Pulsars at Low Frequencies

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Pulsars are highly-magnetized neutron stars that emit radio waves from their magnetic poles and have spin periods ranging from just over 1 millisecond to a few tens of seconds. Despite pulsar signals typically being significantly stronger at lower frequencies and their initial discovery occurring at 81.5 MHz, for many decades a majority of pulsar observations was performed at frequencies above ~400 MHz. The preference for higher frequency was largely to avoid the effects of the bright synchrotron radiation from our own galaxy as well as to mitigate the effects of the interstellar medium, both of which are significantly stronger at lower frequencies.

In recent years, there has been a resurgence in the study of pulsars at low frequency due to the construction of new aperture array telescopes such as the Low Frequency Array (LOFAR), the Long Wavelength Array (LWA), and the Murchison Widefield Array (MWA) as well as the improvement of instrumentation on existing telescopes such as the Giant Metrewave Radio Telescope (GMRT), the Ukrainian T-Shaped Radio telescope (UTR-2), and the Green Bank Telescope (GBT). In recent years, low frequency instruments have been effective in finding new radio pulsars through surveys of large portions of the sky. Such pulsar surveys are important for discovering stable, very fast spinning pulsars called millisecond pulsars that are used in an ongoing search for the effects of gravitational waves on the pulsar signal. Additionally, recent low frequency pulsar observations have been used to study the emission properties of pulsars and study the effects of the interstellar medium caused by free electrons and magnetic fields.