Contribution ID: **13** Type: **Contributed Talk**

# The Galactic population of canonical pulsars

*Tuesday 11 October 2022 09:30 (15 minutes)*

Current wisdom accounts the diversity of neutron star observational manifestations to their birth scenarios influencing their thermal and magnetic field evolution. Among the kind of observed neutron stars, radio pulsars represent by far the largest population of neutron stars.

In our work we aim at constraining the observed population of canonical neutron star period, magnetic field and spatial distribution at birth in order to understand the radio and high-energy emission processes in a pulsar magnetosphere. For this purpose we design a population synthesis method self-consistently taking into account the secular evolution of a force-free magnetosphere and the magnetic field decay.

We generate a population of pulsars and evolve them from their birth to the present time, working in the force-free approximation. We assume a given initial distribution for the spin period, surface magnetic field and spatial galactic location. Radio emission properties are accounted by the polar cap geometry whereas the gamma-ray emission is assumed to be produced within the striped wind model.

We found that a decaying magnetic field gave better agreement with observations compared to a constant magnetic field model. Starting from an initial mean magnetic field strength of $B = 2.5 \times 10^{8}$~T with a characteristic decay timescale of $4.6 \times 10^5$ yr, a neutron star birth rate of $1/70$ yr and a mean initial spin period of 60 $ms$, we found that the force-free model satisfactorily reproduces the distribution of pulsars in the $P - \dot{P}$ diagram with simulated populations of radio-loud, radio-only and radio quiet gamma-ray pulsars similar to the observed populations.

More details about this work can be found here http://arxiv.org/abs/2206.13837

## Track

Pulsars

**Primary authors:** MITRA, DIPANJAN (INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI); PÉTRI, Jérôme (Université de Strasbourg); DIRSON, Ludmilla

**Presenter:** DIRSON, Ludmilla

**Session Classification:** Plenary 3