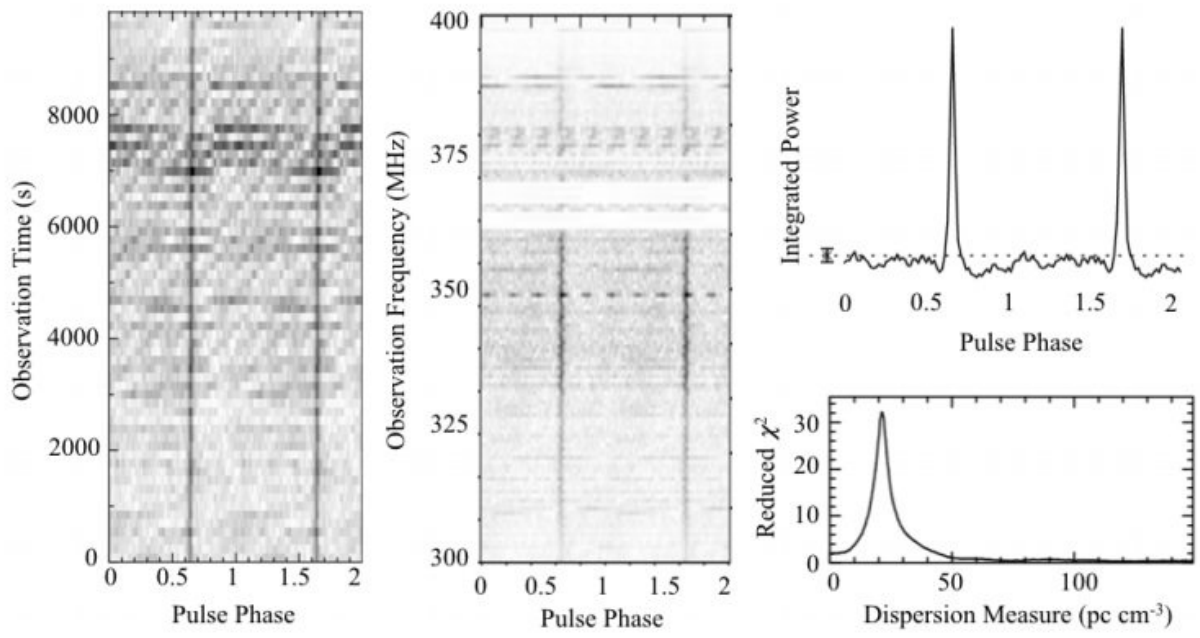
New pulsar discovered during a search for a companion to a low-mass white dwarf

June 26 2018, by Tomasz Nowakowski



Characteristics of PSR J0802–0955. Credit: Andrews et al., 2018.

An international team of astronomers has serendipitously detected a new pulsar during a search for neutron star companions to low-mass white dwarfs conducted with the use of the Robert C. Byrd Green Bank Telescope (GBT) in Green Bank, West Virginia. The discovery is reported in a paper published June 15 on arXiv.org.

Pulsars are highly magnetized rotating neutron star or white dwarf that emits a beam of electromagnetic radiation. This radiation has a regular periodicity, usually detected in the form of short bursts of radio emission. In general, pulsars are found by using large radio telescopes. So far, thousand of these objects has been detected.

Recently, a group of researchers led by Jeff J. Andrews of the Foundation for Research and Technology-Hellas in Greece, has employed GBT for radio observations focused on finding neutron stars accompanying low-mass white dwarfs. The observational campaign, which studied stars in the Extremely Low Mass White Dwarf (ELM WD) survey, resulted in the detection of a previously unidentified pulsar with a relatively long pulse period. The newly found object received designation PSR J0802–0955.

"We report the discovery of a previously unidentified pulsar as part of a radio campaign to identify neutron star companions to low-mass white dwarfs (LMWDs) using the Robert C. Byrd Green Bank Telescope (GBT). (…) To search for pulsar companions to LMWDs identified in the Extremely Low Mass WD survey, we engaged in a radio wave follow-up campaign using the GBT," the paper reads.

According to the study, PSR J0802–0955 has a spin period of about 571 milliseconds and a dispersion measure of approximately 69.4 light years/cm^3. The pulsar was found coincident with the position of a white dwarf star with a mass of 0.2 solar masses, known as SDSS J080250.13–095549.8.

However, the researchers concluded that the newly detected object is an isolated pulsar. They noted that relatively long pulse period of PSR J0802–0955, the lack of radial velocity variations in the radio data, and GBT's large beam size at the observing frequency of 340 MHz, indicate that this pulsar is unassociated with SDSS J080250.13–095549.8 at

roughly the same position and distance.

"PSR J0802−0955 shows a stable pulse period with no Doppler variations down to a precision of about 10−6 seconds for individual 35-minute subdivisions. Based on the optical radial velocity curve from the LMWD, a putative 1.4 solar mass neutron star companion would show modulations to the spin period of about 10−4 seconds over the length of our observation. We therefore conclude that PSR J0802−0955 is most likely an isolated, field pulsar," the scientists wrote in the paper.

Hence, PSR J0802−0955 is another identified object of the ELM WD survey, which seeks low-mass white dwarfs in binary systems. LMWDs are typically found in binary systems as the universe is not old enough to form them through single-star evolution. Studies show that while most LMWD companions are white dwarfs, some may be neutron stars.

More information: A Serendipitous Pulsar Discovery in a Search for a Companion to a Low-Mass White Dwarf, arXiv:1806.05889 [astro-ph.SR] arxiv.org/abs/1806.05889

Abstract
We report the discovery of a previously unidentified pulsar as part of a radio campaign to identify neutron star companions to low-mass white dwarfs (LMWDs) using the Robert C. Byrd Green Bank Telescope (GBT). PSR J0802-0955, which is coincident with the position of a WD with a mass of 0.2 solar masses, has a pulse period of 571 ms. Because of its relatively long pulse period, the lack of radial velocity (RV) variations in the radio data, and GBT's large beam size at the observing frequency of 340 MHz, we conclude that PSR J0802-0955 is unassociated with the LMWD at roughly the same position and distance.