

Pulsar Searches at Effelsberg

B. Klein¹, M. Kramer², P. Müller¹, R. Wielebinski¹

¹*Max-Planck-Institut für Radioastronomie, Bonn, Germany*

²*University of Manchester, Jodrell Bank Observatory, UK*

Abstract. We report on the progress of our search for highly dispersed pulsars near the Galactic Center at 5 GHz using the 100-m radio telescope in Effelsberg. We also present key aspects of our new survey for millisecond pulsars at 21 cm in parts of the northern sky. This survey will greatly benefit from the L-band multibeam receiver and a new FFT-based backend which are currently under construction at the MPIfR.

1. The 5 GHz Search for Pulsars in the Galactic Center

The detection of radio pulsars in the vicinity of the Galactic Center (GC) is apparently hampered by the largely increased scattering of pulsar signals caused by electron density irregularities in the interstellar medium. This effect cannot be removed by instrumental means but can be greatly reduced by observations at higher frequencies ($\propto \nu^{-4.4}$). For our GC survey we have used $\nu = 5$ GHz as a compromise between the steep spectra of pulsars ($S \propto \nu^\alpha$, $\alpha \sim -1.66$) and the increased scattering of pulsar signals towards the GC (Kramer et al. 2000).

We have observed the inner pointings of a 0.6 deg^2 field (~ 30 pc around the GC) centered on the GC with 1 hour integration per pointing, reaching a minimum detectable flux density of 0.03 mJy at 5 GHz for normal period pulsars with $DM < 3000 \text{ cm}^{-3} \text{ pc}$. The outer pointings in this field, with an integration time of 36 min, reach a flux density limit of 0.04 mJy (Fig. 1 left). These sensitivities correspond to luminosities of $L_{1400} \geq 14.5 \text{ mJy kpc}^2$ (inner pointings) and $L_{1400} \geq 21.5 \text{ mJy kpc}^2$ (outer pointings) at 21 cm. They compare to a median luminosity currently observed for all known pulsars of $\sim 25 \text{ mJy kpc}^2$ at 1.4 GHz.

While no pulsar has been found up to now, this high-frequency survey of the GC confirms that either there is a deficit of pulsars in the Galactic Center (Johnston et al. 1995), or the scattering influence in the inner ~ 60 pc is larger than predicted by the new NE2001 electron density model (Cordes & Lazio 2002). This result is supported by the flatter spectrum ($\propto \nu^{-3.4}$) observed for high-DM pulsars towards the GC, causing larger scattering than usually predicted (Löhmer et al. 2001).

2. A Millisecond Pulsar Search in the Northern Sky

After a successful pilot search covering a small field that led to the discovery of four pulsars (Lorimer et al. 2000), we present the key aspects of our new

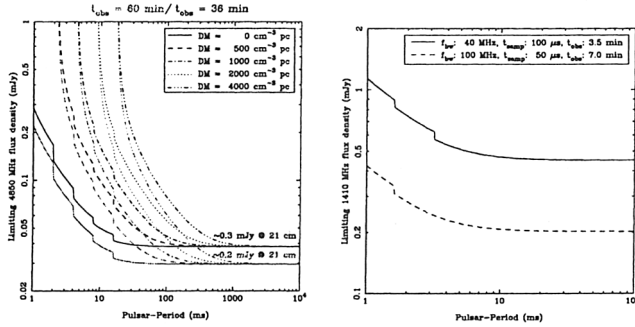


Figure 1. *Left panel:* Sensitivity of the 5 GHz GC survey plotted for different DM values. *Right panel:* Sensitivity curves for the on-going millisecond pulsar search and for the future survey (dashed line).

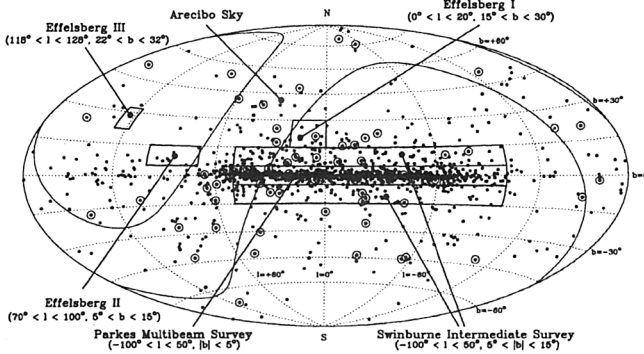


Figure 2. Sky distribution of ~ 1400 pulsars. Pulsars known to be members of binary systems are circled. Besides some successful Parkes survey regions, the three Effelsberg search fields are shown.

survey for millisecond pulsars at 21 cm in parts of the Northern sky in Figure 1 (sensitivity) and Figure 2 (search fields).

References

Cordes, J. M., & Lazio, J. W. 2002, astro-ph/0207156
 Johnston, S., Walker, M. A., van Kerkwijk, M. H., Lyne, A. G., & D’Amico, N. 1995, MNRAS, 274, L43
 Kramer, M., Klein, B., Lorimer, D., Müller, P., Jessner, A., & Wielebinski, R. 2000, in ASP Conf. Ser., Vol. 202, Pulsar Astronomy — 2000 and Beyond, eds. M. Kramer, N. Wex, & R. Wielebinski, (San Francisco: ASP), p. 37
 Löhmer, O., Kramer, M., Mitra, D., Lorimer, D. R., & Lyne, A. G. 2001, ApJ, 562, L157
 Lorimer, D. R., Kramer, M., Müller, P., Wex, N., Jessner, A., Lange, C., & Wielebinski, R. 2000, A&A, 358, 169