

## HIRAX:

### The Hydrogen Intensity and Real-time Analysis eXperiment

HIRAX will use the redshifted 21-cm emission line of neutral hydrogen to reconstruct a vast three-dimensional map of large-scale structure in the universe. Such hydrogen intensity maps 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.

Measurements with HIRAX will constrain BAOs with exquisite precision, opening new views into structure formation and the universe's expansion history, and shedding light on the mystery of dark energy.

Beyond BAO measurement, HIRAX is also designed to search for pulsars, detect fast radio bursts and other transients, find neutral hydrogen absorbers, and other auxiliary science.



HIRAX is based in South Africa and will utilize the following locations:

- Initial testing is underway at Durban University of Technology (DUT) in Durban, KZN, using a single 6-m prototype dish.
- An 8 element prototype array planned for Hartbeesport Radio Astronomy Observatory (HartRAO) in 2016.
- The full 1000 element array will be sited at the SKA Karoo facility.



HIRAX will map the southern sky (DEC  $-60^\circ$  to  $0^\circ$ ) over 400-800 MHz.



The HIRAX design includes:

- 1000 stationary dishes with a 6-m diameter.
- These dishes tilt North-South and use Earth's rotation for East-West coverage.
- Digital electronics for HIRAX will piggyback off developments made for the CHIME experiment.

Given this design, the HIRAX experiment has a Dark Energy FOM  $\sim 100$  and complements MeerKAT B2.



The prototype 6-m dish was assembled at DUT in August 2015. Testing with the dish is currently in progress.



#### Current Funding Status:

HIRAX is in its initial planning stages and has been conditionally approved by the South African National Research Foundation, pending a detailed site agreement with the SKA.

#### HIRAX Collaboration Members:

UKZN: Sievers, Moodley, Chiang, Hilton,  
Poole (engineering)  
Stellenbosch: Brink  
UCT: Woudt, Taylor  
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ASIAA: Chang  
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