SEARCHING FOR BLACK HOLES

NASA Grant NAG5-4193

Final Report

For the Period 1 April 1997 through 30 September 2000

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February 2001

Prepared for:

National Aeronautics and Space Administration
Washington, D.C.

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The Smithsonian Astrophysical Observatory
is a member of the
Harvard-Smithsonian Center for Astrophysics

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black hole, and evidence for its existence has been very difficult to find. This result was highlighted at a 1997 January AAS press conference, and has appeared in ApJ (Advection

M. R. Garcia and P. C. Callanan, AJ 1996

We report on x-ray observations of two soft x-ray transients (SXT) containing neutron stars, 4U 2129+47 and EXO 0748-676. Our emphasis is on the quiescent properties of these sources, but we make comparisons to their outburst properties as well.

The x-ray spectrum and lightcurve of the eclipsing Low-Mass X-ray Binary (LMXB) 4U 2129+47 is measured with the ROSAT PSPC during its current quiescent state. This is the first such measurement for an accretion disk corona x-ray binary in a low state: these observations may provide new insights into the structure of LMXBs in quiescence. The quiescent x-ray luminosity of $\sim 10^{32.9}$erg/s and blackbody temperature of $kT \sim 0.22$ keV are similar to other quiescent LMXB. The quiescent x-ray light curve appears to show orbital modulation, but the statistics are insufficient to distinguish between a v-shaped partial eclipse (as seen in the high state) or a total, square wave eclipse. The similarity in the luminosity and temperature to other (non-eclipsing) quiescent LMXB implies that the vertical structure in the disk which blocked our direct view of the neutron star in the high state has collapsed, and the neutron star is seen directly.

EXO 0748-676 was serendipitously observed with the Einstein IPC in quiescence before it was discovered as a bright transient with EXOSAT. Our re-analysis of this quiescent observation finds $L_x \sim 10^{34.1}$, and blackbody temperature of $kT \sim 0.21$ keV, again similar to other LMXBs in quiescence.

6 Optical Spectral Monitoring of XTE J1118+480 in Outburst - I. Evidence for a Precessing Accretion Disk, MAP Torres, PJ Callanan, MR Garcia, P Garnavich, Z Balog, P Berlind, M Brown, M Calkins, and A Mahdavi, in prep for ApJ, Feb 2001.

We present spectroscopic observations of the X-ray transient XTE J1118+480 acqui red during different epochs following the 2000 March outburst. We find that the emission line profiles show evident variations in their double-peak structure at time scales longer than the 4.1 hr orbital period. We suggest that these change s are due to a tidally driven precessing disk. Doppler imaging of the more inten se Balmer lines and the HeII λ4686 line show evidence of a persist ent emission spot superposed on the disc. The Balmer Doppler maps on May 25 2000 shows an elliptical ring as expected for an eccentric disk. We discuss the poss ible nature of the optical flux in the system and conclude that it may be due to a viscously heated disk.

Optical and X-ray Observations of Aql X-1 for a Complete Outburst Cycle, RK Jain, CD Bailyn, MR Garcia, and AM Levine, submitted to ApJ Feb 2001.

of the outburst, although we find the modulation during the initial rise to be somewhat faster at $P \sim 18.5$ hours. The optical initial rise preceded the X-ray (RXTE/ASM) rise by ~ 6 days. Utilizing this, we triggered six RXTE/PCA pointings before the source was detectable with the ASM. The source did no undergo spectral transitions during this time and the power density spectrum is typical of SXTs during the low hard state, exhibiting a $1/f$-like noise for frequencies greater than the break frequency and a flat component for low frequencies.

A Search for the IR Counterpart to the black hole Candidate 4U1630-47, P.J. Callanan, J. F. McCarthy, M.R. Garcia, 2000, A&A, 355, 1049C

Abstract

We present the first attempt to localize the IR counterpart of the recurrent, ultra soft X-ray transient 4U 1630-47. We have obtained two sets of K band images of this highly obscured region, during both outburst and quiescence. The recent radio position reported by Hjellming et al. (1999) allow us to perform accurate astrometry on the field. We discuss three stars which lie near the radio position: although two have colours which appear to be consistent with the reddening towards 4U 1630-47, neither are strongly variable. Deeper IR monitoring, during both outburst and quiescence, is required to reliably identify an IR counterpart.

7 Aql X-1 in Outburst and Quiescence, M.R. Garcia, P. Callanan, J. McCarthy, K. Eriksen, R. Hjellming, 1999, ApJ 518, 422

We present photometry and spectroscopy of the soft x-ray transient Aql X-1. Optical photometry during an active state shows a strong (0.6 mag peak-to-peak) modulation at a period of 19 hours. Infrared (K'-band) photometry during a quiescent state limits any ellipsoidal variations to ¡0.07 mag (peak-to-peak), which implies an inclination i¡31 (90quiescent state shows at most very small radial velocity variations, which implies a very low inclination of i¡12 (90limit). The low inclination is rather unexpected given the large photometric modulation seen in the active state. The upper limit to the equivalent width of the anomalous Li 6707A line is ¡0.3A, which is similar to the measured strength of this line in several other x-ray transients.

8 On the Mass of the Black Hole in GS2000+25, P. Callanan, M. Garcia, A. Filippenko, I. McLean and H. Teplitz, 1996 ApJL 470, L57.

Abstract

We present J- and K'-band (1.95–2.35 mu m) photometry of the quiescent X-ray nova

GS 2000+25, obtained in an attempt to constrain the mass of the compact object (MX). Combined with the mass function of 4.97 Msolar, the infrared light curves imply MX ¡= 11 Msolar (90confidence level), regardless of the evolutionary state of the secondary, for a mass ratio q of 4 ¡ q ¡ 30. For a secondary mass in the range M2 = 0.4–0.9 Msolar (as expected for a K dwarf companion), and assuming a negligible contribution from the disk at these wavelengths, we find MX = 8.5 +/- 1.5 Msolar and an inclination of 65 deg +/- 9 deg. The observed infrared color is consistent with that expected of a K dwarf secondary. If the accretion disk continuum is given by f lambda lambda -1.8, as observed in other quiescent X-ray novae, we constrain the accretion disk contribution to the K' flux (independently of optical estimates) to ¡=12%.

9 Observations of the X-ray Nova GRO J0422+32: III: A Low Inclination X-ray Nova Paul J. Callanan, Michael R. Garcia, Jeffrey E. M^{c}Clintock, Ping Zhao, 1996 ApJ 461 351.

10 Observations of the X-ray Nova GRO J0422+32: II : Optical Spectra Approaching Quiescence, 1995, Michael R. Garcia, Paul J. Callanan, Jeffrey E. McClintock, Ping Zhao, 1996 ApJ 460 932.

11 Observations of the X-ray Nova GRO J0422+32: I: Outburst and the Decay to Quiescence, 1995, P.J. Callanan, M. R. Garcia, J. E. McClintock, P. Zhao, R.A. Remillard, C. D. Bailyn, J.A. Orosz, B.A. Harmon, W.S. Paciesas, Ap.J., 441, 786.