An Archive of Chandra Observations of Regions of Star Formation (ANCHORS)

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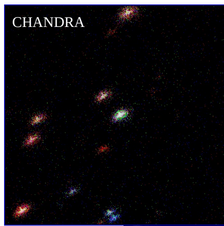
ANCHORS is a web based archive of all the point sources observed during Chandra observations of regions of star formation. It is designed to aid both the X-ray astronomer with a desire to compare X-ray datasets and the star formation astronomer wishing to compare stars across the spectrum. For some 50 Chandra fields, yielding 10,000+ sources, the database contains X-ray source properties including position, net count rates, flux, hardness ratios, lightcurve statistics and plots. Spectra are fit using several models, with final parameters and plots recorded in the archive. Multi-wavelength images and data are cross-linked to other archives such as 2MASS and SIMBAD. Many of the observations are of southern clusters and have no contemporary optical photometry. We are using time on the SMARTS telescopes to fill this void and will make the data available through the ANCHORS HTML/XML interface. The Chandra and SMARTS data are processed and compiled by separate automated pipelines. The pipelines ensure consistent analysis techniques for direct comparisons among clusters. We report on current status and availability to the community and prospects for expansion.

The *Chandra X-ray Observatory* was launched in July 1999 and has performed reliably since. Typical nuances and judgement calls in data analysis lead to many difficulties in comparing published data from different observers or from different observation dates. The data reduction and analysis software itself changes over time which can affect the final results even on the same dataset. In most cases different spectral models, parameter settings, and classification criteria will be applied based on the observer's preferences and familiarity. The goal of our catalog is to provide a uniform (not necessarily optimal) database for the comparison of data from different stellar clusters. This type of catalog provides added science return as well as convenient observatory health and performance metrics. The catalog will make it possible to treat science quantities in similar ways to how databased spacecraft temperatures and voltages are treated for monitoring and trending. The full benefit of ANCHORS will be realized in sorting and searching on any property (temperature, absorption, age, mass ...) across numerous stellar clusters.



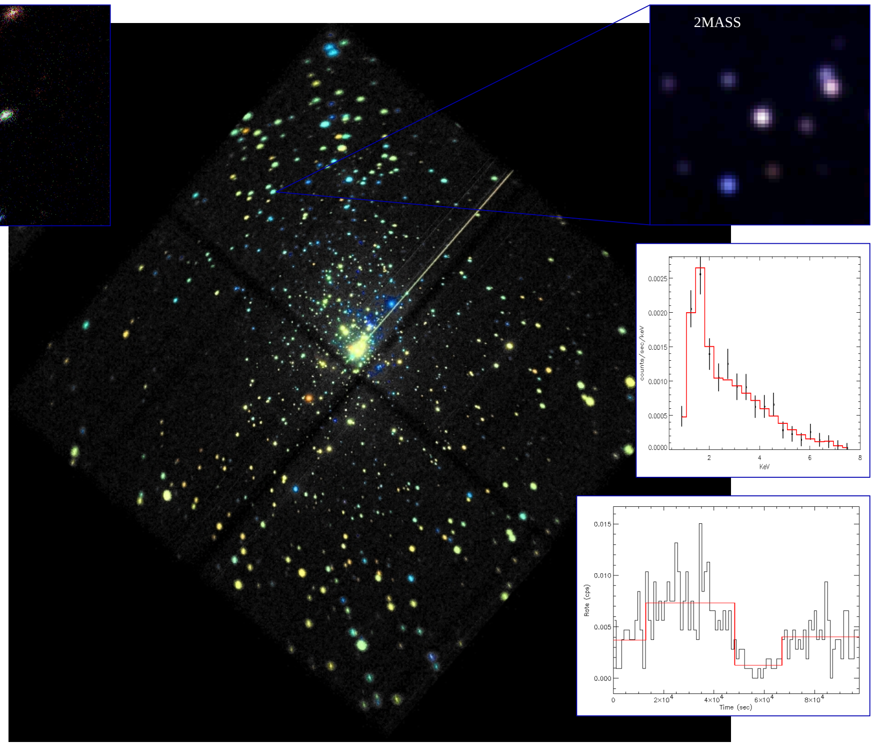
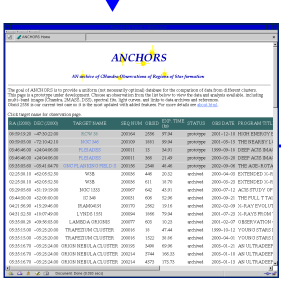
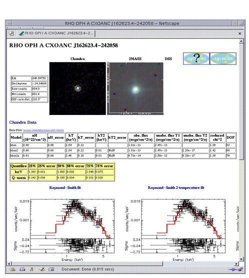


figure 1. The archival 850ks Chandra Orion Ultra Deep field. We measure and track the elongation and rotation of sources as a function of off-axis angle and chip position. Spectral fits and lightcurve analysis is performed for each field source.

The ANCHORS Pipeline





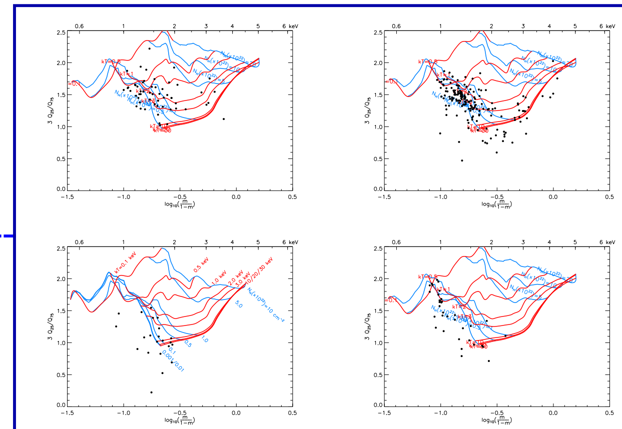


figure 2. Example science results. Quantiles provide a handy alternative or supplement to X-ray hardness ratios, especially in low count regimes. The quantile E(x%) value is simply the energy below which x% of the photons fall and Q(x%)=[E(x%)-E(lo)]/[E(hi)-E(lo)]. At left we plot four clusters of various ages, from youngest to oldest:

Top left: NGC 1333
Top right: IC 348
Bottom left: h Per
Bottom right: Pleiades

The overplotted grids are derived from Raymond-Smith models taking into account an appropriate Chandra (ACIS-I) response.

Quantiles show promise for quickly discerning ages, classifications, and cluster membership vs. foreground stars/background AGN. In the ANCHORS pipeline, they could be used to assign initial values in spectral fitting.

ANCHORS Features

- Source detection by wavdetect.
- Automated processing by YAXX (Aldcroft, SAO).
- Spectral fits (Raymond-Smith) by Sherpa.
- Quantile analysis (Hong, SAO) and hardness ratios.
- Unabsorbed source fluxes.
- Bayesian block lightcurves (Scargle, NASA).
- Chandra, 2MASS, DSS images from SkyView.
- Downloadable data files.
- Links to query SIMBAD.
- Links to Chandra data archive.
- XML allows customized data formats and sorting/searching utilities.

Future Enhancements

- Import infrared/optical data from existing 2MASS, Spitzer, DSS, and USNO archives.
- Obtain new optical data through SMARTS (7 clusters already observed).
- Provide distance, age, mass, references etc., from the literature when available and use to derive luminosities.
- Link to Vizier, Webda, ADS, etc. entries.
- Calculate additional temporal properties such as a K-S statistic.
- Add interactive plotting of user selected quantities.
- Allow on-line re-fitting using built-in or user defined models and parameters.
- Create advanced searching, sorting, and retrieval tools
- Conform to NVO standards