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NinjaSat Monitoring of High-Mass X-ray Binary SMC X-1

SMC X-1 is a high-mass X-ray binary exhibiting an X-ray pulsar with a ~0.7 s spin period and a non-stationary superorbital modulation ranging from ~40 to ~65 days. Its luminosity of 5E38 erg/s makes it a local analogue of ultraluminous X-ray pulsars, powered by supercritical accretion. To investigate whether SMC X-1's superorbital modulation originates from a change in the mass accretion rate or simply from a warped accretion disk, we carried out a series of monitoring observations with NinjaSat, a 6U CubeSat in low-Earth orbit. Combining NinjaSat and MAXI data, we found no significant spin-frequency drop during superorbital low states, indicating that the source does not enter a propeller regime. Although we observe a marginal correlation between the spin-frequency residual and flux, this could be caused by sampling a single superorbital cycle within a longer-term frequency modulation. We conclude that the superorbital modulation of SMC X-1 is predominantly geometric in nature, although further observations during shallower low states, such as during the "excursion" epochs, may offer additional insights into this system.

Section

High Energy

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