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Multiwavelength pulsations and surface temperature distribution in the middle-aged pulsar B1055-52

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We explore the X-ray emission from PSR B1055-52 using observations from XMM-Newton taken in 2019 and 2000. Traditional models of neutron star atmospheres fail to adequately describe the phase-integrated X-ray emission of this pulsar. Instead, our findings suggest a dual blackbody model with differing temperatures and areas, supplemented by a nonthermal power-law component, fits best. Our analysis reveals significant phase-related variations in the thermal emission, indicating a nonuniform temperature distribution across the neutron star's surface, potentially due to combined internal and external heating. Additionally, we observe distinct high pulse fractions (60%–80%) in the 0.7–1.5 keV range and identify a potential second hot spot at lower energies, supporting the hypothesis of an orthogonal rotator geometry and an asymmetrically aligned magnetic field. In this talk, I will present these findings in detail and discuss their implications for our understanding of neutron star structure and magnetic field dynamics.

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