Software Package for Analysis of Thermal X-Ray Spectra of Supernova Remnants

Borkowski, K. J. (*NCSU*), Arnaud, K. A., Dorman, B. (*NASA/GSFC*), Hughes, J. P. (*Rutgers*), Sarazin, C. L. (*UVa*), Smith, R. K. (*SAO*)

Abstract

X-ray astronomy is advancing rapidly as data from the *Chandra* and *XMM-Newton* satellites become available. Among the brightest sources of X-ray emission are supernova remnants (SNRs). Their thermal X-ray emission cannot be analyzed with standard X-ray plasma codes, such as Raymond-Smith or MEKAL codes, because plasmas in SNRs are generally not in the equilibrium ionization. While there are various nonequlibrium ionization (NEI) codes available to researchers, each one of them has its own shortcomings, which results in a generally unsatisfactory situation.

We present new NEI models which address the problem just described. We integrated the most basic NEI models (such as constant temperature single ionization timescale models, plane-parallel shock models, and Sedov models with and without ion-electron equipartition) and the new Astrophysical Plasma Emission Code (APEC) within the XSPEC software package. The new code effectively replaces the NEI models currently in use in XSPEC. The resulting state-of-the-art NEI package should allow for better modeling of existing and future X-ray data on SNRs. We describe capabilities of the new package and improvements in the atomic database, and demonstrate how it may be used in practice on real *Chandra* datasets.

CATEGORY: SUPERNOVAE, SUPERNOVA REMNANTS AND ISOLATED NEUTRON STARS