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The many lives of magnetized neutron stars

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The magnetic field strength at birth is arguably one of the most important properties to determine the evolutionary path of a neutron star. Objects with very high fields, collectively known as magnetars, are characterized by high X-ray quiescent luminosities, outbursts, and, for some of them, sporadic giant flares. While the magnetic field strength is believed to drive their collective behaviour, however, the diversity of their properties, and, especially, the observation of magnetar-like bursts from 'low-field' pulsars, has been a theoretical puzzle. In this talk, I will discuss results of long-term MHD simulations which, by following the evolution of magnetic stresses within the neutron star crust, have allowed to relate the observed magnetar phenomenology to the physical properties of the neutron stars, and in particular to their age and magnetic field strength and topology. The dichotomy of 'high-B' field pulsars versus magnetars is naturally explained, and occasional outbursts from old, low B-field neutron stars are predicted. I will conclude speculating on the fate of old magnetars.

Primary author: PERNA, Rosalba (Department of Astrophysical and Planetary Sciences and JILA, University of Colorado, USA)

Co-author: PONS, Jose (University of Alicante, Spain)

Presenter: PERNA, Rosalba (Department of Astrophysical and Planetary Sciences and JILA, University of Colorado, USA)

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