

Study on the accretion and radiation process in 1A 0535+26 during the 2020 giant outburst

Thursday, 16 June 2022 15:00 (15 minutes)

Through the brightest giant outburst ever of accreting X-ray pulsar 1A 0535+262 in November/December 2020 was observed by Insight-HXMT. We use a method to decompose the pulse profile into the sum of the contribution of the two magnetic poles, constrain the geometry of the pulsar, derive the radiation beam, and study the various characteristics of the radiation beam pattern during the outburst. The beam patterns obtained from the analysis can be interpreted as a combination of the accretion column with halo emission and scattering in the upper accretion stream. The calculation results show that from the beginning to the end of the outburst, the radiation beam patterns will gradually switch from the pencil-beam corresponding to low accretion rate to the fan-beam corresponding to high accretion rate, and back to the pencil-beam pattern at finally, it indicates that the accretion rate changes from low to high and back to low. There are distinct differences in the radiation beam pattern between the rising and fading phases although they have similar luminosity, we suggest that it may be caused by the changes in the position of the accretion disk concerning the pulsar during the outburst process, such as a tilt or shaking.

Topic

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Session Classification: Session III