

EVIDENCE OF SPIN AND ORBITAL ANGULAR MOMENTUM ALIGNMENT IN X-RAY BINARY PULSARS THROUGH PULSE PROFILE MODELING

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For the first time we show a preferential alignment between the spin and orbital angular momentum vectors in X-ray binary systems. Utilizing our X-ray pulsar model *Polestar*, we performed a blind fit on 20 separate pulse profiles from 20 different galactic X-ray binary pulsars. 12 out of the 20 fits showed the spin angular momentum vector of the neutron star is aligned with the orbital angular momentum vector of the X-ray binary system. The calculated probability of this occurring by chance is $\lesssim 0.003\%$. Various mechanisms may be responsible for this alignment, including angular momentum transfer through accreted material and preferential alignment at birth. This technique suggests a novel way of inferring the orbital inclination angle for the many systems that are resistant to more conventional techniques. Additionally it represents an entirely new avenue for constraining the mass function, a key ingredient in the recipe for determining the equation of state of ultra-dense matter.