

Spectra of the spreading layers on the neutron star surface and constraints on the neutron star equation of state

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Abstract

Spectra of the spreading layers on the neutron star surface are calculated on the basis of the Inogamov-Sunyaev model taking into account general relativity correction to the surface gravity and considering various chemical composition of the accreting matter. Local (at a given latitude) spectra are similar to the X-ray burst spectra and are described by a diluted blackbody. Total spreading layer spectra are integrated accounting for the light bending, gravitational red-shift and the relativistic Doppler effect and aberration. They depend slightly on the inclination angle and on the luminosity. These spectra also can be fitted by a diluted blackbody with the colour temperature depending mainly on a neutron star compactness. Owing to the fact that the flux from the spreading layer is close to the critical Eddington, we can put constraints on a neutron star radius without the need to know precisely the emitting region area or the distance to the source. The boundary layer spectra observed in the luminous low-mass X-ray binaries, and described by a blackbody of colour temperature $T_c = 2.4 \pm 0.1$ keV, restrict the neutron star radii to $R = 14.8 \pm 1.5$ km (for a $1.4\text{-}M_{\odot}$ star and solar composition of the accreting matter), which corresponds to the hard equation of state. © 2006 RAS.

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Keywords

Accretion, accretion discs, Radiative transfer, Stars: neutron, X-rays: binaries