Sunyaev-Zeldovich Array (SZA). CARMA will consist of six 10.4-m, nine 6.1-m, and eight 3.5-m diameter antennas on a site at elevation 2200 m in the Inyo Mountains near Bishop, California. The array will be operated by an association that includes the California Institute of Technology and the Universities of California (Berkeley), Chicago, Illinois (Urbana-Champaign), and Maryland. Observations will be supported at wavelengths of 1 cm, 3 mm, and 1.3 mm.

CARMA will have a unique spatial dynamic range. Observations in reconfigurable arrays with baselines from 5 m to 1.7 km will provide resolution and wide field imaging unprecedented in the millimeter band. This heterogeneous array of antennas will afford excellent imaging by allowing a larger range of spatial frequencies to be sampled instantaneously, and by using the varying primary beam patterns to decouple the source brightness distribution from the primary beam illumination. Total power data can be provided by the 10.4-m antennas, which are significantly larger than the shortest interferometer spacings.

The flexible first light correlator will use field programmable gate array (FPGA) technology to provide all single-polarization cross-correlations on two subarrays of 8 and 15 antennas with a total bandwidth of 8 GHz on the sky. Polarimetry will be possible in a time-sharing mode. The next generation correlator will correlate the full 23-antenna array in both polarizations.

CARMA will support student training, technology development, and front-line astronomical research in a wide range of fields including cosmology, galaxy formation and evolution, star and planet formation, stellar evolution, chemistry of the interstellar medium, and within the Solar System, comets, planets, and the Sun. Preliminary science operations will begin in late 2005 with observing at 1.3 mm and 3 mm using the 6-m and 10-m antennas. Routine operation is expected in 2006. Antenna stations allowing observations with baselines up to 1.7 km will be completed by late that year. The 3.5-m antennas of the SZA will be used during the first two years to study the Sunyaev-Zeldovich effect in galaxy clusters, after which they will be incorporated into regular CARMA observing. Dual-polarization receivers should be installed on all antennas within three years.

The array is intended to support research and teaching by visitors as well as by the university partners. Approximately 30% of all observing time will be available to visitors, beginning with the first call for proposals in 2006.