

FINAL REPORT
THE X-RAY HALO OF AM Her
CONTRACT NAS5-31223

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INTRODUCTION

As a result of the scattering of x-rays by interstellar dust grains, x-ray halos are expected theoretically, and are known observationally to be a feature endemic to Galactic x-ray sources. Candidates for sources affected by dust grain scattering include highly-reddened time-variable compact Galactic x-ray sources whose flux variations and flux distributions are affected by the presence of x-rays which travel indirectly from the source to the observer, and so are delayed in time with respect to direct rays. One important subset of such time-variable sources are the eclipsing cataclysmic variables (CVs). In such sources, the unscattered x-rays are extinguished completely during eclipse, leaving behind only the time-delayed x-rays scattered by interstellar grains. Because the characteristic time delay for scattered x-rays is so long, the x-ray halo of an eclipsing CV can persist throughout the eclipse. Observations of such sources are thus free of the uncertainties introduced by the point response function of the telescope due to the otherwise superposed intense point source of unscattered x-rays. By analyzing the time-dependence of the shape of the x-ray halo during the eclipse, it may be possible to determine the distance to the x-ray source as well as to determine the distribution of grains along the line of sight.

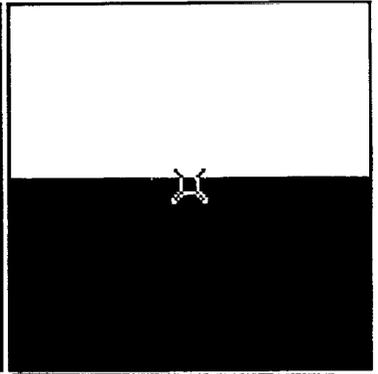
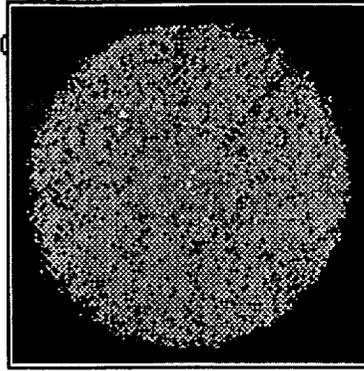
AM Her is the prototype of a class of strongly-magnetic CVs which are phase-locked in synchronous rotation with the binary orbit and which accrete material onto (predominantly) one of their magnetic poles. AM Her itself is viewed at such an orientation that the mass-accreting (x-ray emitting) magnetic pole is hidden behind the body of the white dwarf for approximately half of the 3.09 hr orbit. AM Her was conservatively expected to have a fractional halo intensity of 1 % of its unscattered intensity, easily detected by ROSAT.

RESULTS

AM Her undergoes extended periods of low x-ray emission. Unfortunately, AM Her was in such a state during the ROSAT observation. While counting rates from the source were expected to be in the range 100-300 counts per second, the observed rate was about 0.5 counts per second and the total counts acquired during the 14400 sec live time was about 2300 counts. Thus, only about 23 counts would be expected in the halo, far too few to be useful.

Most of the 36 hours of effort funded by this contract was spent learning to operate the IRAF/PROS software package. Figure 1 shows the image obtained using all of the data from the 14400 sec live time. The central 16 arc min of the field is shown in Figure 2. Figure 3 shows a radial profile of the source along with an estimate of the point spread function of the ROSAT telescope with a PSPC in the focal plane. As expected, there is very little indication of the presence of a halo in the small amount of data obtained during the observation.

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(IRAF)



347.0 512.0 <0

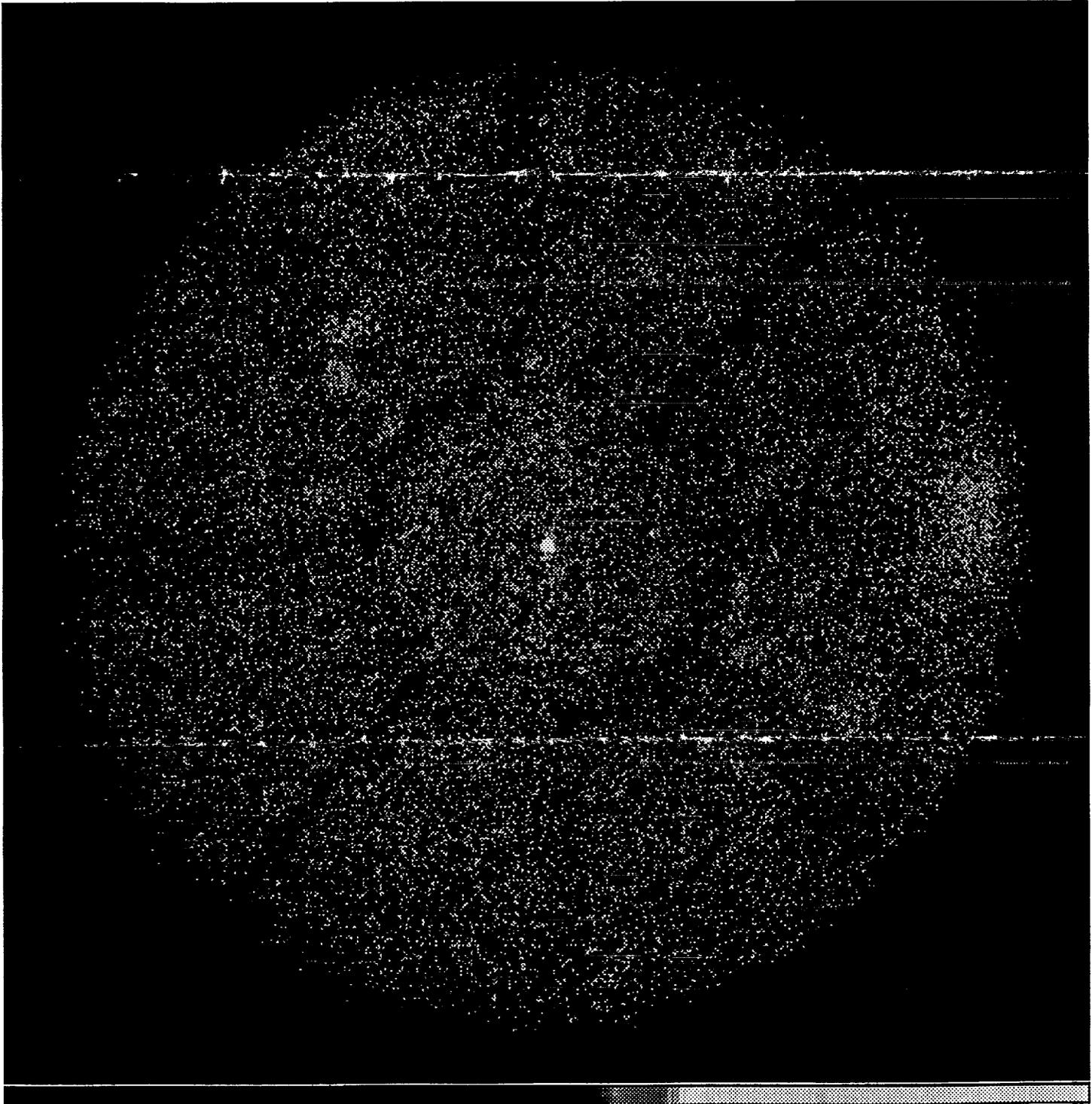
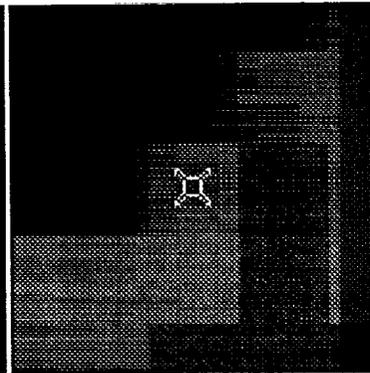
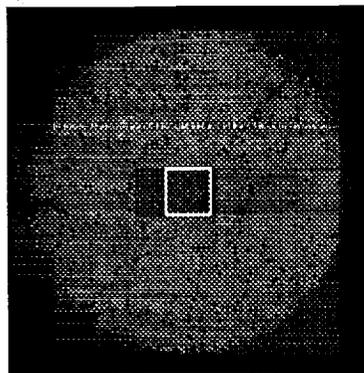


Figure 1

rp900001.qp[block=30] - AMHER
(IRAF)



286.0 285.0 1.884

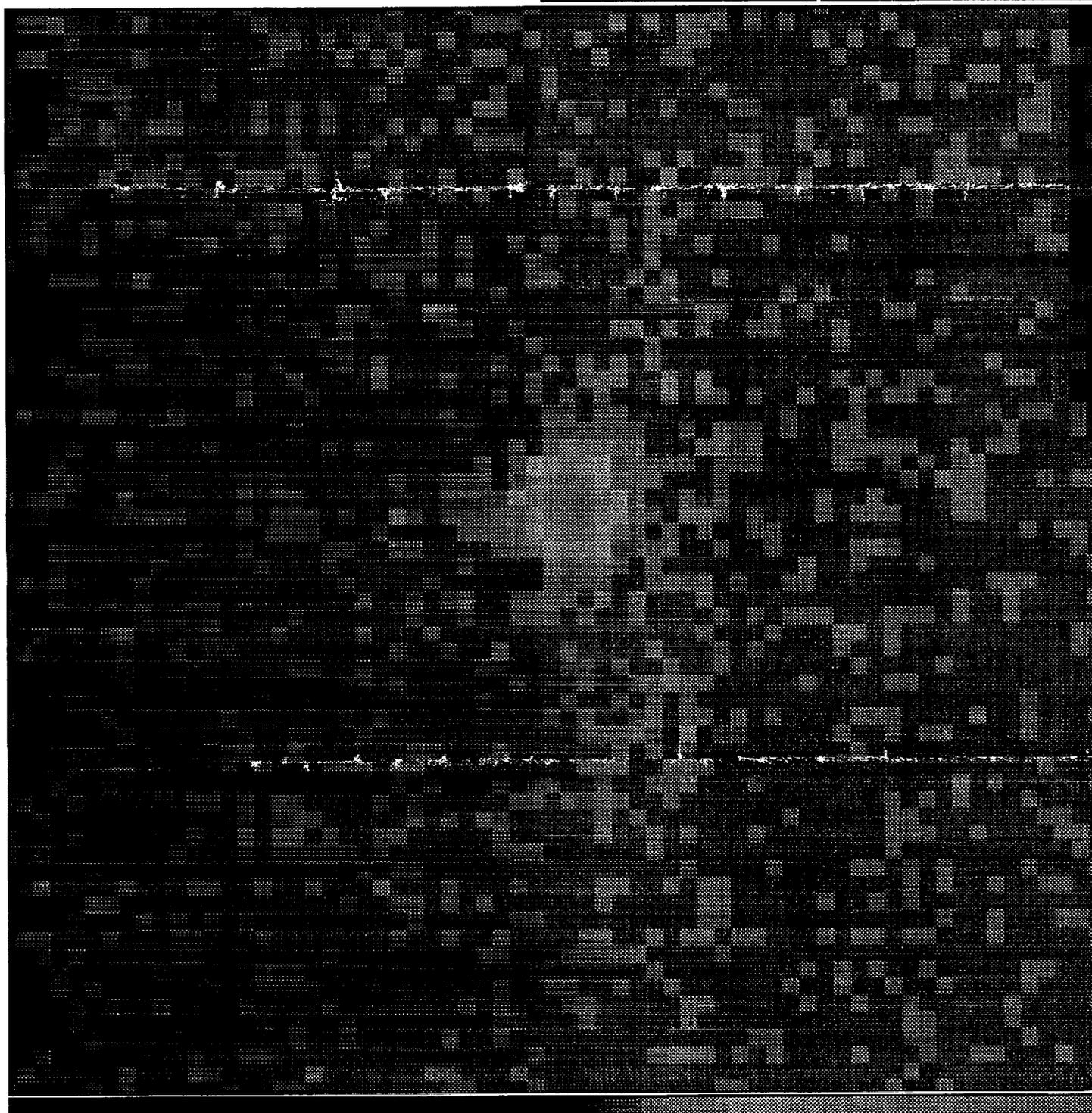


Figure 2

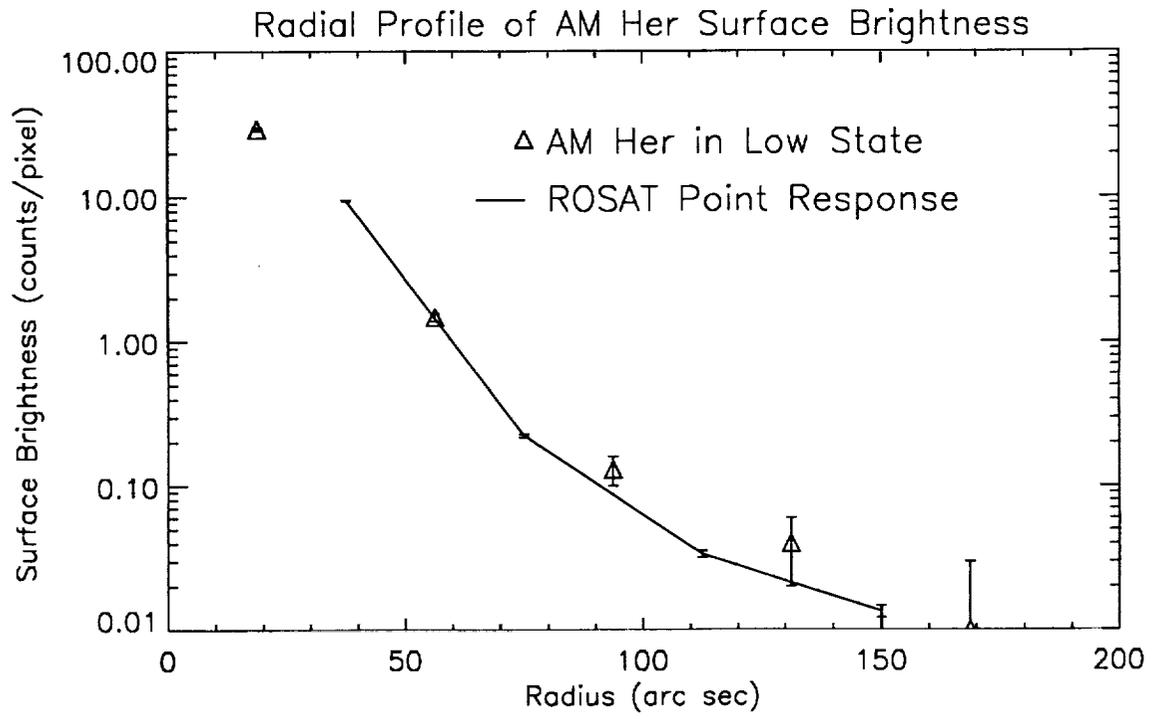


Figure 3



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16. Abstract The objective of this research was to study the halo surrounding the ROSAT image of the cataclysmic variable AM Her that is formed by scattering of x-rays by interstellar dust grains. AM Her was in a low state of x-ray emission during the 14400 sec observation and thus an insufficient number of counts were obtained to detect the x-ray halo.					
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