Model spectra of neutron star surface thermal emission

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ABSTRACT: Many neutron star spectra reveal a thermal origin in the soft X-ray band, such as those of some radio pulsars (particularly of the middle-aged gamma-ray pulsars), and of radio-quiet isolated neutron stars. The thermal emission is believed to come from the atmospheres of neutron stars and it carries valuable information of physical properties of the surface. We construct a neutron star atmosphere model with the surface magnetic field of 10^{11} to 10^{13} gauss and the effective temperature of several million Kelvin. The fully ionized hydrogen with ideal gas equation of state is used for the composition of atmosphere. The radiative transfer equation is solved for two polarization modes in the plane-parellel and the radiative equilibrium atmosphere with opacities due to thermal bremsstrahlung and Thomson scattering only. We compute the radiative transfer equation with full angle dependence of both photon polarization modes and compare that with the radiative transfer equation adopting the diffusion approximation assumption. The orientation of magnetic filed can be arbitrary in our model and we disscuss spectra, beaming patterns and temperature profiles for different field orientaions. Near the electron cyclotron frequency the absorption feature in spectra for both ploarization modes are apparent. The next step for our model is to include the opacities that have higher harmonics. We would like to explore the absorption features, which are observed in the spectrum of 1E 1207.4-5209 and some other sources.