

## Searching for Ultra Compact Binaries in Globular Clusters

### What Are Ultra Compact Binaries?

An ultra compact binary is a binary that consists two white dwarf stars and has an orbital period shorter than ~70min (A binary consists of two stars orbiting around their centre of mass, it enables the masses of stars to be calculated). Ultra compact binaries are astrophysically interesting because it was predicted there would be several thousands, but to date only around twenty of them have been identified. They are also predicted to be a large source of gravitational radiation. Gravitational radiation is produced when large bodies accelerate.

### How did I search for them?

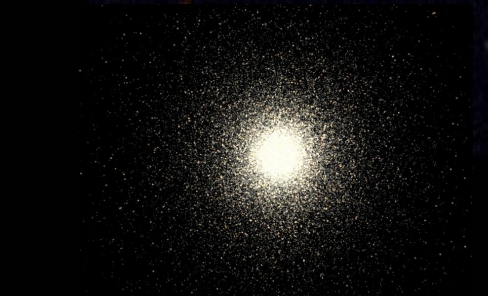
I used images taken by the optical monitor/UV camera on the XMM Newton satellite. I did this because a characteristic of an Ultra Compact Binary is that it displays pulsations in its UV spectrum. I couldn't use a UV monitor from earth because the UV rays get absorbed by the earth's ozone layer.



Above: XMM Newton satellite in orbit

### Where did I search for them?

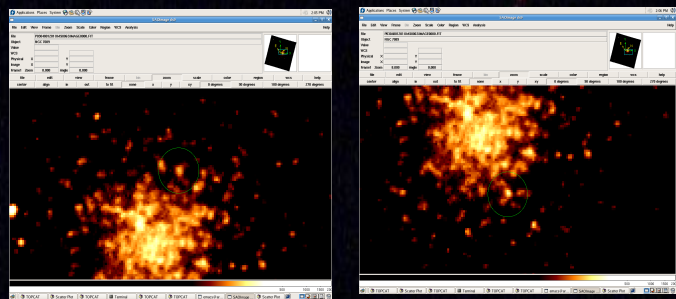
Globular clusters have been predicted to be a good source of ultra compact binaries. A globular cluster is a gravitational bound concentration of between ten thousand to a million stars. Most are as old as the Milky Way galaxy- several billion years!! For our search we decided to investigate two different globular clusters to see if we could find any variations in brightness of single stars which would indicate pulsations.



Above: A globular cluster

### How did I access the XMM Newton Satellite?

To source the FITS files that contained the UV images, the sky coordinates and the details on brightness for each star in each globular cluster we were investigating, we used the XMM online archive. I just registered a query containing the globular clusters ID number and it produced all the images that had been taken of each globular cluster. The two globular clusters we investigated were M13 and NGC 7089



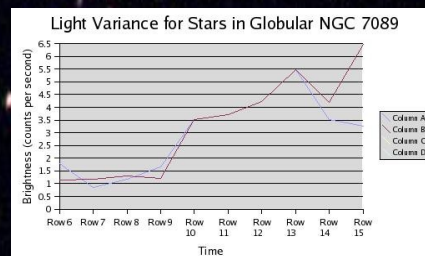
Above: Screen shots of both of the varying sources in NGC 7089 being examined using the ds9 program

### How did I identify varying sources?

I inserted the tables of data on the stars we got from the FITS files, into a program called TOPCAT. There was data from four epochs for the globular cluster M13 and from ten epochs for NGC 7089. I displayed their variance using graphs through TOPCAT. I decided to investigate sources that showed a variance in their arcs of 1.0 or more.

### Results

I found evidence of one varying source in M13 and two in NGC 7089. The light variance curve for NGC 7089 is displayed below.



### Conclusion

I can conclude that I have identified three varying sources from the two globular clusters we studied. They are now candidate ultra compact binaries, variations in the UV light curve are merely one characteristic of an ultra compact binary and is the first step in its identification process.

