Spectroscopy and Timing of the Middle-aged Pulsar B1055–52

M.A. Teter(*Montana State Univ.*), D. Sanwal, G.G. Pavlov (*Penn State*), V.E. Zavlin (*MPE, Garching*), S. Tsuruta (*Montana State Univ.*), R.N. Manchester (*ATNF*)

Abstract

The middle-aged radio, X-ray and gamma-ray pulsar B1055-52 (P = 197 ms, $\tau = P/2\dot{P} = 5\times10^5$ yr) was observed with *Chandra* using the ACIS Continuous Clocking (CC) mode. This observation, combined with the archival *ROSAT* data, allows us to decompose the spectrum into 3 components — a soft thermal component with $kT_s \simeq 72$ eV and $R_s \simeq 13$ km, a hard thermal component with $kT_h \simeq 144$ eV and $R_h \simeq 780$ m, and a power-law component with a photon index $\Gamma \simeq 1.53$ (the radii are given for a distance of 1 kpc). The soft and hard thermal components can be interpreted as radiation from the whole neutron star surface and the polar caps, respectively, and the power-law component as non-thermal emission from the pulsar magnetosphere. Extension of the magnetospheric component to lower and higher energies matches the γ-ray and optical spectra.

After correcting for instrumental effects, the absolute timing for the ACIS/CC mode is accurate to about 3 milliseconds. We find that the peak of the energy-resolved X-ray pulse profiles from 0.5 keV to 2 keV matches the phase of the main radio peak within the timing uncertainties. Below 0.4 keV, the phase of the X-ray peak gradually shifts so that for energy range 0.2 – 0.3 keV, it lags behind the radio peak by about 0.25 in phase, similar to that observed in the *ROSAT* data. Above 2.0 keV, the peak of the pulse profile leads the radio peak by about 0.1 in phase. There is some evidence for a second peak in the pulse profile for energies above 2.0 keV.

The energy-resolved light curves show variations in the shape and pulsed fraction with energy. The phase-resolved spectral analysis is presented as the phase dependence of various spectral parameters. We will discuss interpretations of the data in terms of neutron star models.

CATEGORY: SUPERNOVAE, SUPERNOVA REMNANTS AND ISOLATED NEUTRON STARS