Searches for and Follow-up Studies of Southern Radio Pulsars

by

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Abstract

The Parkes Multibeam Pulsar Survey (PM Survey) is a new high-frequency survey for radio pulsars in the southern Galactic plane. With about 80% of the survey completed, 569 new pulsars have been discovered, of which 187 have complete timing solutions. A number of interesting pulsars have been discovered, including PSR J1119−6127, a young radio pulsar with a very large magnetic field.

We report the results of a companion survey for radio pulsars in the Small Magellanic Cloud (SMC). Two new pulsars have been discovered in this survey, one of which is located within the SMC. The number of pulsars found is consistent with the expected number derived using several methods. The age distribution of luminous Magellanic Cloud pulsars supports the conjecture that pulsars younger than about 5 Myr are preferentially more luminous than older pulsars.

Thirty-nine pulsars discovered in the PM Survey were timed. We have estimated physical parameters for these pulsars, and these parameters will be used in a larger population synthesis modeling effort when the PM Survey is completed. The timing results reveal interesting properties for several pulsars in the sample. Using pulsar-gated radio imaging, we have established accurate positions for several young pulsars from the PM Survey, which in some cases were required to obtain timing solutions.

We have discovered a previously unknown shell radio supernova remnant (SNR), G292.2−0.5, coincident with the young pulsar PSR J1119−6127. The shell morphology, size, and spectral index are all consistent with other young shell SNRs and indicate that G292.2−0.5 is associated with PSR J1119−6127. We have set upper limits on the surface brightness of a pulsar wind nebula (PWN) powered by PSR J1119−6127. These limits are consistent with a model prediction of the surface brightness of a PWN around a young high-magnetic-field pulsar. These results suggest a possible explanation for the lack of central activity in many young shell SNRs.

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