XMM-Newton RGS spectrum of RX J0720.4-3125: Absorption feature at 0.57 keV.**

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Results. We found a narrow absorption feature at 0.57 keV in the co-added RGS spectrum of the isolated neutron star RX J0720.4−3125 with an equivalent width of 1.35 ± 0.3 eV and FWHM ~ 6.0 eV. The feature was identified with an absorption line of highly ionized oxygen O VII, most probably originating in the ambient medium of RX J0720.4−3125. An extensive investigation with the photo-ionization code CLOUDY indicates the possibility that the optical flux excess observed in the spectrum of RX J0720.4−3125 at least partially originates in a relatively dense (e.g. $n_H \sim 10^8 cm^{-3}$) slab, located in the vicinity of the neutron star (e.g. $\sim 10^{10}$cm).

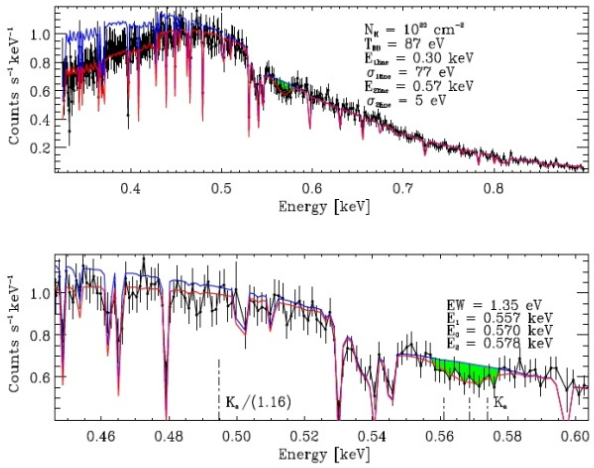


Fig. 1. *XMM-Newton* high-resolution co-added spectrum of the isolated neutron star RX J0720.4−3125. An absorbed blackbody (blue) and an absorbed blackbody with two additional Gaussian absorption lines (red, a wide absorption feature at 0.3 keV and a narrow feature at 0.57 keV) are shown. The equivalent width and the FWHM of the narrow absorption line (green), which we associate with OVII, were determined at 1.35 eV and ~6.0 eV, respectively. Different spectral line positions at gravitational redshift (g_r = 0) are indicated.

NS atm./ISM/Circumstellar?

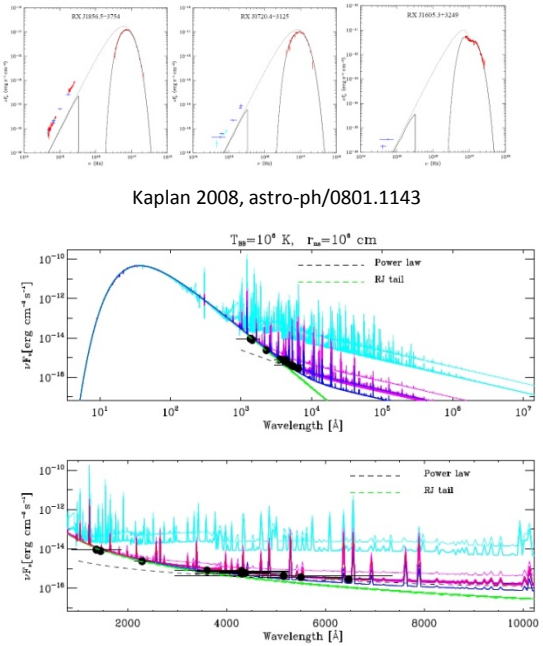
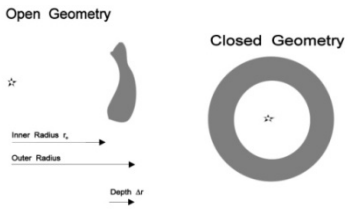


Fig. 4. Simulated spectra of a photo-ionized plasma associated with a NS (blackbody spectrum T=10^6 K and luminosity of 10^{33}erg s^{-1}) for different initial hydrogen volume densities, located at the distance of $r_{inner} = 10^{10}$cm. The filled dots indicate the observed optical/UV fluxes of RX J0720.4−3125 (Kulkarni & van Kerkwijk 1998; Kaplan et al. 2003; Motch et al. 2003; Eisenbeiss et al. 2009). Fore some parameter sets the simulated spectra can explain the power-law component with an "optical excess".



$n_H = 3.5 \times 10^8\ cm^{-3}$
$r_{in} = 10^{10}\ cm$ $r_{out} = 10^{15}\ cm$
$cf = 0.013$ $ff = 1.0$
$V_{turbulence} = 0.0\ km/s$

1. An absorption feature at 0.57 keV is clearly detected in the co-added *XMM-Newton* RGS spectrum of RX J0720.4−3125. The detected absorption feature likely is a blend.
2. Most probably, it originates mainly in the ambient medium of RX J0720.4−3125 and may be identified with highly ionized oxygen (O VII), consisting of Doppler shifted components. Neither an interstellar nor an atmospheric, partial origin can be excluded completely.
3. The observed optical/UV flux excess of RX J0720.4−3125 compared to the extrapolated X-ray blackbody radiation partially may be caused by emergent emission of a nearby, relatively dense photo-ionized cloud.

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