CCOs and the slow magnetar in RCW 103

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Central Compact Objects (CCOs) are a handful of sources located close to the geometrical center of young supernova remnants. They show thermal-like, soft X-ray emission and have no counterparts at any other wavelength. Based on the measured values of P and $\dot{P}$ for three members of the family, CCOs are supposed to be young, isolated neutron stars (INS) endowed with a low dipolar magnetic field ($10^{10} - 10^{11}$ G), hence also dubbed "anti-magnetars". However, the properties of CCOs (also including, in some cases, very high surface thermal anisotropies) and their relationship with other classes of INS, possibly ruled by supernova fall-back accretion, are far from being well understood.

Here we focus on the case of 1E 161348-5055 (1E) in RCW103. It was the first proposed radio-quiet INS candidate in a supernova remnant, and thus a prototype for the CCO class. However, peculiar temporal properties, including a 6.67 hour periodicity, as well as a dramatic long-term variability, set the case for a unique source, whose nature has been debated for a decade. Very recently, on 2016, June, 1E underwent a new outburst, emitting for the first time a millisecond burst of hard X-rays, coupled to a factor 100 brightening in the persistent soft X-ray emission. A non-thermal emission component extending up to 30 keV was also detected. This strongly suggests that 1E is an isolated magnetar, with the slowest spin period ever observed, by orders of magnitude.

The most viable slow-down scenario for 1E points to a picture involving fall-back accretion after the supernova explosion, similarly to what is invoked (although in a different regime) to explain the properties of the other CCOs. It is apparent that a very complex scenario (with many unconstrained parameters!) is required to understand the wide, puzzling diversity in the manifestations of INSs.

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