We carried out observations of nearby galaxies with the GBT and Arecibo radio telescopes at 820 and 327 MHz, respectively, to search for extragalactic pulsars. Currently, the Magellanic Clouds are the only galaxies except for Milky Way known to harbor radio pulsars, with a total of 20 pulsars being discovered there to date. Discovery of pulsars in other galaxies can be used to trace the history of massive star formation and would allow to probe the intermediate intergalactic medium. We selected 22 galaxies of the Local Group at high galactic latitudes, \(|b| > 26\) deg, with most of them being dwarf spheroidal with old star population. This makes them promising targets to search for giant pulsars from recycled millisecond pulsars. Both single-pulse and periodicity searches were performed for trial dispersion measures up to about 1000. No extragalactic pulsars are found in one third of the selected targets processed so far.

Extragalactic pulsars — why?

- Are guides of pulsar population in host galaxies
- Are probes of ISM in host galaxies as well as intergalactic medium

To date only 20 pulsars are extragalactic: 16 in LMC, 4 in SMC

B0540-69, with Giant Pulses (Eldon & Romani, 2004)

Detectability

From McLaughlin & Cordes (2003) for Crab-like pulsars:

\[
\Delta t = 81.92 \mu s
\]

For MSPs, such as B1937+21:

\[
\Delta t = 128 \mu s
\]

Selection criteria

- Nearby galaxies within 1 Mpc
- High galactic latitudes \(|b| > 26\) deg
- Visible at either Arecibo or GBT

Most of the selected galaxies (see the Table) are dwarf spheroidal galaxies that have very old star populations (several Gyr, Bellazzini et al., 2002) with a small population of younger stars (< 1 Gyr, Leo I, Lee et al., 1993), having many more RR Lyrae (Walker, 2003; Siegel & Majewski, 2000). This implies a presence of globular clusters that makes targeted dwarf galaxies very promising to search for giant pulses from old recycled millisecond pulsars.

Observations

- GBT, Spigot
- 820 MHz
- BW=50 MHz
- 1024/2048 channels
- 8 bit
- \(\Delta t = 81.92 \mu s\)

- Arecibo, 4 WAPPs
- 327 MHz
- BW=50 MHz
- 1024 lags
- 16-bit
- \(\Delta t = 128 \mu s\)

Pipeline

- Standard PRESTO pipeline
- Using zero-DM technique (Eatough et al. 2009)
- DM range, from 0 to about 1000 pc cm\(^{-3}\)
- Number of DM trials per observation is 3528 for 1024-chan data, and 4704 for 2048-chan data
- DM gridding of 0.2 pc cm\(^{-3}\) for DM range 0-408 pc cm\(^{-3}\) for 1024-chan data, and for DM range 0-816 pc cm\(^{-3}\) for 2048-chan data
- Both periodicity and single-pulse searches

Interesting candidates

- The DM of the candidate is much larger than DM of 42 pc cm\(^{-3}\) from NE2001 model (Cordes & Lazio 2002) for the line-of-sight to Sex dw — the strongest argument against it.
- Significance of the profile of 2.1σ is also very low.

Though interesting, this single-pulse candidate occurs at DM of about 175 pc cm\(^{-3}\), also much higher than DM derived from NE2001 model. No dispersion sweep is seen in waterfall plot. Most likely to be RFI.