AUSTRALIA TELESCOPE OBSERVING APPLICATION

PKS

yr,term: 2001SEPT

PARKES TELESCOPE

SEND TO: Director, ATNF, P.O. Box 76, Epping, NSW 2121, Australia

For ATNF information see : http://www.atnf.csiro.au

ATNF use
ident:
rcvd:

1. Title of proposal:
Northern extension of HIPASS

2. Authors Principal investigator on line 1	**Institution/Country** (if not Australia)	**for Ph.D. thesis ?**	**Present at Parkes ?**
K.C. Freeman	RSAA, ANU		
	– on behalf of the northern HIPASS group		
	(see scientific case)		

3. Contact author and mailing address: K. Freeman
RSAA

phone: 02 6125 0264 FAX: 02 6125 0260 e-mail: kcf@mso.anu.edu.au

4. Continuation of previous proposal? Y **Previous proposal no:** P248
Related ATNF proposal numbers (if any):

5. Scientific categories: ☐ Solar System ☐ Stellar ☐ Galactic ☐ Mag. Clouds ☒ Extragalactic

6. Type of observation: ☐ Continuum ☒ Spectral line ☐ Point source ☒ Mapping
☐ Monitoring ☐ Pulsar ☐ High time resol. ☐ Survey
☐ Lin pol ☐ Cir pol ☐ Solar ☒ Multibeam

7. Receiver(s): Multibeam

8. Sidereal time range (please state): 6 ± 2 hr

9. Total requested time (days): 12×6 hrs (night) Minimum useful time (days): 12×6 hrs

Estimated telescope time needed (incl. above) to complete project (days): 12×6 hrs
Time allocated so far (days): 30

10. Any publications to date from this proposal? N **(If YES, please list separately)**

11. Short summary of proposal (~150 words, minimum font size 8 point):

We wish to complete the northern extension of HIPASS. With complementary data from the Lovell telescope, complete sky coverage will greatly improve our view of local large-scale structure and our measurement of cosmological parameters. The Northern survey is 96% complete and we are requesting 72 hours in this term to clean up the remaining regions.

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12. Please indicate the amount of additional help required:

- [x] None
- [ ] Consultation
- [ ] Friend (Epping: initial assistance with data reduction)
- [ ] Observing assistance
- [ ] Staff Collaborator

13. Spectroscopy only:	Line 1	Line 2	Line 3
transitions to be observed	21cm HI		
velocity range (km s^{-1})	−1290 to 12700		
number of channels per spectrum	1024		
approx observing frequency	1394.5 MHz		
number of simultaneous spectra	26		
total bandwidth [MHz]	64 MHz		
receiver tuning range	1362.5 - 1426.5		

14. Back End System: Multibeam correlator

15. Feed(s):

16. Focal plane/vertex arrangements: Focal plane rotation required

17. Computer programs: multi, mbcor, LiveData, aips++

18. Consumables (eg mag tape): Up to 18 CD-ROMS/day

19. Number of sources: 1 [If more than 6 sources, please attach list. If more than 30 give only selection criteria and LST range(s)]

20. Name [order of priority]	**Coordinates (J2000) RA (h,m)**	**DEC ($\pm°,'$)**	**Band (cm)**	**Intensity (cont) total (Jy)**	**peak (mJy)**	**rms noise required (mJy)**	**Cal. size (Jy)**	**Possible LST range h ⇒ h**	**Time requested (hr)**
Northern Sky	4-8 hr	10 to 25						4-8	

21. Special hardware, software or operating requirements:

22. Non-standard equipment supplied by user: *(by arrangement, OIC, Parkes Observatory)*

23. Preferred range of dates for scheduling: 12×6 hrs in Dec

24. Unsuitable dates:

25. Please attach a description and scientific justification of proposal, in not more than 1500 words

pks_applic.tex

Northern Extension of HIPASS

(Ragbir Barthal (UWS), Claude Carignan (U.Montreal), Mike Disney (U.Cardiff), Michael Drinkwater (U.Melb), Ken Freeman (RSAA, PI) Brad Gibson (U.Swinburne), Erwin de Blok (ATNF) Raymond Haynes (ATNF), Trish Henning (UNM), Helmut Jerjen (RSAA), Virginia Kilborn (U.Melb), Pat Knezek (JHU), Baerbel Koribalski (ATNF), Robert Minchin (U.Cardiff), Jess O'Brien (RSAA), Tom Oosterloo (NFRA), Mary Putman (RSAA), Stuart Ryder (AAO), Elaine Sadler (U.Syd), Lister Staveley-Smith (ATNF), Ian Stewart (U.Leicester) Frank Stootman (UWS), Meryl Waugh (U.Melb), Rachel Webster (U.Melb), Alan Wright (ATNF))

1 Scientific Justification

The HIPASS and ZOA blind HI surveys have had great success in conducting an accurate atomic hydrogen census of the local Universe, and have defined the current neutral density and HI mass function better than previously possible. An extension into the northern hemisphere is now desireable. In particular, the Lovell telescope possesses a 21-cm multibeam receiver with a significant amount of dedicated telescope time, so a complete all-sky HI survey is now attainable. The reasons for extending the Parkes surveys into the northern hemisphere are compelling:

- An all-sky HI survey will double the number of galaxies available and therefore better determine the HI mass function (e.g. Zwaan et al. 1997, Kilborn et al. 1999). By examining regions of different galaxy density, it will also better define any change of the mass function with environment. More importantly, an all-sky survey is more immune from 'cosmic variance' caused by large-scale clustering, and will therefore better define the HI mass function normalisation.
- Some authors (e.g. Faber & Burstein 1988) explain the discrepancy between the position of maximum CMB temperature, in the Local Group frame, and the putative 'Great Attractor' position as being due to a 'Local Velocity Anomaly' arising from gravitational repulsion from a local void. An all-sky galaxy sample can better examine this issue. A blind HI sample has the great advantage of being unaffected by Galactic extinction. Analyses based on optical surveys (e.g. Shaya, Tully & Pierce 1992) are complete for only half the sky ($|b| > 30°$). As a warning, Shaya et al. point out that, even with a conservative obscuration correction, the low-latitude IC 342/Maffei group has the greatest gravitational influence in their model.
- The Local Supercluster (centred on the Virgo Cluster at declination 12°) lies mainly in the northern hemisphere. Any attempt to characterize the local Universe ($v < 3000$ km s^{-1}) without including this structure, will of course be unrealistic. The connection between the Virgo S cloud and the southern extension of the Local supercluster is especially interesting.
- The Magellanic Stream, which the HIPASS survey has been successful in characterising (Putman et al. 1998), extends well into the northern hemisphere. As Figure 1 shows, the Stream is well-defined up to the limit of the HIPASS survey. Extension into the north is very desirable as this part of the Stream probably lies closest to the Galaxy and is the most susceptible to interaction with the Galaxy's gaseous halo. To what extent, for example, is the Stream responsible for the HVC population of the Galaxy?

2 The Northern Survey

For declinations > 25°, the Lovell telescope now has an operational 4-beam receiver. This system appears to have only half the speed of the Parkes system. However, only 28% of the sky lies above declination 25°, so this can potentially be done by the Lovell telescope on a timescale similar to the Parkes surveys. Observations are proceeding at a rate of a few months each year on the Lovell telescope.

The northern extension to HIPASS is currently about 96% complete. At this stage, most of the remaining scans lie in our northernmost zone, between declinations 18° and 25°. These scans must be

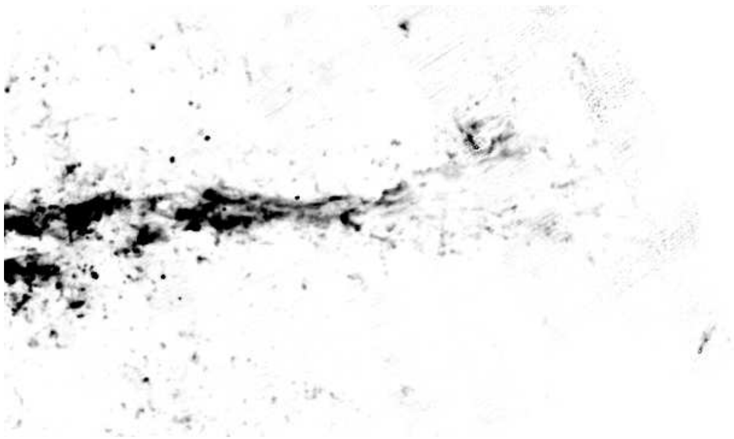

Figure 1: A HIPASS image of the Magellanic Stream as it enters the Northern hemisphere (Putman et al. 2000, in preparation).

made within about ± 40 minutes of time from the meridian. Daytime observations of these northern fields are therefore not very successful, because the sun is close to the fields.

Most of the remaining scans are near 6 hours RA. We would like to clean up the region and need about 72 hours to accomplish this. So we are requesting 72 hours of multibeam time, scheduled at night (blocks of 12×6 hrs), in the LST range 6 ± 2 hrs. The most suitable observing month is December.

3 Data Availability

As with southern HIPASS, we propose that calibrated data cubes be made available soon after completion of the survey. For southern HIPASS, this was done within two months.

Faber, S.M. & Burstein, D. 1988, in Proc. Vatican Study Week: Large Scale Motions in the Universe, eds Rubin, V.C. & Coyne, G.V. (Princeton University Press) p.116

Kilborn, V. Webster, R.L., & Staveley-Smith, L. 1999, PASA, 16, 8

Putman, M.E., Gibson, B.K., Staveley-Smith, L., Banks, G., Barnes, D.G., Bhatal, R., Disney, M.J., Ekers, R. D., Freeman, K. C., Haynes, R. F., Henning, P., Jerjen, H., Kilborn, V., Koribalski, B., Knezek, P., Malin, D. F., Mould, J. R., Oosterloo, T., Price, R. M., Ryder, S. D., Sadler, E. M., Stewart, I., Stootman, F., Vaile, R. A., Webster, R. L., Wright, A. E. 1998, Nature, 394, 752

Shaya, E.J., Tully, R.B. & Pierce, M.J. 1992, ApJ, 391, 16

Zwaan, M.A., Briggs, F.H., Sprayberry, D., & Sorar, E. 1997, ApJ, 490, 173