

Constraints on the number of X-ray pulsars in IC 10 from a deep XMM-Newton observation

We report the most sensitive search yet for X-ray pulsars in the dwarf starburst galaxy IC 10, which is known to contain a population of young high mass X-ray binaries. A total of 207 point-like X-ray sources were detected in the direction of IC 10 by a 2012 XMM-Newton observation with a total exposure time of 134.5 ks. We searched for pulsations in 207 sources. Pulsation searches in faint objects can be sensitive to the energy bands of the light curves and the background subtraction areas. Hence we analyzed separately the PN and Metal Oxide Semi-conductor (MOS) barycenter corrected 0.2-12 keV data, with good time interval (GTI) filtering, and fixed background subtraction. The searches were then repeated in the narrower 0.5-8 keV energy band to increase the signal-to-noise ratio with different background subtraction regions. Overall, 5 point sources produced significant peaks in the Lomb-Scargle periodogram (assuming white noise). A ~ 4100 s period seen in all 3 instruments for the black hole (BH) + Wolf-Rayet (WR) binary IC 10 X-1 is probably due to red noise of astrophysical origin. Considering the periods, luminosities, and spatial distribution of the pulsar candidates in the direction of IC 10, they do not belong to the same distribution as the ones in the Magellanic Clouds and Milky Way. This result holds even if the candidates are spurious, since if the Small Magellanic Cloud (SMC) were placed at the distance of IC 10, we would expect to see ~ 5 pulsars at $L_x > 10^{36}$ erg/s inside the D_{25} contour, and their periods would be of order 100 seconds, rather than the mostly ~ 1 s periods for the candidates reported here, which lie outside the main body of the galaxy.

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