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Importance of Compton scattering for radiation spectra of isolated neutron stars with weak magnetic fields

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Abstract

Aims. Emergent model spectra of neutron-star atmospheres are widely used to fit the observed soft X-ray spectra of different types of isolated neutron stars. We investigate the effect of Compton scattering on the emergent spectra of hot (Teff ≥ 106 K) isolated neutron stars with weak magnetic fields. Methods. In order to compute model atmospheres in hydrostatic and radiative equilibrium we solve the radiation transfer equation with the Kompaneets operator. We calculate a set of models with effective temperatures in the range 1-5 × 106 K, with two values of surface gravity (log g = 13.9 and 14.3) and different chemical compositions. Results. Radiation spectra computed with Compton scattering are softer than those computed without Compton scattering at high energies (E > 5 keV) for light-element (H or He) model atmospheres. The Compton effect is more significant in H model atmospheres and models with low surface gravity. The emergent spectra of the hottest (Teff > 3 × 106 K) model atmospheres can be described by diluted blackbody spectra with hardness factors ~ 1.6-1.9. Compton scattering is less important in models with solar abundance of heavy elements. © ESO 2007.

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Keywords

Methods: numerical, Radiative transfer, Scattering, Stars: atmospheres, Stars: neutron, X-rays: stars