

The Hydrogen Intensity and Real-time Analysis eXperiment

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1 Extended Abstract

The Hydrogen Intensity and Real-time Analysis eXperiment (HIRAX [1], Table 1) is an intensity mapping project to be co-located with the Square Kilometer Array in South Africa. By making use of an 1024 element interferometer of low-cost 6m dishes arranged in a compact grid, HIRAX will map the low-frequency southern sky from 400–800 MHz, probing neutral hydrogen emission over the redshift range of 0.8–2.5. The principle goal of this survey is to accurately measure the observed baryon acoustic oscillation feature imprinted on large-scale structure through HI intensity mapping (See e.g. [2]). As this epoch spans the onset of the transition from matter-dominated to dark energy-dominated expansion, HIRAX will provide highly competitive constraints on cosmological parameters, particularly the equation of state of dark energy. Forecasts of these constraints using the methodology of [3] are shown in Figure 1. The final survey will map 15,000 square degrees of the southern sky, overlapping contemporary and forthcoming surveys such as those from the Large Synoptic Survey Telescope and the Dark Energy Survey, as well as ground based Cosmic Microwave Background surveys. HIRAX will therefore enable a wide range of HI cross-correlation studies with external large-scale structure probes. Additionally, HIRAX will be a powerful instrument for detecting and monitoring radio transients such as Fast Radio Bursts and pulsars.

Table 1. Instrument specifications for HIRAX [1]

Frequency Range	400–800 MHz
Frequency Resolution	390 kHz
Dish size	6 m , $f/D=0.25$
Interferometric layout	32×32 , 7 m spacing
Field of View	15 deg^2 – 56 deg^2
Resolution	$\sim 5'$ – $10'$
Beam Crossing Time	17–32 minutes
System Temperature	50 K
Survey Size	$15,000 \text{ deg}^2$

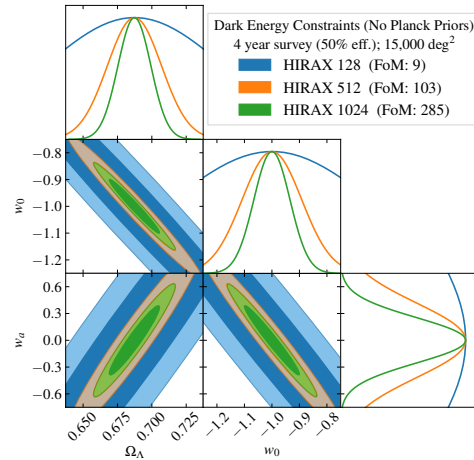


Figure 1. Forecasted Dark Energy constraints.

References

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