X-ray sources identification of Chandra data in NGC 6218

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Scientific Goal

- To identify the faint x-ray sources in the globular cluster system.
- To know the formation of the x-ray emission system.
X-ray Observation

- NGC 6218 was observed by Chandra ACIS-S on 2004 July 17 for about 27ks.
- The S3 chip of Chandra covers the whole half-mass radius of NGC 6218.
X-ray Observation

- FOV of Chandra ACIS-S
Data Reduction

• Reprocessing level=1 data to create a new level=2 data for analysis.

• Apply the newest calibration: remove cosmic rays after glow, remove bad pixel, revise the CCD response and good time interval (GTI).

• Eliminate high background count rate (count rate > 5 cps).
Data Reduction

- Filter the energy band: 0.3-7 keV
- The high energy particle background is fairly flat in the 2-7 keV range. However, it both rises sharply below the 0.3 keV mark and climbs by a factor of 8 between 7-10 keV.
Data Reduction

• Effective exposure time reduces from 26.9ks to 26.2ks.
Source Detection

• Software : wavdetect in CIAO 3.4
• Detection on four band : 0.3-1 keV(soft band), 1-2 keV(medium band), 2-7 keV(hard band), 0.3-7 keV.
• Parameter setting : 
Sources Detection

• Sources list

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Sources Detection
Hardness ratio and Spectral Fitting

• Most sources don’t have enough photon counts (less than 200 counts) to do the meaningful spectrum fitting.

• Calculate the hardness ratio can roughly tell the spectral feature of the sources.
Hardness ratio and Spectral Fitting

• CX2 spectrum
Hardness ratio and Spectral Fitting

- CX2 spectrum fitting parameter:
  - $w_{abs} \ nH = 0.290162 \pm 0.123834 \times 10^{22}$
  - powerlaw $\ PhoIndex = 2.16369 \pm 0.321999$
- Chi-Squared = 17.82 using 15 PHA bins.
- Reduced chi-squared = 1.485 for 12 degrees of freedom
- Null hypothesis probability = $1.211654 \times 10^{-01}$
Hardness ratio and Spectral Fitting

• Color-color diagram
Summary

• We detect 17 x-ray sources in the chandra data of NGC 6218. 7 of the 17 are within the half-mass radius of NGC 6218 or HST FOV. All of the 7 sources have low luminosity ~ 1E+31 erg/s.

• From color-color diagram, they are soft x-ray sources.

• We can not tell what kind of x-ray sources they are for now.
Future Work

• Compare the result of Chandra data to other x-ray data of NGC 6218.
• Find the counterpart of these x-ray sources in optical and to identify these sources.
• Compare the x-ray sources composition to other globular clusters.
References

• http://cxc.harvard.edu/ciao/
• http://physwww.mcmaster.ca/~harris/mwgc.dat

• THANK YOU!