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Fast Moving Pulsars in the ISM: 3D RMHD modelling of Bow-Shock Pulsar Wind Nebulae

Pulsars out of their parent SNR directly interact with the ISM producing so called Bow-Shock Pulsar Wind Nebulae. These have been directly observed from Radio to X-ray, and are found also associated to TeV halos, with a large variety of morphologies. They offer a unique environment where the pulsar wind can be studied by modelling its interaction with the surrounding ambient medium, in a fashion that is different/complementary from the canonical Plerions. These system have also been suggested as the possible origin of the positron excess detected by AMS and PAMELA, in contrast to dark matter. I will present results from the first 3D Relativistic MHD simulations of such nebulae, with a particular focus on the expected emission signatures, the properties of high energy particle escape, the level of turbulence and magnetic amplification, the contamination by ISM neutrals and how they depend on the wind structure and magnetization.

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