

Simultaneous Observations of GRS 1758–258 in 1997 by VLA, RXTE and OSSE: Spectroscopy and Timing

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We report the results of our multi-wavelength observations of GRS 1758–258 made in August 1997. The observations enable us to obtain a complete spectrum of the source over an energy range of 2 – 500 keV. The spectrum shows that GRS 1758–258 was in its hard state. It is well fitted by the Sunyaev-Titarchuk (ST) Compton scattering model with a plasma temperature of 45 keV and a Thomson depth of 3.3. The spectrum is also fit by a power law with an exponential cutoff (PLE) with a photon index of 1.40 and a cutoff energy of 207 keV plus a soft black-body component with a temperature of 1.27 keV. No significant iron lines are detected. The daily radio, X-ray and gamma-ray light curves show that GRS 1758–258 was stable during the observation period, but was highly variable on smaller time scales in X- and gamma-rays. The power density spectra are typical for the low-state, but we find the photon flux for the 5 to 10 keV band to be more variable than that in the other two energy bands (2 – 5 keV and 10 – 40 keV). The integrated fractional rms amplitudes (IFRA) in the three energy bands are 0.349 ± 0.003 , 0.271 ± 0.004 , and 0.225 ± 0.005 respectively. Two harmonic QPOs with central frequencies of 0.21 ± 0.2 Hz and 0.42 ± 0.4 Hz are identified in the averaged power spectrum. A pair of harmonic QPOs at frequencies of 1.41 ± 0.04 Hz and 2.82 ± 0.08 Hz are found in one observation segment. The phase lags between the hard photons and the soft photons have a flat distribution over a wide range of frequencies. A high coherence of about 1.0 (0.01 – 1 Hz) between the hard photons and the soft photons is also obtained in our observations.