

Pulsars as cosmic-ray sources

Pulsars have been proposed as candidate sources of high-energy cosmic rays, due to their large magnetic fields and rotational energy, and gamma-ray observations demonstrating their ability to accelerate electrons and positrons. However, a precise description of the acceleration processes at play is still to be established.

Numerical experiments, such as particle-in-cell (PIC) simulations of pulsars magnetospheres and winds, can provide us with a deeper understanding of physical processes influencing cosmic-ray injection, propagation and acceleration in the vicinity of these objects.

I will describe our series of PIC simulations of aligned pulsar magnetospheres, that aim to assess from first principles the mechanisms for the injection of cosmic rays from the neutron star surface, and their acceleration in the magnetosphere and the wind, and eventually to strengthen multi-wavelength and multi-messenger predictions for both individual pulsars and populations of pulsars.

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