

A *Chandra* Observation of the Nearby Sculptor Group Sd Galaxy NGC 7793

Thomas G. Pannuti¹, Eric M. Schlegel²
and Christina K. Lacey³

¹*Spitzer* Science Center, California Institute of Technology, Mailstop 220-6,
Pasadena, CA 91101, USA
email: tpannuti@ipac.caltech.edu

²Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138 USA
email: eschlegel@cfa.harvard.edu

³Department of Physics, University of South Carolina, Columbia, SC 29208 USA
email: lacey@sc.edu

Abstract. We present the results of a *Chandra* observation made of the nearby spiral galaxy NGC 7793: the effective exposure time of this observation was 49094 seconds. Twenty-two discrete sources were identified at a minimum of a 3σ level to an estimated limiting luminosity of $\sim 2 \times 10^{36}$ ergs sec⁻¹. We have performed a spectral analysis of the known ultraluminous X-ray source (ULX) in this galaxy: statistically-acceptable fits to the spectrum can be obtained with either a power law model, a bremsstrahlung model or a DISKBB model. We have also searched for counterparts at multiple wavelengths to these sources: based on this search, we have classified two supernova remnants, one HII region and two foreground stars.

Keywords. X-rays: galaxies, galaxies: individual (NGC 7793).

1. Introduction

The Sd galaxy NGC 7793 is a member of the nearby Sculptor Group of galaxies and lies at a distance of approximately 3.38 Mpc (Puche 1988). Based on X-ray observations made with *Einstein* (Fabbiano *et al.* 1992) and the *Röntgensatellit* (*ROSAT*) (Read & Pietsch 1999), seven discrete X-ray sources – including an ultraluminous X-ray source (ULX) located along the southern edge of the galaxy – had been identified within the optical extent of NGC 7793. The supernova remnant (SNR) population in NGC 7793 is one of the best studied of any external galaxy: based on analysis of X-ray, optical and radio observations (Blair & Long 1997, Pannuti *et al.* 2002) a total of 31 SNRs have been identified in this galaxy. We have observed NGC 7793 with *Chandra* as part of our study of X-ray emission from SNRs in nearby galaxies.

2. Observations

We used the Advanced Charge-Coupled Device (CCD) Imaging Spectrometer (ACIS) aboard *Chandra* in Very Faint Mode to observe NGC 7793: virtually all of the galaxy was sampled with the ACIS-S3 chip and the effective exposure time of the observation was 49094 seconds. We re-filtered the Level 1 data, correcting for the induced charge-transfer inefficiency. Point sources were detected using the “wavdetect” algorithm (Freeman *et al.* 2002) at 1”, 2” and 4” scales.

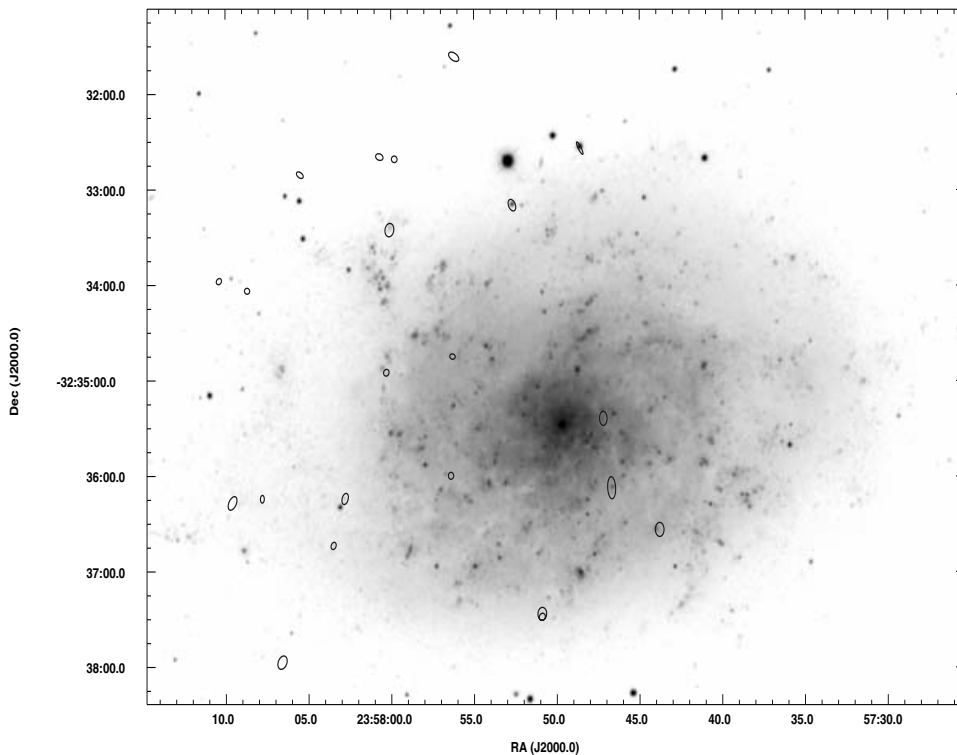


Figure 1. An *R*-band image of NGC 7793 with the positions of the 22 discrete X-ray sources detected by *Chandra* indicated.

3. Results

A total of 22 discrete sources were detected at a minimum of a 3σ level, corresponding to a limiting unabsorbed luminosity of approximately 3×10^{36} ergs sec^{-1} . The positions of the detected sources are plotted on an *R*-band image of NGC 7793 in Figure 1. Statistically-acceptable fits to the spectrum of the ULX can be obtained with either a power law model (with a photon index $\Gamma=1.4\pm 0.1$), a bremsstrahlung model ($kT=25_{-9}^{+20}$ keV) or a DISKBB model ($kT_{\text{in}}=1.94_{-0.14}^{+0.16}$). We have searched for counterparts at other wavelengths for the detected X-ray sources: and identify X-ray counterparts to two SNRs, one HII region and two foreground stars. The remaining X-ray sources are most likely resident X-ray binaries in NGC 7793, or background galaxies.

Acknowledgements

T.G.P. acknowledges support for this work from *Chandra* Grant GO3-4104Z.

References

- Blair, W. P. & Long, K. S. 1997, *ApJS*, 108, 261
- Fabbiano, G., Kim, D.-W., & Trinchieri, G. 1992, *ApJS*, 80, 531
- Freeman, P. E., Kashyap, V., Rosner, R., & Lamb, D. Q. 2002, *ApJS*, 138, 185
- Pannuti, T. G., Duric, N., Lacey, C. K., Ferguson, A. M. N., Magnor, M. A., & Mendelowitz, C. 2002, *ApJ* 565, 966
- Puche, D. & Carignan, C. 1988, *AJ*, 95, 1025
- Read, A. M. & Pietsch, W. 1999, *A&A*, 341, 8