

Discovery and evolution of the new black hole candidate Swift J1539.2–6227 during its 2008 outburst

H. A. Krimm^{1,2}, J. A. Tomsick³, C. B. Markwardt⁴,
C. Brocksopp⁵, F. Grisé⁶, P. Kaaret⁶, P. Romano⁷

October 27, 2010

ABSTRACT

We report on the discovery by the *Swift* Gamma-Ray Burst Explorer of the black hole candidate Swift J1539.2–6227 and the subsequent course of an outburst beginning in November 2008 and lasting at least seven months. The source was discovered during normal observations with the *Swift* Burst Alert Telescope (BAT) on 2008 November 25. An extended observing campaign with the *Rossi X-Ray Timing Explorer (RXTE)* and *Swift* provided near-daily coverage over 176 days, giving us a rare opportunity to track the evolution of spectral and timing parameters with fine temporal resolution through a series of spectral states. The source was first detected in a hard state during which strong low-frequency quasi-periodic oscillations (QPOs) were detected. The QPOs persisted for about 35 days and a signature of the transition from the hard to soft intermediate states was seen in the timing data. The source entered a short-lived thermal state about 40 days after the start of the outburst. There were variations in spectral hardness as the source flux declined and returned to a hard state at the end of the outburst. The progression of spectral states and the nature of the timing features provide strong evidence that Swift J1539.2–6227 is a candidate black hole in a low-mass X-ray binary system.

Subject headings: accretion, accretion disks – black hole physics – X-rays: binaries

¹CRESST and NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

²Universities Space Research Association, 10211 Wincopin Circle, Suite 500, Columbia, MD 21044, USA

³Space Science Laboratory, University of California, 7 Gauss Way, Berkeley, CA 94720-7450, USA

⁴NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

⁵Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, Surrey RH5 6NT, UK

⁶Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242, USA

⁷INAF, Istituto di Astrofisica Spaziale e Fisica Cosmica, Via U. La Malfa 153, I-90146 Palermo, Italy