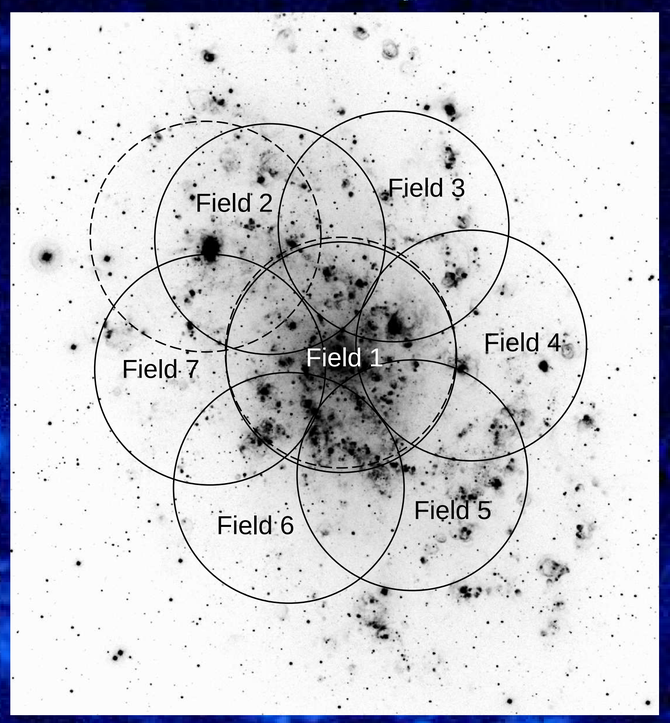
## The ChASeM33 Project

- The Chandra ACIS Survey of M33 (ChASeM33) is a "Very Large Project" with the *Chandra X-ray Observatory* (CXO) to observe the inner regions of the M33 galaxy.
- The program consists of seven fields in M33 (see Figure 1) which will be observed to a depth of 200 ks. Each field will be observed two times for $\sim 100$ ks with the observations separated by roughly one year.
- The objectives of the survey are:
  1. a study of the overall ecology of the hot Interstellar Medium (ISM) in M33 and the implications for other spiral galaxies
  2. a study of the star-formation history of the galaxy as recorded by the compact X-ray sources
  3. a study of the SNR population in M33 and a census of their properties
- Slightly over half of the observations have been conducted to date.
- Figure 2 shows a mosaic image which combines the existing observations with archival observations (Sasaki *et al.* 2006). The image has been created by selecting events in the 0.35-8.0 keV band and within 8.0′ of the on-axis position of the CXO telescope. The data have been binned into $2'' \times 2''$ pixels and adaptively smoothed.
- Figure 3 shows a closeup of the extraordinarily bright HII region NGC 604. Figure 4 shows the HST WFPC2 Hα image (Maiz-Apellaniz *et al.* 2004).
- Figure 5 shows a closeup of the nucleus region from one of the ACIS-I observations showing the entire square FOV and the gaps between the CCDs. The data have not been smoothed as the data in Figure 2.
- Figure 6 shows a closeup of the bright Southern arm with SNRs from the GKL 98 catalog identified (Gordon *et al.* 1998).
- Figure 7 shows a closeup of the HII region IC 131.




## The ChASeM33 Team


P.P. Plucinsky, T.J. Gaetz, M. Sasaki, R.J. Edgar, R.P. Kirshner, J.E. Grindlay, Harvard-Smithsonian Center for Astrophysics.

L. Bianchi, W.P. Blair, P. Ghavamian, K.D. Kuntz, R.K. Smith, D.A. Thilker, Johns Hopkins University

B.F. Williams, University of Washington

W. Pietsch, F. Haberl, Max Planck Institut für Extraterrestriche Physik

K.S. Long, Space Telescope Science Center Institute.

P.F. Winkler, Middlebury College

T. Pannuti, Spitzer Science Center, JPL, Caltech

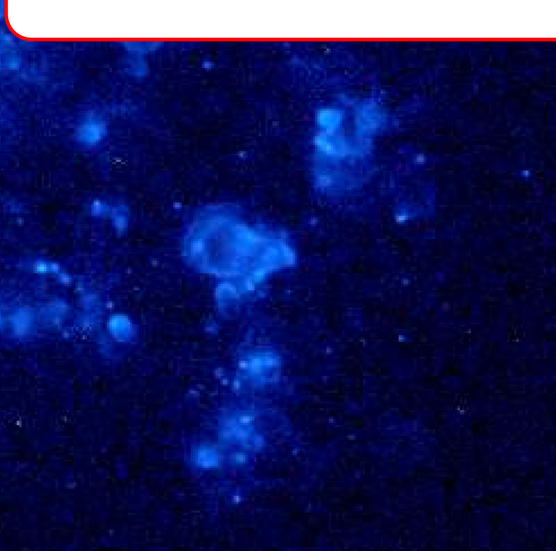
T. Mazeh, A. Shporer, Tel Aviv University

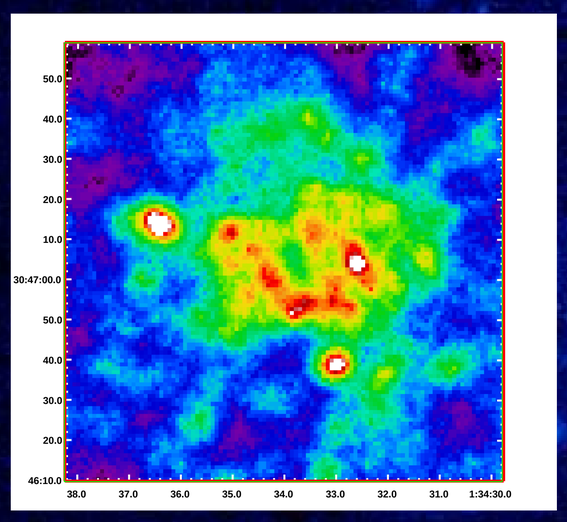
D. Breitschwerdt, University of Vienna

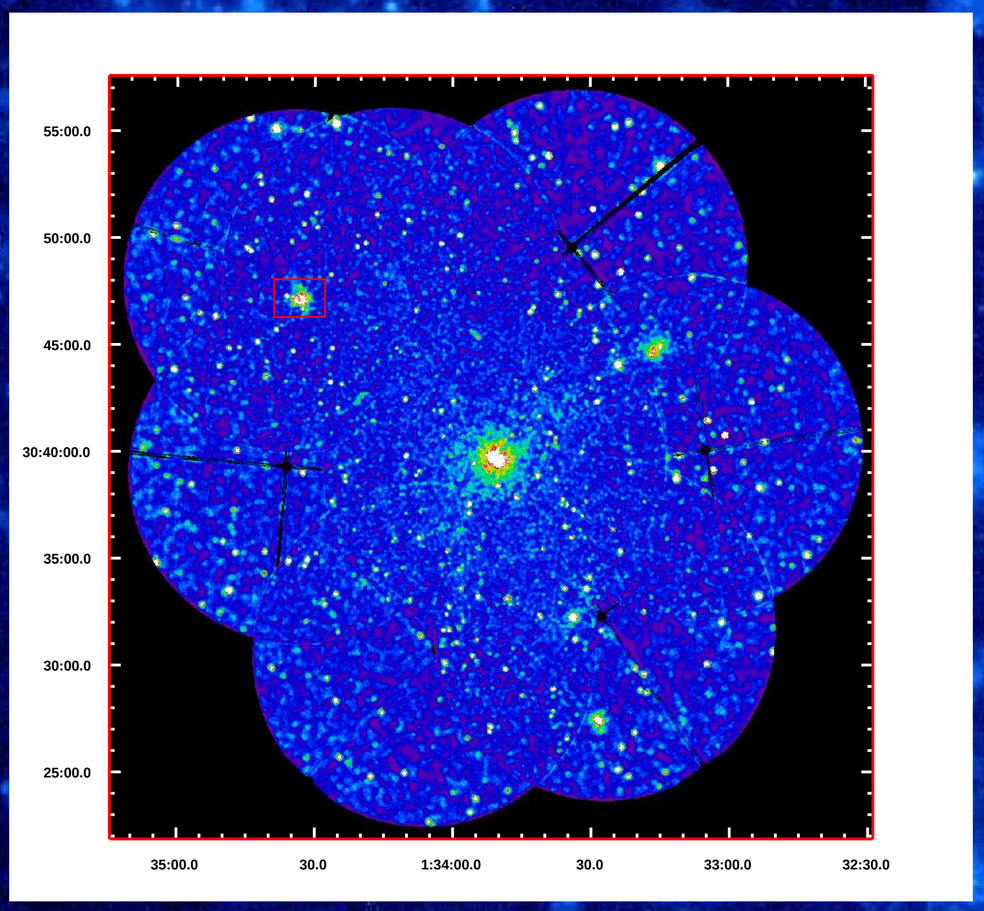
M.A. de Avillez, Univeristy of Evora

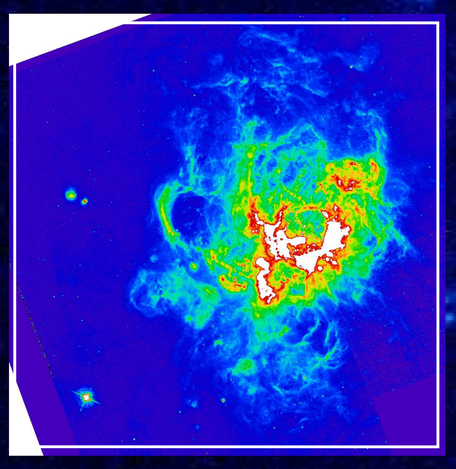
D.J. Helfand, Columbia University

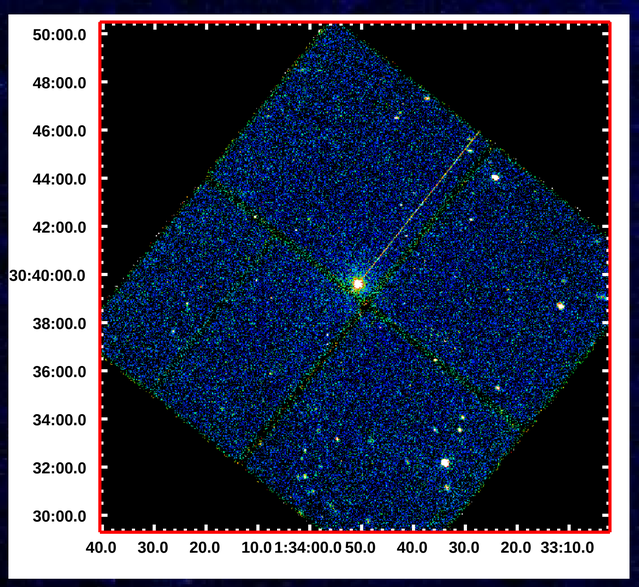
J.P. Hughes, Rutgers University

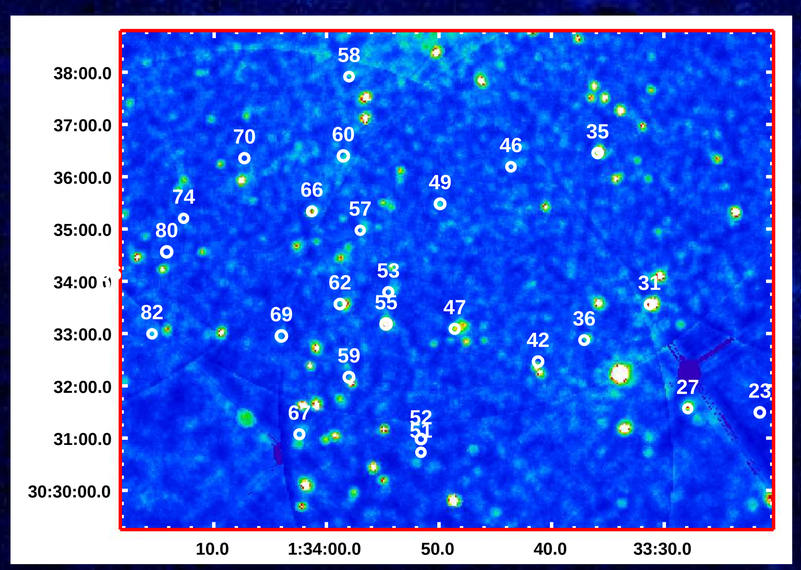







REFERENCES:

Gaetz, T.J. *et al.* 2006, ApJ, in preparation.

Ghavamian, P., Blair, W. P., Long, K. S., Sasaki, M., Gaetz, T. J., & Plucinsky, P. P. 2005, AJ, 130, 539

Gordon, S. M., Kirshner, R. P., Long, K. S., Blair, W. P., Duric, N., & Smith, R. C. 1998, ApJS, 117, 89

Maíz-Apellániz, J., Pérez, E., & Mas-Hesse, J. M. 2004, AJ, 128, 1196

Pietsch, W., Haberl, F., Sasaki, M., Gaetz, T. J., Plucinsky, P. P., Ghavamian, P., Long, K. S., & Pannuti, T. G. 2006, ApJ, 646, 420

Sasaki, M. *et al.* 2006, ApJ, in preparation.

Williams, B.F. *et al.* 2006, ApJ, in preparation.

# *Chandra ACIS Survey of M33 (ChASeM33): A First Look*

## Source Analysis

- The eclipsing X-ray Binary M33 X-7 was observed in several of the ChASeM33 observations. X-7 was observed in eclipse ingress and egress for the first time. Pietsch *et al.* 2006 argue that the mass of the optical counterpart, the shape of the X-ray spectrum, and the short-term X-ray time variability indicate that X-7 is the first eclipsing black hole high-mass X-ray binary.
- Our previous work on the SNR population in M33 (Ghavamian *et al.* 2005) identified 22 of the 98 known optical SNRs in X-rays. In addition, we proposed three new candidate SNRs from the X-rays, of which two have optical counterparts.
- The brightest SNR in M33, GKL98-21 or M33SNR21, has been resolved in X-rays for the first time (Gaetz *et al.* 2006 & poster this meeting). The remnant shows a shell-like structure with pronounced limb-brightening on the eastern side. The X-ray spectrum is line-dominated and apparently completely thermal.
- The *CIAO* source detection tool "wavedetect" was run on the individual observations. Source lists were created from the individual observations and then common sources in the overlap regions were identified. 482 sources have been identified in the existing observations.
- The sources with more than 100 counts were fit with a fixed absorption and power-law spectrum to compute a luminosity assuming a distance of 840 pc. The luminosities of sources with less than 100 cts were computed using conversion factors determined from the highest quality fits to the bright sources. The cumulative luminosity functions (Williams *et al.* 2006) corrected and uncorrected for absorption are shown in Figure 8.