Mapping the universe's accelerated expansion with HIRAX

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A new frontier of radio astronomy is using the redshifted 21-cm emission line of neutral hydrogen to reconstruct a three-dimensional map of large-scale structure in the universe. These measurements encode a faint imprint, known as baryon acoustic oscillations (BAOs), that correspond to remnant ripples left behind by sound waves echoing through the plasma of the early universe. These oscillations have a characteristic angular scale that serves as a "ruler" for measuring the universe's expansion history. Measurements from upcoming experiments will constrain BAOs with exquisite precision, opening new views into structure formation and shedding light on the mystery of dark energy.

I will describe the Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX), a radio telescope array that has the goals of measuring BAOs, searching for pulsars, detecting fast radio bursts and other transients, finding neutral hydrogen absorbers, measuring diffuse Galactic foreground emission, and other auxiliary science. HIRAX will map most of the southern sky (in a declination range of approximately -60° to 0°) over a frequency range of 400–800 MHz, and the experiment will be located in the Karoo desert, near the South African Square Kilometer Array site. The array will consist of roughly 1000 6-m stationary dishes placed in a compact, redundant configuration. HIRAX is in its initial prototyping stages, and an eight-element pathfinder array has been constructed at the Hartebeesthoek Radio Astronomy Observatory; commissioning of this pathfinder is currently in progress. We expect to begin constructing the first HIRAX dishes in the Karoo in late 2019. I will discuss the status of the HIRAX instrument, upcoming plans, and science prospects.