

nsmax: Neutron Star Magnetic Atmosphere

This model interpolates from a grid of neutron star (NS) atmosphere spectra to produce a final spectrum that depends on the parameters listed below. The atmosphere spectra are obtained using the latest equation of state and opacity results for a partially ionized, strongly magnetized hydrogen or mid-Z element plasma. The models are constructed by solving the coupled radiative transfer equations for the two photon polarization modes in a magnetized medium, and the atmosphere is in radiative and hydrostatic equilibrium. The atmosphere models mainly depend on the surface effective temperature T_{eff} and magnetic field strength B and inclination Θ_B ; there is also a dependence on the surface gravity $g=(1+z_g)GM/R^2$, where $1+z_g=(1-2GM/R)^{-1/2}$ is the gravitational redshift and M and R are the NS mass and radius, respectively.

Two sets of models are given: one set with a single surface B and T_{eff} and a set which is constructed with B and T_{eff} varying across the surface according to the magnetic dipole model (for the latter, θ_m is the angle between the direction to the observer and the magnetic axis). The effective temperatures span the range $\log T_{\text{eff}}=5.5-6.8$ for hydrogen and $\log T_{\text{eff}}=5.8-6.9$ for mid-Z elements (note: for the latter, change temperature range in nsmax_lmodel.dat) The models with single (B, T_{eff}) cover the energy range 0.05-10 keV, while the models with (B, T_{eff}) -distributions cover the range 0.09-5 keV.

- par1 = logTeff, surface (unredshifted) effective temperature
- par2 = $1+z_g$, gravitational redshift
- par3 = switch indicating model to use (see nsmax.dat or [model list](#))
- A = $(R_{\text{em}}/d)^2$, normalization, where R_{em} is the size (in km) of the emission region and d is the distance (kpc) to the object Note: A is added automatically by XSPEC.

Please send your comments/questions to Wynn Ho (wynnho@slac.stanford.edu). If you publish results obtained using NSMAX, please reference [Ho, W.C.G., Potekhin, A.Y., & Chabrier, G. \(2008, ApJS, 178, 102\)](#) and also [Mori, K. & Ho, W.C.G. \(2007, MNRAS, 377, 905\)](#) if using the mid-Z models.