

Cosmology, Cell Phones & Video Games: The Canadian Hydrogen Intensity Mapping Experiment

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ABSTRACT: The measurement of cosmic acceleration – the increasingly rapid expansion of the Universe over time – was awarded the Nobel Prize in Physics in 2011, and signals either that a gravitationally repulsive dark energy dominates the energy density of the Universe today, or that Einstein’s General Relativity does not correctly describe gravity on cosmological scales. The impact of this discovery on fundamental physics and astrophysics has been revolutionary, and decoding the physics of cosmic acceleration requires new, higher quality measurements of the expansion rate of the Universe as a function of time.

Hydrogen Intensity (HI) mapping uses redshifted 21cm emission from neutral hydrogen as a 3D tracer of Large Scale Structure (LSS) in the Universe. Imprinted in the LSS is a remnant of the acoustic waves which propagated through the primordial plasma. This feature, the Baryon Acoustic Oscillation (BAO), has a physical size of ~ 150 co-moving Mpc, which appears in the spatial correlation of LSS. By charting the evolution of this scale over cosmic time, we trace the expansion history of the Universe, constraining the Dark Energy equation of state just as it began to influence the expansion of the Universe.

In this talk I will introduce CHIME, an ambitious new radio telescope being built in British Columbia, Canada. CHIME is a transit interferometer designed to measure the BAO via 21cm line emission, covering a bandwidth of 400-800MHz, corresponding to a redshift range of $0.8 < z < 2.5$. It is composed of four 20m x 100m parabolic reflectors which focus radiation in one direction (east-west), while interferometry is used to resolve beams in the other (north-south). Earth rotation sweeps them across the sky, resulting in complete daily coverage of the northern celestial hemisphere.

ALL ARE WELCOME!