Investigation of iron emission lines in the eclipsing high mass X-ray binary pulsar OAO 1657-415

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Abstract. We present the results obtained from timing and spectral studies of high mass X-ray binary pulsar OAO 1657-415 using a Suzaku observations in 2011 September. X-ray pulsations were detected in the light curves up to ~70 keV. The continuum spectra during the high- and low-flux regions in light curves were well described by high energy cutoff power-law model along with a blackbody component and iron fluorescent lines at 6.4 keV and 7.06 keV. Time resolved spectroscopy was carried out by dividing the entire observations into 18 narrow segments. Presence of additional dense matter at various orbital phases was confirmed as the cause of low-flux regions in the observations. Presence of additional matter at several orbital phases of the pulsar was interpreted as due to the inhomogeneously distributed clumps of matter around the neutron star. Using clumpy wind hypothesis, the physical parameters of the clumps causing the high- and low-flux episodes in the pulsar light curve were estimated. The equivalent width of iron emission lines was found to be significantly large at certain orbital phases of low-flux segments. We investigated the iron line emitting regions and suggest the existence of neutral and ionized iron atoms in emission sites that are located within the accretion radius.

Keywords: pulsars: general – stars: individual (OAO 1657-415) – stars: neutron

1. Introduction

Accretion powered high mass X-ray binary pulsar OAO 1657-415 was discovered by Copernicus satellite (Polidan et al. 1978). Initially, the object was incorrectly identified with the massive binary V861 Sco and the system interpreted as a black hole binary. However, the observations with