FINAL SUMMARY REPORT

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Title:	The Highest LX/Lopt Sources in the ROSAT All-Sky Survey
NASA Grant Number:	NNG04GF96G
Period of Performance:	3/15/04 3/14/05

The Highest L_X/L_{opt} Sources in the ROSAT All-Sky Survey

Cycle 2 XMM-Newton Observations

Summary – The purpose of our program was to identify new and interesting soft X-ray sources from the Bright Source Catalog of the *ROSAT* All-Sky Survey. Our intent was to use *XMM* to observe a sample of BSC objects that had been identified as less than 10% likely to be associated with any object in the USNO-A2.0 catalog (Rutledge et al. 2000). We requested a single 5-ks pointing for each of 32 sources in this category in order to make a systematic examination of the properties of these sources. Ultimately, we hoped to identify new isolated neutron stars from within this population.

Our requested observations were scheduled for execution at the end of Cycle 2, for two of our targets only (selected by sky position). A two-target sample does not allow for the statistical investigation that we originally proposed; however, based on the identification of the BSC object in the XMM data, an improved position, and reevaluation of likely off-band counterparts, it does enable a source-by-source evaluation of whether the BSC object is an isolated neutron star (INS).

Analysis – Data for the target 1RXSJ085247.0+223040 was unusable due to high particle flux (despite these problems, observations were not rescheduled). Data for the target 1RXSJ130547.2+641252 were obtained and reduced using the standard XMM-SAS software. No bright X-ray source is identified within the BSC error circle; this factor of $\gtrsim$20 variability establishes that the source is not an INS (Fig. 1).

This finding is consistent with the results of our *Chandra* program for the high L_X/L_{opt} sources (Rutledge et al. 2003). In that work, we found that 5 of 12 high L_X/L_{opt} sources were sufficiently variable to evade detection in deep follow-up observations. Nonetheless, statistical analysis of the properties of the relatively small number of sources we observe suffices to set stringent upper bounds on the number of INS sources within the ROSAT BSC; we find that (at 90% confidence) there are less than 67 such sources in any isotropically-distributed population.

Ongoing Work – Results of this project, and our *Chandra* work, have encouraged us to pursue comprehensively the goal of identifying counterparts to every BSC object. We have suggested that this may be a useful project for NASA's *Swift* mission (Fox 2004).

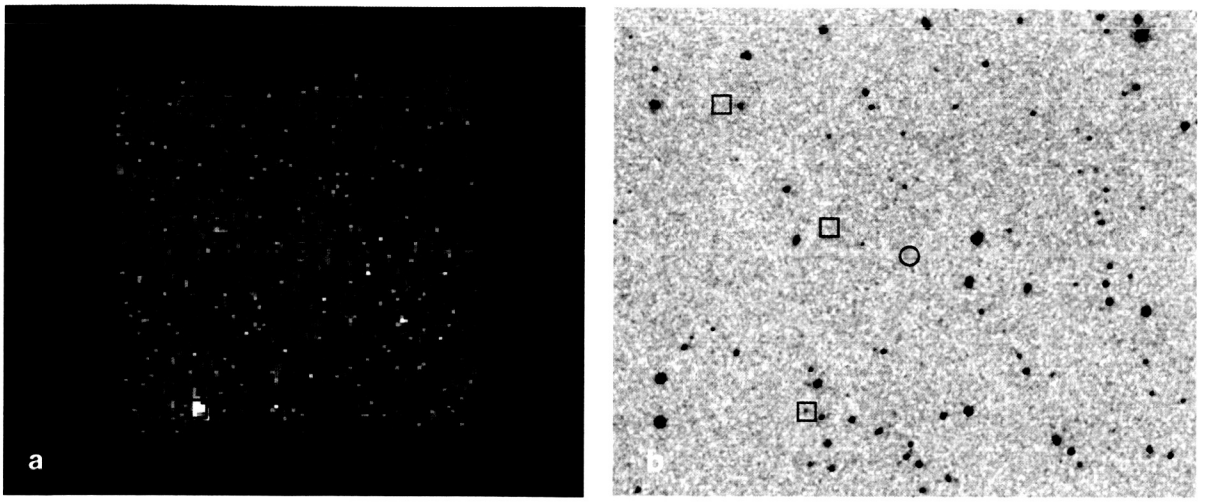

Fig. 1.— XMM observation of 1RXSJ130547.2+641252. On the left (a) we show the *XMM*-MOS2 image of the near vicinity of this ROSAT BSC object. Sources detected in the SAS analysis are indicated with red squares, and the BSC localization for 1RXSJ130547.2+641252 (9″ radius) is shown as a red circle in the center. Over the full MOS field of view, we associate seven XMM sources (including one source seen in the figure) with counterparts in the USNO-B1.0 catalog and/or Digitized Sky Survey (XDSS); this enables us to make a $\sim$1 arcsec boresight correction to the raw coordinates. No X-ray emission is apparent within or near the BSC position for this source; this factor of $\gtrsim$20 decrease in flux establishes that 1RXSJ130547.2+641252 is not an isolated neutron star (INS). On the right (b) we indicate the positions of the X-ray sources, and 1RXSJ130547.2+641252, on the XDSS image of this region. No optical counterpart to the source is apparent.

References

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Rutledge, R. E., et al., 2000, ApJS 131, 335

Rutledge, R. E., Fox, D. W., Bogosavljevic, M., & Mahabal, A., 2003, ApJ, 598, 458