Astronomy and Astrophysics 2010 vol.515 N1

Is there a highly magnetized neutron star in GX 301-2?

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Abstract

We present the results of an in-depth study of the long-period X-ray pulsar GX 301-2. Using archival data of INTEGRAL, RXTE ASM, and CGRO BATSE, we study the spectral and timing properties of the source. Comparison of our timing results with previously published work reveals a secular decay of the orbital period at a rate of ≃-3.25 × 10-5 d yr-1, which is an order of magnitude faster than for other known systems. We argue that this is probably result either of the apsidal motion or of gravitational coupling of the matter lost by the optical companion with the neutron star, although current observations do not allow us to distinguish between those possibilities. We also propose a model to explain the observed long pulse period. We find that a very strong magnetic field B ~ 1014 G can explain the observed pulse period in the framework of existing models for torques affecting the neutron star. We show that the apparent contradiction with the magnetic field strength BCRSF ~ 4 × 1012 G derived from the observed cyclotron line position may be resolved if the line formation region resides in a tall accretion column of height ~2.5-3 R NS. The color temperature measured from the spectrum suggests that such a column may indeed be present, and our estimates show that its height is sufficient to explain the observed cyclotron line position. © ESO, 2010.

http://dx.doi.org/10.1051/0004-6361/200912951

Keywords

Binaries: general, Pulsars: individual: GX 301-2, Stars: neutron