Overview of the Canadian Hydrogen Intensity Mapping Experiment (CHIME)

Adam D. Hincks (for the CHIME Collaboration)
Department of Physics & Astronomy, University of British Columbia,
Vancouver, BC, Canada

The Baryon Acoustic Oscillations (BAO) which occurred in the early universe have left a distinctive imprint in subsequent large-scale structure, thereby providing a standard, cosmological ruler. Measurements of the apparent diameter of BAO over an appreciable period of cosmic time thus reveal the expansion history of the universe and can provide valuable new data for constraining models of dark energy. Intensity mapping of hydrogen's 21 cm line over a broad range in frequencies is an exciting new prospect for determining the large scale, three-dimensional structure of the universe in pursuit of this goal.

CHIME is a transit radio interferometer in the interior of British Columbia that will map this cosmic structure over a redshift range of $0.8 < z < 2.5$ (400–800 MHz) with 1 MHz resolution. An initial $40 \times 37\,\mathrm{m}^2$ instrument with space for 128 dual-polarization feeds has been constructed, and the full-sized, $100 \times 100\,\mathrm{m}^2$ version with 1280 feeds is funded.

CHIME is projected to provide a measurement of the dark energy equation of state that will be competitive with Stage IV DETF experiments like Euclid and BigBOSS. This includes tightening constraints on the time-evolution of the equation of state, an important step for distinguishing between dark energy models. Finally, it has promising potential for ancillary science, such as studying 21 cm absorption, discovering and characterizing pulsars and other transients, and measuring galactic magnetic fields via Faraday rotation.

I will give an overview of CHIME, presenting its science goals as well as the challenges, key among which is the task of separating the galactic foregrounds from the cosmic 21 cm signal. We have been commissioning the instrument since early autumn 2013, and I will report on the progress made so far, as well as discuss some of the lessons we have already learned.