Analytical Comparison of Contemporary and Archival X-ray sources

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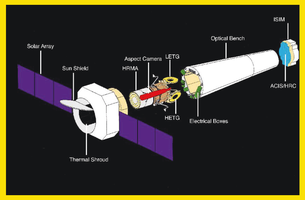
Introduction

X-ray binaries are systems containing two stars orbiting around each other, one of which is a normal star, while the other is a collapsed star, such as a white dwarf, neutron star, or black hole. Gas is pulled from the normal star towards the collapsed star, and X-rays are emitted as it approaches and, in some cases, strikes the compact star. X-ray telescopes, such as *Chandra*, measure X-rays from these systems, allowing us to learn about their behavior.



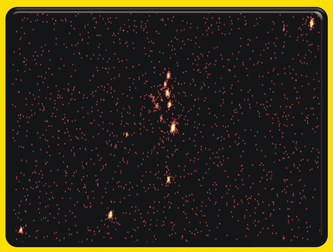
NASA's Chandra Telescope[a]

I studied the distribution of energy (the energy spectra) in X-ray binaries in the globular cluster NGC 6752 from two sets of data, searching for variability; the data was taken at two different times from the *Chandra* telescope.

Globular Cluster NGC 6752

A globular cluster is a spherical concentration of stars, often consisting of celestial objects that are less common in the galactic disk. These objects include X-ray sources found in various types of X-ray binaries. NGC 6752 is a globular cluster located at a distance of 4.1 ± 0.2 kilo-parsecs, known to contain numerous cataclysmic variables (CVs), as well as other X-ray sources. CVs are a type of X-ray binary consisting of a white dwarf accreting gas from its companion star.

Illustration of a Cataclysmic Variable.[b]



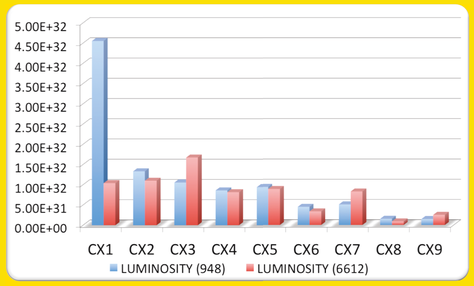
X-ray image of Globular Cluster NGC 6752, sources CX1-CX9

NGC 6752

Optical image of NGC 6752 from the *Hubble Space Telescope*. NGC 6752 is a globular cluster, a dense congregation of stars in a fairly round distribution. These clusters are home to a myriad of celestial objects, including various types of stars, however, only a few of these objects are X-ray sources.

General Findings

The overall results I found were that most of the sources' luminosities had increased during the duration between the two observations (observation ID: 948 and 6612).

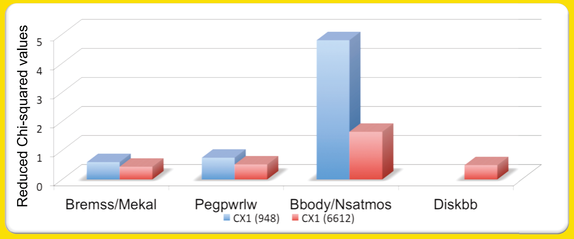


The source, CX1, shows a large difference between values for luminosities; this source is further discussed in detail in the following section.

- Accreting binary systems tend to vary in luminosity, therefore the changes are not uncommon.
- Most values seem to be in the luminosity range for CVs (10^{30}-10^{32} erg s^{-1})

CX1

The source, CX1, had a substantial change in count rate between the two observations. The first observation has a count rate of 3.716e-02 +/- 1.124e-03 (counts/s) for an exposure time of 2.947e+04 sec, and the second, 7.181e-03 +/- 4.368e-04 (counts/s), for an exposure time of 3.797e+04 sec. Spectral fitting confirms that the luminosity of this source changed dramatically. If the source is a CV, this source may have experienced an outburst at the time of the first observation. The best fit model for this source was a power-law absorbed by interstellar gas.



Reduced Chi-squared values for various models fit to both data sets for source CX1.

Conclusions

From the data, it can be deduced that most of the luminosities of the X-ray sources correspond to expected values for cataclysmic variables. With further research, other conclusions that can be drawn from this information are:

- Whether the sources' observed behaviour is characteristic or uncharacteristic.
- Whether some sources were incorrectly categorized.

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References

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