Abstract

AN X-RAY VIEW OF COMPACT OBJECTS

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In this thesis we studied some of neutron star X-ray binaries. A neutron star is a compact object which emits X-rays as a result of accretion when it is in a binary system with a normal or degenerated star. The X-rays originating from these binaries are coming as pulses of X-rays. The study were mainly focused on the timing and spectral analysis. In the timing analysis the light curves, pulse profile etc., are studied whereas in spectral analysis we fit the spectra of X-ray pulsars using different models to understand the different physical processes occurring in the accretion disk, accretion column, magnetosphere and on the surface of neutron star. The cyclotron line present in a spectrum of pulsar is direct indication of presence of magnetic field of the neutron star and one can directly estimate the value of magnetic field from the cyclotron line energy. We have used the data from *RXTE, NuSTAR, Swift* and *NICER* observations. The sources considered for study are SMC X-1, Swift J1756.9-2508 and 4U 1901+03.

SMC X-1 is a High Mass X-ray binary (HMXB) system and has a pulse period of 0.7 s. The light curves of the source of total observational time ~ 225.5 ks have been analyzed. It is observed that there were presence of a large number of flares due to type II burst in the light curves of SMC X-1. A total of 272 flares were observed with the mean value of FWHM of a flare was ~ 21 s. The shape of the pulse profiles during different observations were same irrespective of the flares which suggest that the geometry of the accretion disk was unchanged during these observations. We also observed that there were no correlation of spectral parameters with flares.

The second source Swift J1756.9-2508 is an accreting mill-second X-ray pulsar having pulse period of ~ 5.5 ms. We have studied the source during its 2018 outburst. The dependence of pulse

profiles and pulse fraction on energy are studied. The pulse profile of the pulsar was observed to deviate from the sinusoidal shaped. The broad 0.3-79 keV spectrum of the pulsar was observed to be hard and flat with a cutoff energy of 74.58 keV. We have also carried out pulse - phase, orbital - phase and time - resolved spectral analysis. We have not observed emission lines or Compton hump in the spectrum of the milli-second X-ray pulsar.

The third source we have studied is a Be/X-ray pulsar 4U 1901+03. It is known that the pulsar went through an outburst in 2019. We have used *Swift, NuSTAR* and *NICER* observational data of the pulsar during the outburst for analysis. The pulse profile of the pulsar evolves throughout the outburst. We observed that the 10 keV absorption like feature shows dependence on luminosity and increases with luminosity. In addition to this another absorption like feature near 30 keV were observed in last two *NuSTAR* observations out of the four observations. Fitting this 30 keV feature by GABS model we estimated the line energy to be about 30.51 keV and 30.41 keV respectively for last two observations. We also note that both the 10 keV and 30 keV features shows variation with pulse phases.

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