



X-RAY ASTRONOMY 2019

Current Challenges and New Frontiers in the Next Decade

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X-Ray Census of Millisecond Pulsars in the Galactic Field

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We have conducted a systematic survey for the X-ray properties of millisecond pulsars (MSPs). Currently, there are 47 MSPs with confirmed X-ray detections. We have also placed the upper limits for the X-ray emission from the other 36 MSPs by using the archival data. We have normalized their X-ray luminosities L_x and their effective photon indices Γ into a homogeneous data set, which enables us to carry out a detailed statistical analysis. Based on our censored sample, we report a relation of $L_x \propto 10^{31.05} (\dot{E}/10^{35})^{1.31} \text{ ergs}^{-1}$ (2-10 keV) for the MSPs. The inferred X-ray conversion efficiency is found to be lower than the previously reported estimate that could be affected by selection bias. L_x also correlates/anti-correlates with the magnetic field strength at the light cylinder B_{LC} /characteristic age τ . On the other hand, there is no correlation between L_x and their surface magnetic field strength B_s . We have further divided the sample into four classes: (i) black-widows, (ii) redbacks, (iii) isolated MSPs, and (iv) other MSP binaries, and compare the properties among them. We noted that while the rotational parameters and the orbital periods of redbacks and black-widows are similar, L_x of redbacks are significantly higher than those of black-widows in the 2-10 keV band. Also the Γ of redbacks are apparently smaller than those of black-widows, which indicates that the X-ray emission of redbacks are harder than that of black-widows. This can be explained by the different contribution of intrabinary shocks in the X-ray emission of these two classes.

Topic

Compact and diffuse sources in galaxies and in the Galactic Center

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