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The Tianlai polar cap and high latitude surveys: forecasts

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ABSTRACT

We present the science case of the surveys being carried by the Tianlai dish array interferometer toward the NCP, as well as the high latitude area overlapping the SDSS legacy spectroscopic survey.

Key words: galaxies: evolution – large-scale structure – 21-cm

1 INTRODUCTION

- HI intensity mapping
- Tianlai project , reference to the cylinder paper and dish array paper
- Reminding the main challenges : reaching the sensitivity through long integration time, amplitude and phase calibration when observing tn transit, and sperating the cosmological 21cm signal from the foregrounds : references, focus on the high-k analysis

The usual description of the paper structure

Paper will cover the following subjects::

- Science reach of Tianlai dish array surveys, at low ($z \sim 0.1$) and medium($z \sim 0.3 - 0.5$) redshifts, targeted toward restricted area
- NCP region , $5-100\mathrm{deg}^2$ area , 2-5 mK visibilities noise level (1MHz x 30" sampling, $\sim$ 1 month observation per declination)
- Mid-latitude (near CasA declination, to overlap with SDSS legacy spectroscopic surver , $1000 - 2000\mathrm{deg}^2$ area, $100 - 200\mathrm{deg}^2$ area overlap with SDSS
- Detection of nearby $z \lesssim 0.05$ HI clumps : reliable estimates of number of detectable clumps (mass & redshift distribution)
- Detection of LSS in cross-correlation with optical survey
- Possible detection of LSS as excess auto-correlation signal ?

Some remarks

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• Consider cross-correlation with ALFALFA or FAST HI survey , need survey at lower latitudes to have overlap with theses surveys (Peter)

• There are frequency bands unusable due to strong RFI (from satellites) , around 1380 MHz for example - We should blank these frequency bands which will decrease the statistical significance (Olivier)

• For section 3, evaluate the impact of going from analytical smooth beams to realistic beams from simulations - Peter hopes to have the computed beams soon

• Check whether the stripes observed by SDSS at the highest declinations (80 deg) could be a target area (Albert)

2 LOW REDSHIFT SURVEYS

• Low redshift surveys : a path to prove effectiveness of the Intensity mapping technic and transit-mode observations, to reach high sensitivities (instrument stability and calibration challenges)

• Explore also some aspects of component separation (foreground subtraction)

• Advantage of dish arrays : targeted observations, NCP to reach vers high sensitivity,

• Siscuss the way instrument noise (radiometer equation) project on sky - when observations are discussed as cosmolgical power spectrum $P(k)$: variations with reshift - Discuss also the accessible k-range (wave-number) - depending on the survey area and instrument configuration ($k_\perp k_\parallel$).

• Present the the three cosmological signals we might aim for : direct detection of HI clumps at very low redshifts ($z < 0.05$), cross-corerlation with optical surveys and possible LSS detection in auto-correlation at $z \sim 4 - 5$.

3 NOISE LEVELS: FROM VISIBILITIES TO MAPS

• per pixel noise level (visibility space and map space)

• Impact of imperfect calibration - (phase and amplitude calibration errors)

• illustrate for the NCP case, as well as lower latitude case

4 HI CLUMP DETECTION

mass distribution and effective detection thresholds (based on simulation including foregrounds and radio-sources , followed by map-making , or in visibility space)

5 LSS IN CROSS CORRELATION WITH OPTICAL SURVEYS

• discuss the possible scenarions : NCP, mid latitude , cross correlation with SDSS ,

• show optical catalog redshift distribution.

• effect of incomplete spectroscopic catalogs

• effect of redshift errors

6 DIRECT LSS DETECTION $Z \sim 0.5$

7 DISCUSSION

Discussion / Optimal strategy : NCP area coverage and redshift ranges, mi- latitude coverage and redshift ranges

This paper has been typeset from a TEX/LATEX file prepared by the author.