ROSAT OBSERVATIONS OF SYMBIOTIC STARS

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Abstract. The German X-ray astronomy satellite ROSAT (launched 1990 June 1) performed an all-sky survey (from 1990 Jul 30 till 1991 Jan 26) with the Position Sensitive Proportional Counter (2 deg FoV, .1-2.4 keV) covering 96% of the sky. Analysis of bright X-ray sources suggests PSPC positions can be accurately determined to within 30 arcsec, and 1..2 arcmin for soft weak ones. We have examined the survey data for detections from among a list of 189 symbiotic and symbiotic-like objects compiled by Vaidis (1988) with own extensions, chosen for completeness. For 178 objects, all-sky data was available. Standard Analysis Software System (SASS) and EXtended Standard Analysis Software packages (EXSAS) both use a three-step approach to detect sources. After quality screening, a sliding-window algorithm (LD) locates bright sources. These are excluded in the 2D-spline interpolated smoothed background map. A second sliding window MD runs on the background subtracted event files. All possible sources were then tested by maximum likelihood in the background-subtracted, exposure-corrected image. If LD, MD, or ML did not detected a source at the optical position, an upper limit ML program tried to find enhanced emission. For EXSAS, photon event files contain all photons within 20 arcmin radius around a source. Cut radii, background determination, and other parameters can be iteratively improved.

29 sources were flagged by SASS as detected with off-optical distances of up to 10 arcmin. 14 were accepted (w/in 3 arcmin). Source confusion was investigated using the ROSAT Master Source Catalog (X-ray source positions from SIMBAD, IUE, the Verron AGN catalog, Einstein, EXOSAT, and the (Edinburgh) scanned UK Schmitt blue (and some red) plate southern sky atlas (ca 200 million stars).

The 15 sources finally verified by EXSAS (including one not detected with SASS) are listed in Paper 1 (ROSAT Detections of Symbiotic Stars, Bickert et.al. 1992), Table 1. Re-detected were the symbiotic novae AG Dra, RR Tel, CH Cyg, AG Peg, V1016 Cyg, HM Sge, and at 3.5 σ Z And (but not T CrB, V1017 Sgr, or RS Oph). We also see the near-by R Aqr, and the hard neutron star symbiotic GX1+4. New detections are NSV 4775 (which Kenyon suspects to be a VV Cep), the S-types Hen-1924=CD-43 14304 and AG Peg, the carbon stars Draco C-1 and LMC S63 (which has to be verified, possibly attitude problems), and the D- types RX Pup and H2-38 (containing Miras).

Paper 2 (ROSAT Upper Limits for Symbiotic Stars, Bickert et.al. 1992, preprint) results are summarized in Table 1: names, optical positions, stellar distances, galactic absorption, blue, visual, and K infrared magnitudes, spectral classes of the binary components, and the SASS and EXSAS derived values for 178 stars with distance between optical and maximum likelihood X-ray position, likelihoods, fluxes in cps (to avoid model- and fit-errors), exposure times and background (in count/sec/arcmin^2). Table 2 compares SASS/EXSAS with additionally hardness ratios (for EXSAS also background subtracted). All these are PRELIMINARY due to the data analysis learning curve: photon timing and diverse attitude problems as well as inconsistencies in vignetting and dead-time correction have been found and will be removed till the complete survey reprocessing beginning November 92.

Pointed observation data from AO phase 2 on Draco C-1 (PI:Bickert) and AG Dra (PI: Luthardt) are also shown (forthcoming papers). Table 3 summarizes pointings done, scheduled, or planned for AO3.2