Linking LMXB and GC Populations: Non-Uniform Spatial Distributions in Elliptical Galaxies

Formation and Evolution of Globular Clusters Conference, KITP

Nicola Brassington

CfA

Collaborators: G. Fabbiano, D-W. Kim, A. Zezas, L. Angelini, R. Davies, J. Gallagher, V. Kalogera, T. Fragos, A. King, S. Pellegrini, G. Trinchieri, S. Zepf & A. Kundu

Quick Recap

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- *Chandra* Observations of two old elliptical galaxies: NGC 3379 & NGC 4278.

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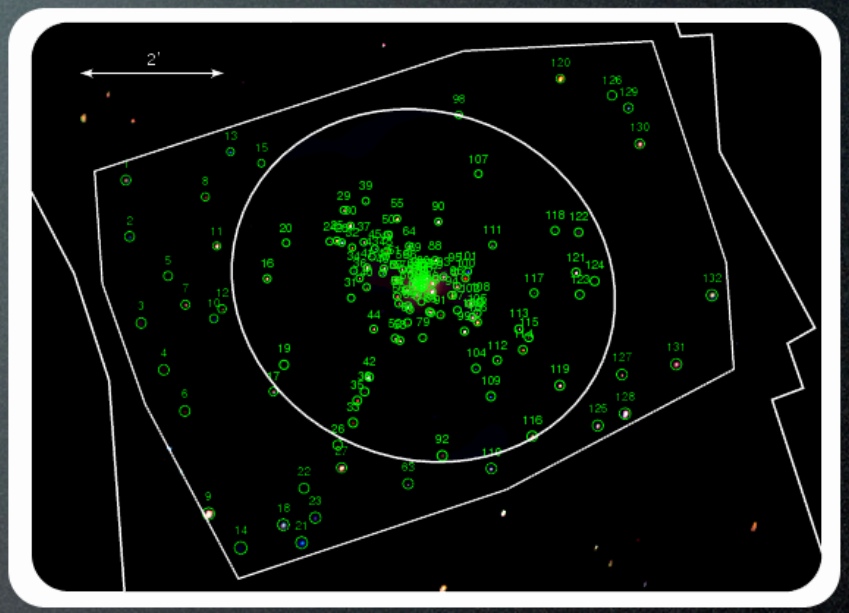
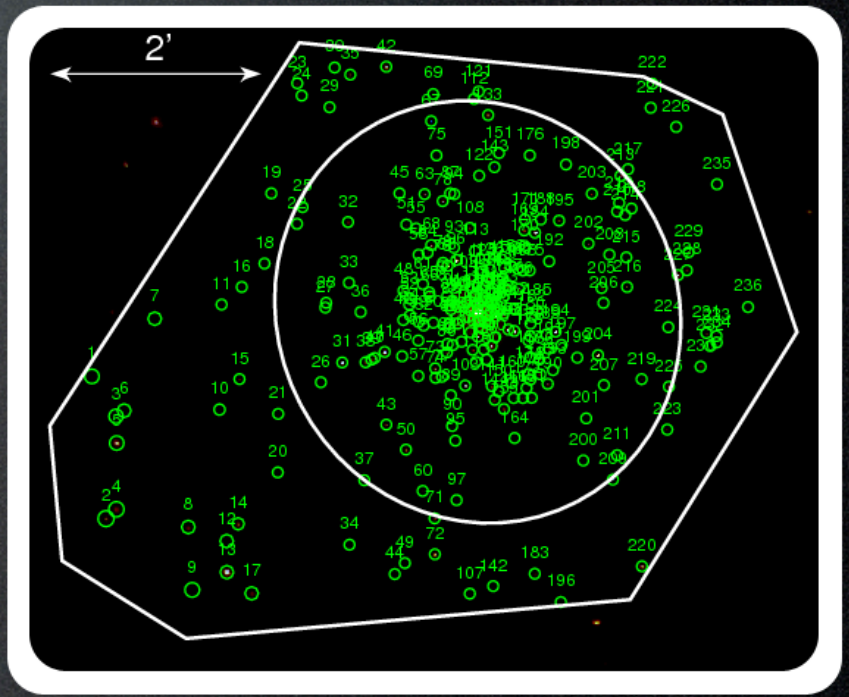
- Multi-epoch observations:
  - 5 pointings 324-ks (D_{25} 98 sources L_x~6x10^{36} erg s^{-1})
  - 6 pointings 459-ks (D_{25} 180 sources L_x~1x10^{37} erg s^{-1})





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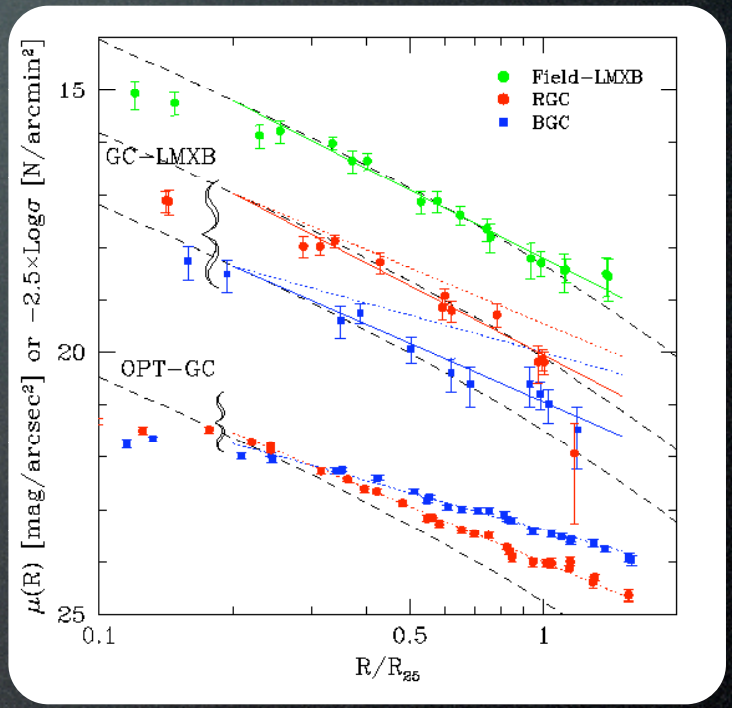

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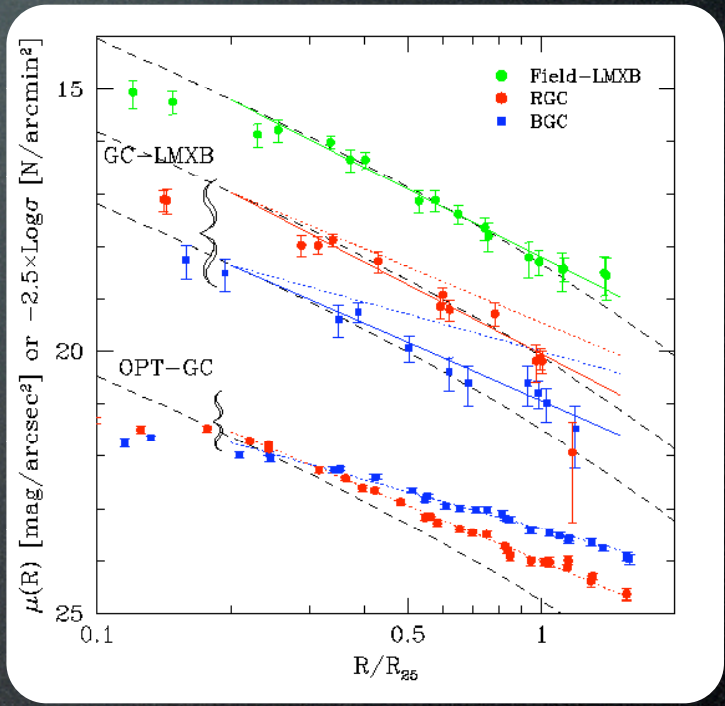

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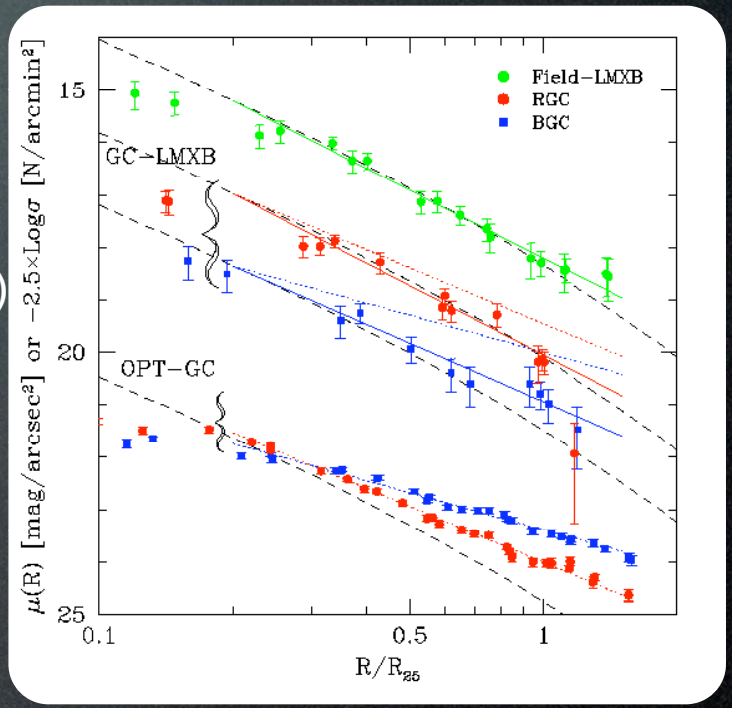

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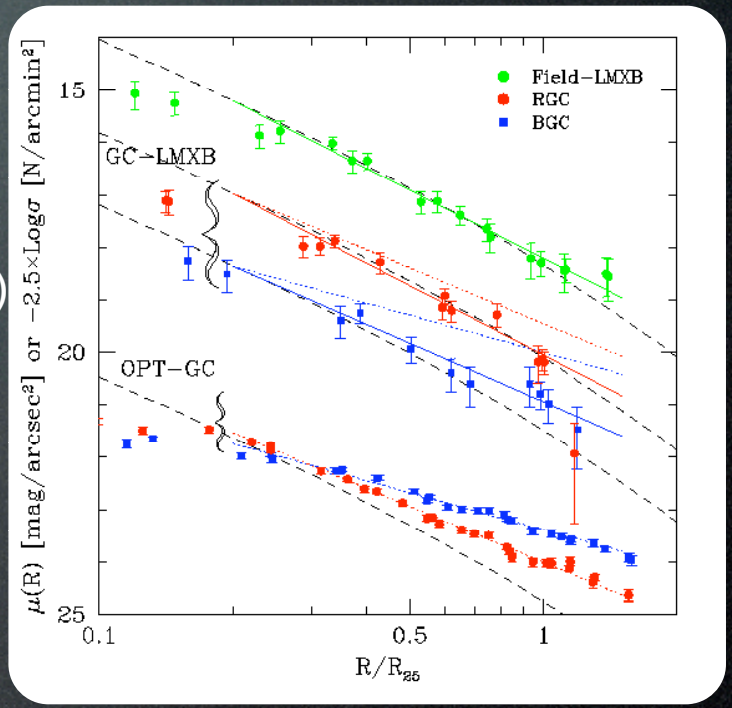

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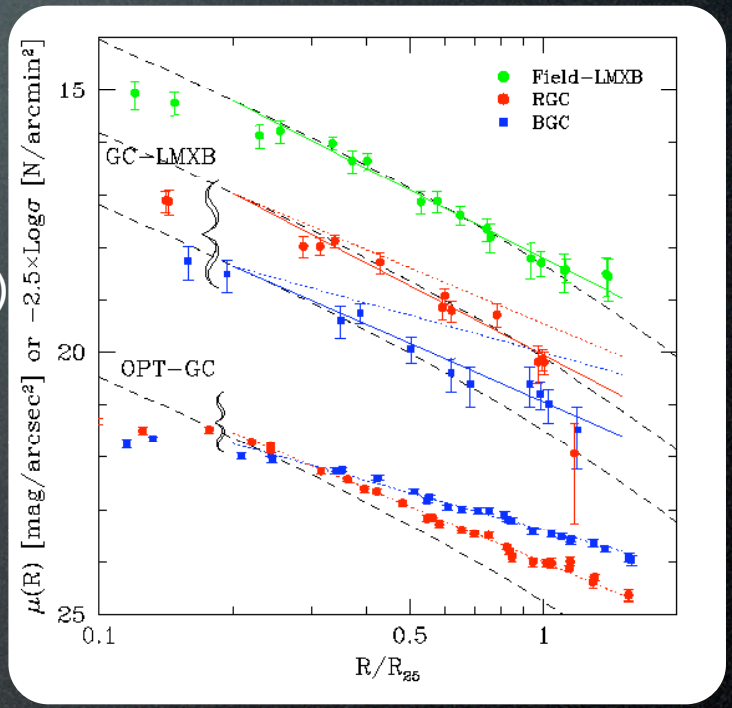

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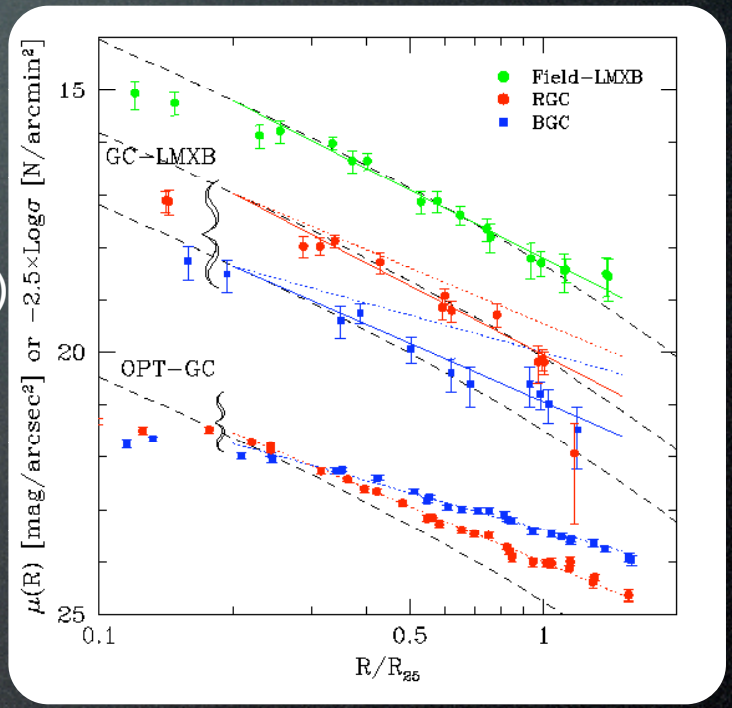

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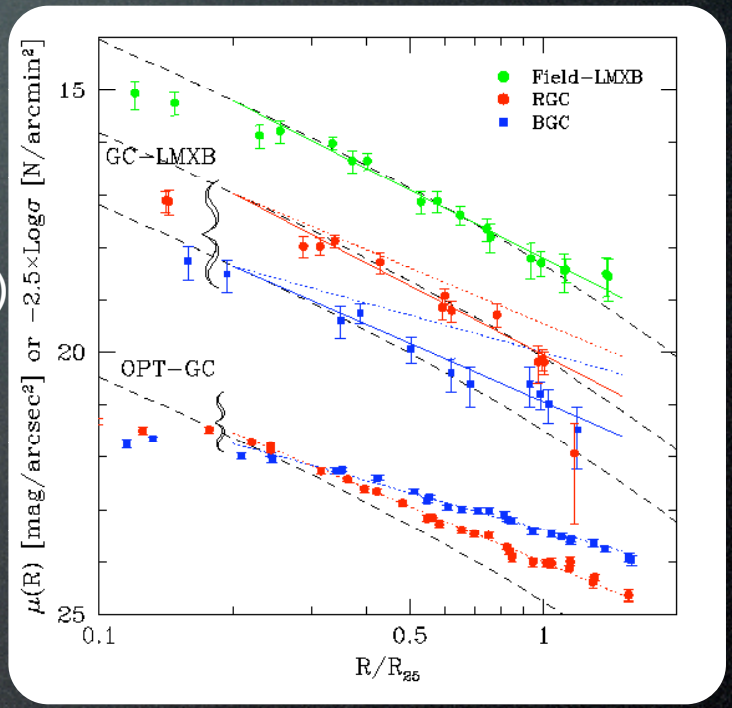

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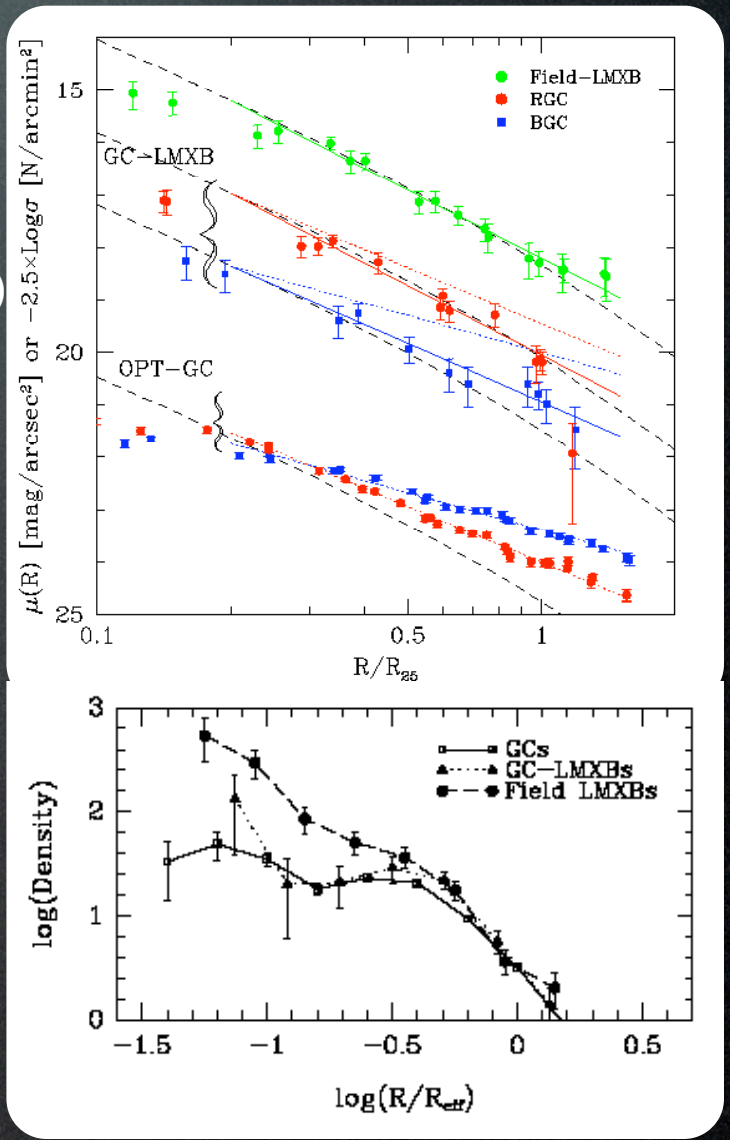

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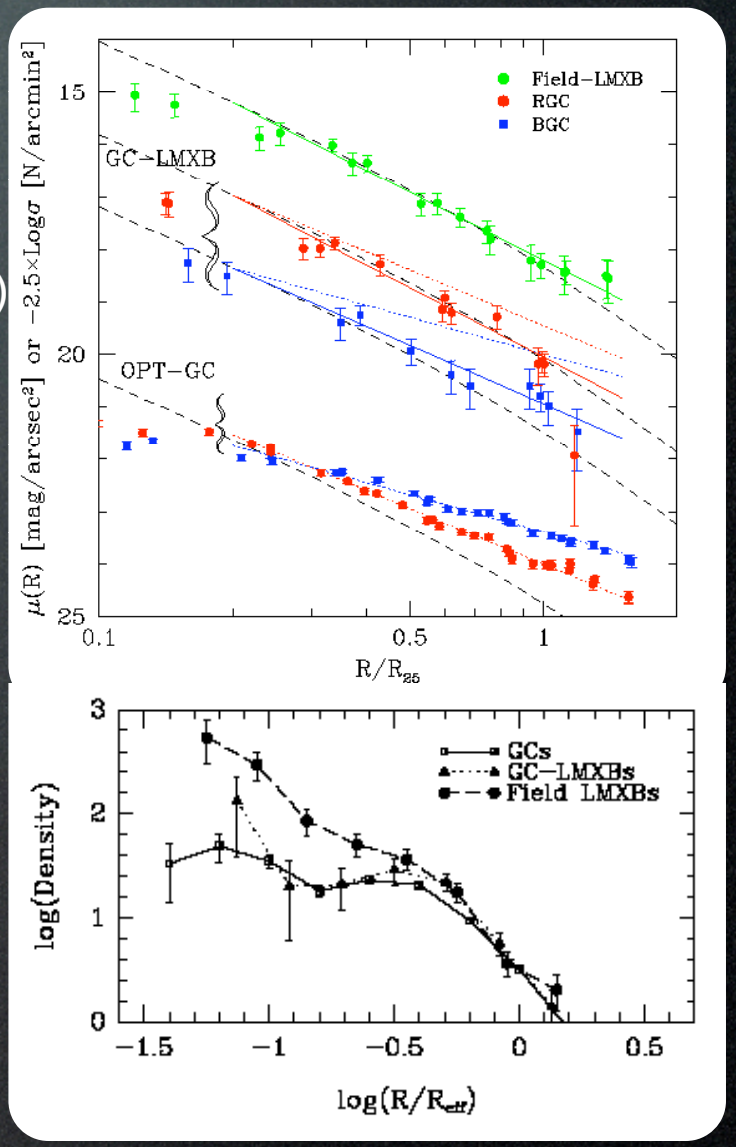

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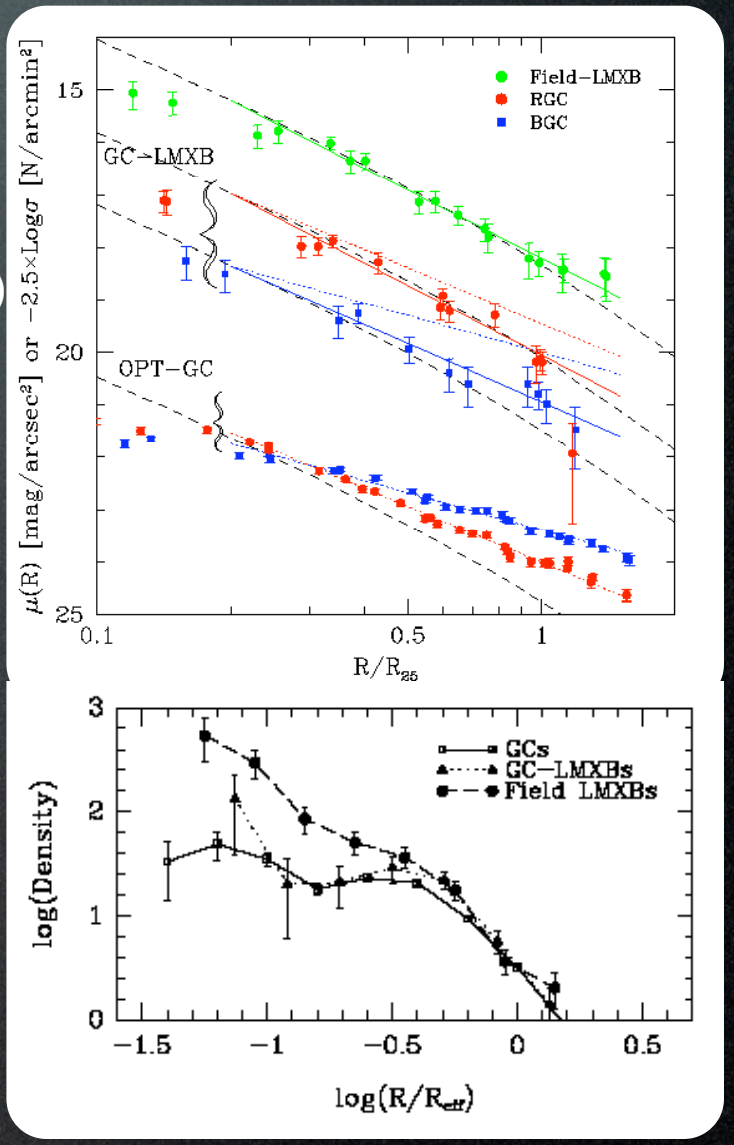

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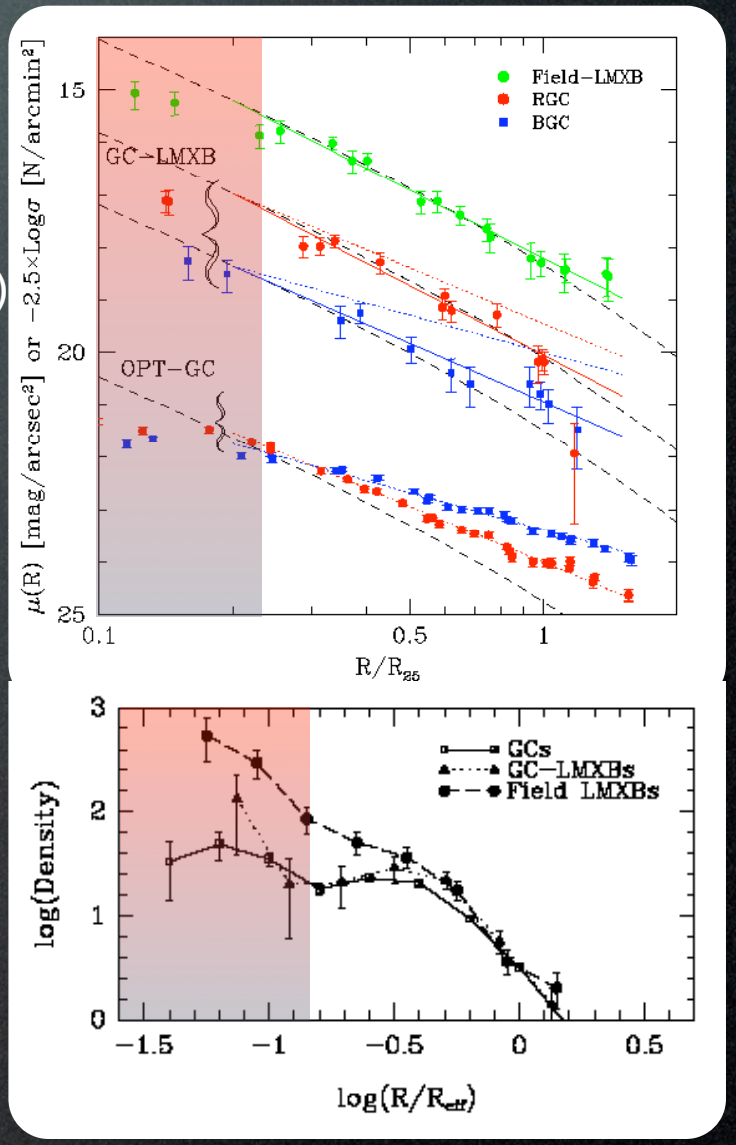
- …However, for nearby galaxies sources at radii < 10″ are crowded/confused with *Chandra*



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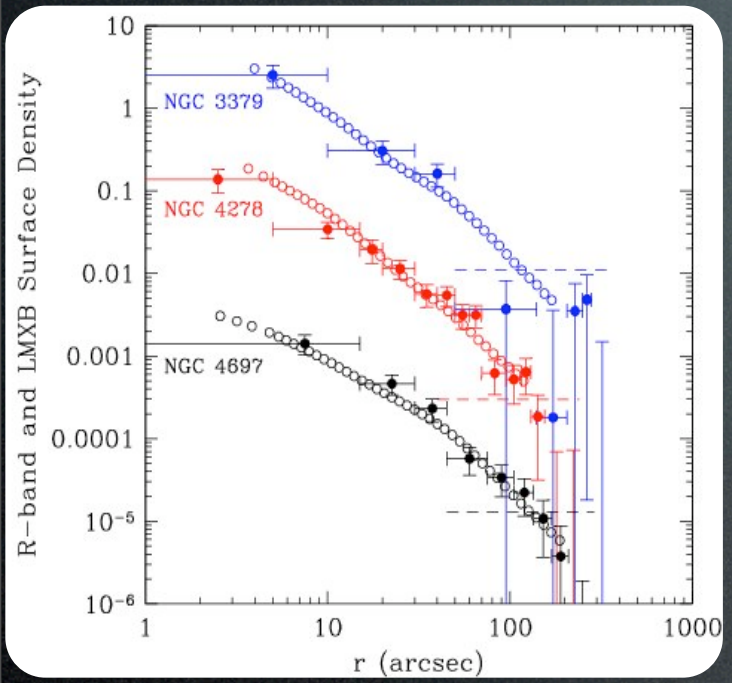

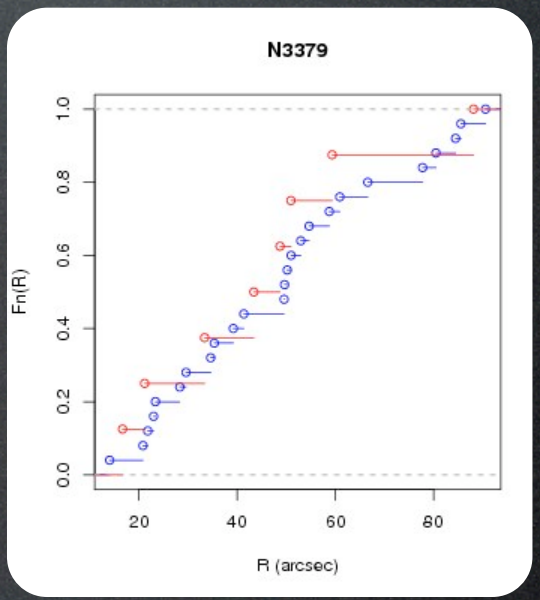

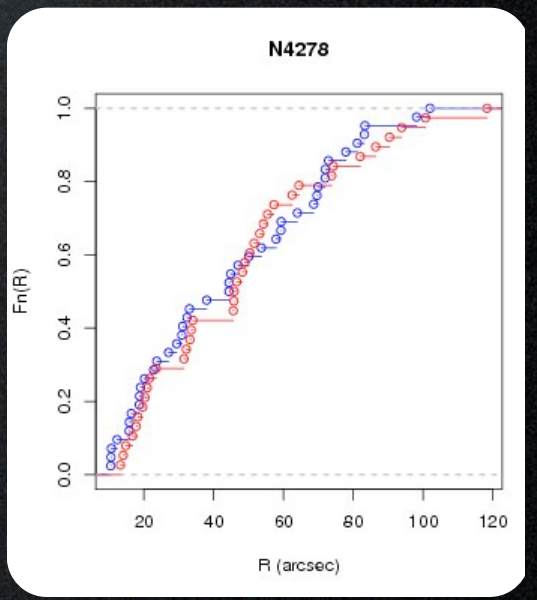

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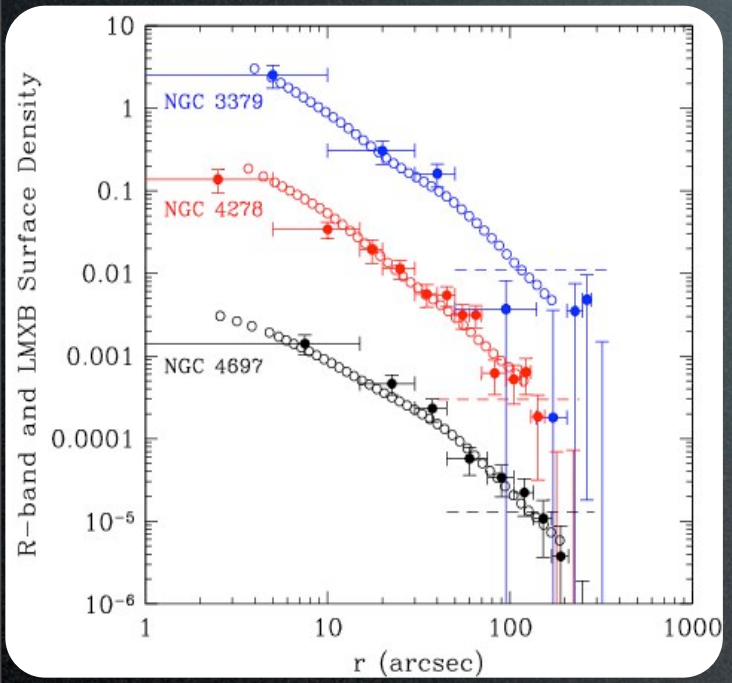

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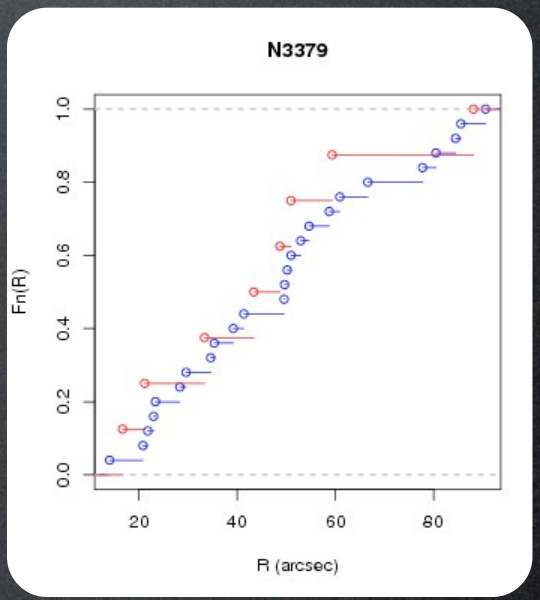

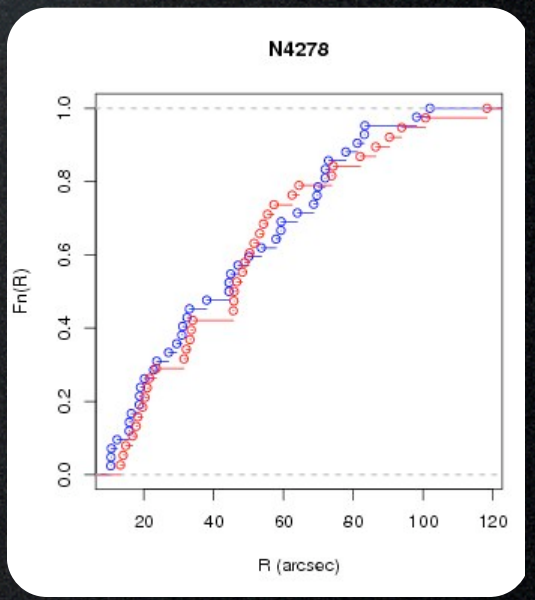

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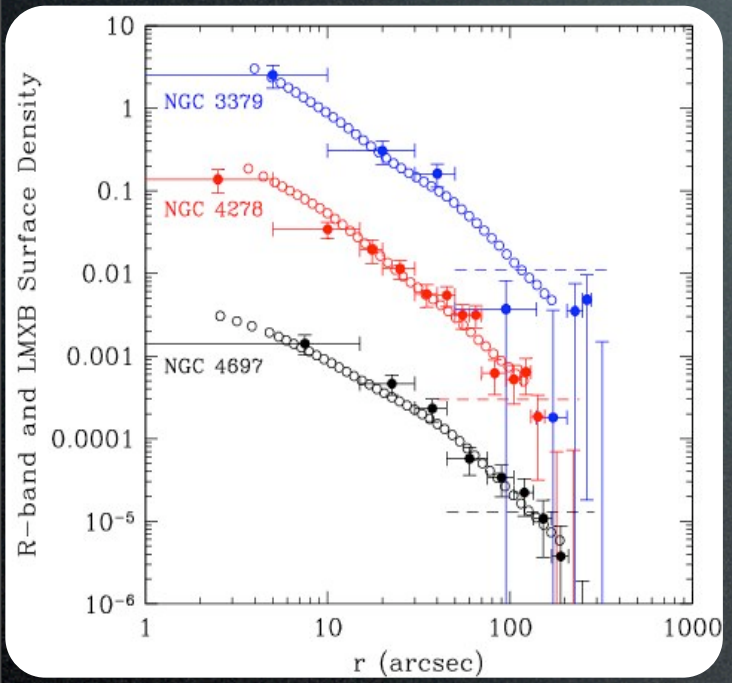

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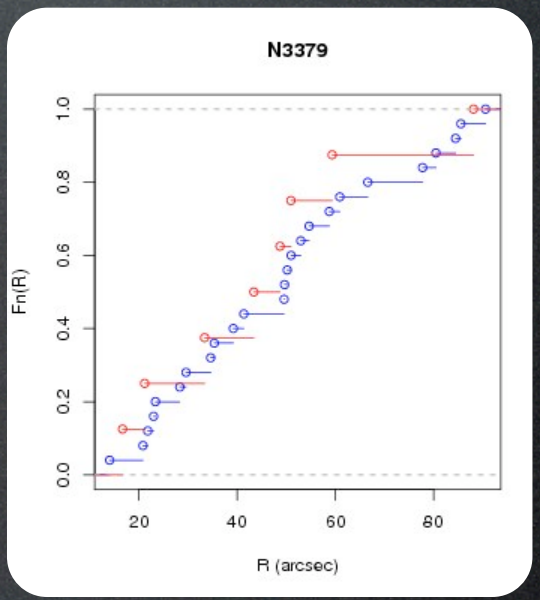

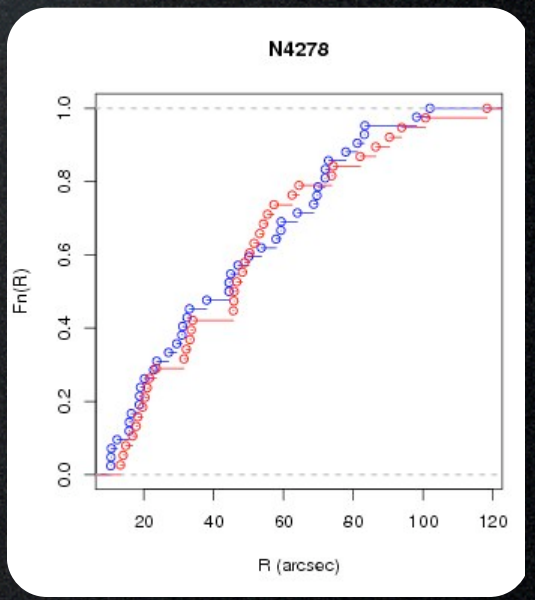

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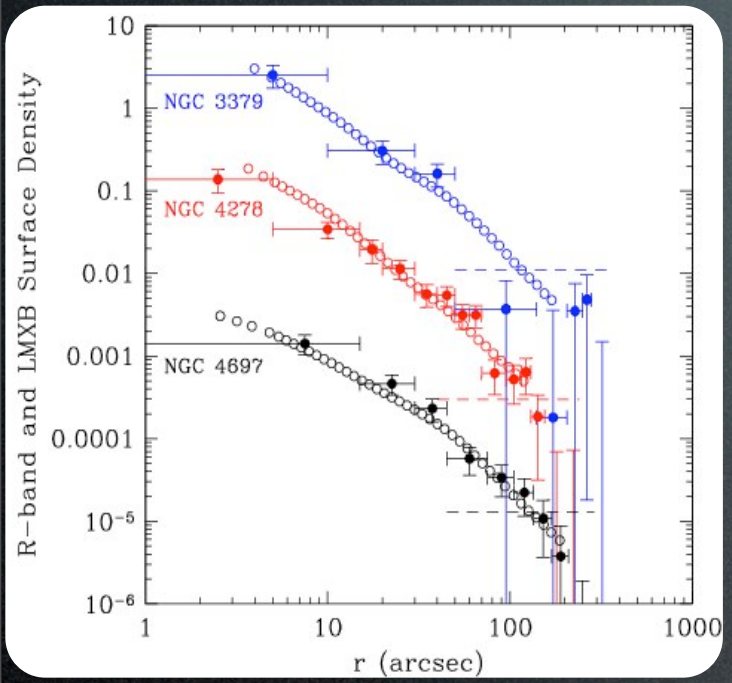

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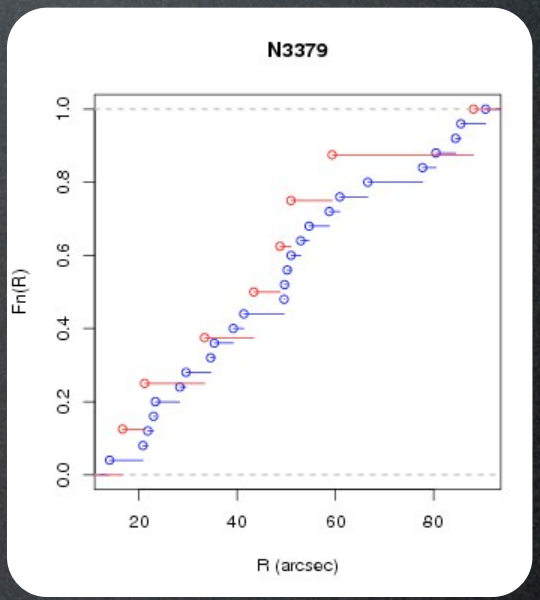

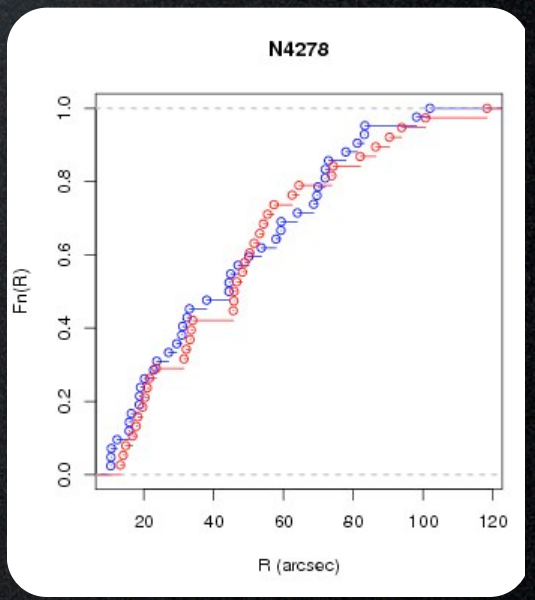

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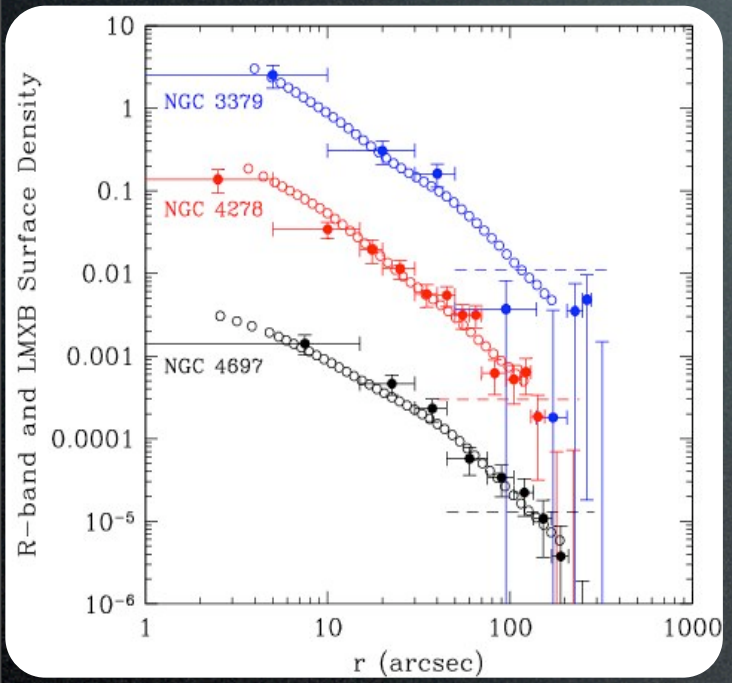

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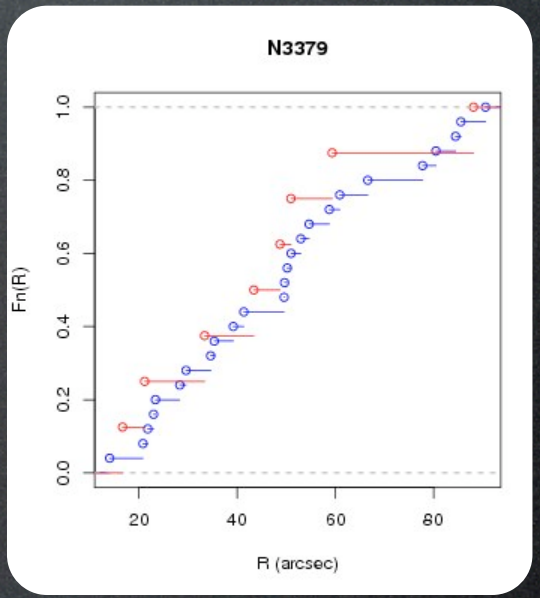

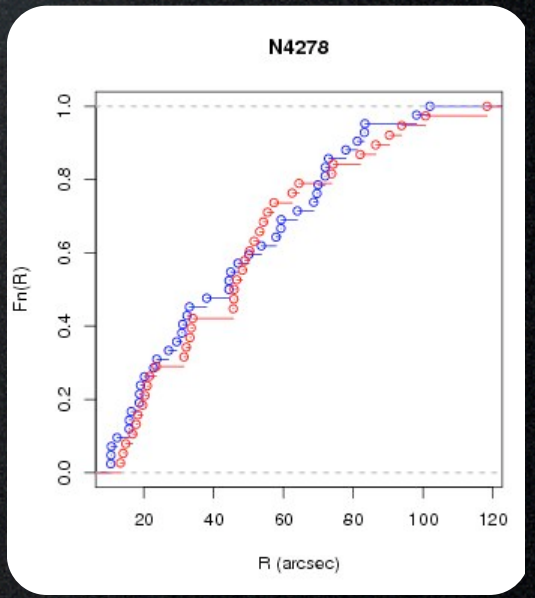

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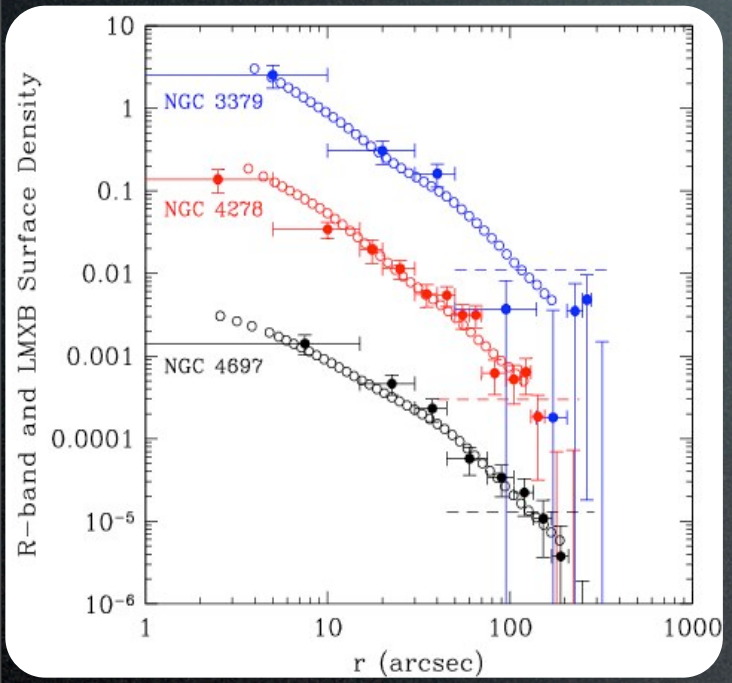

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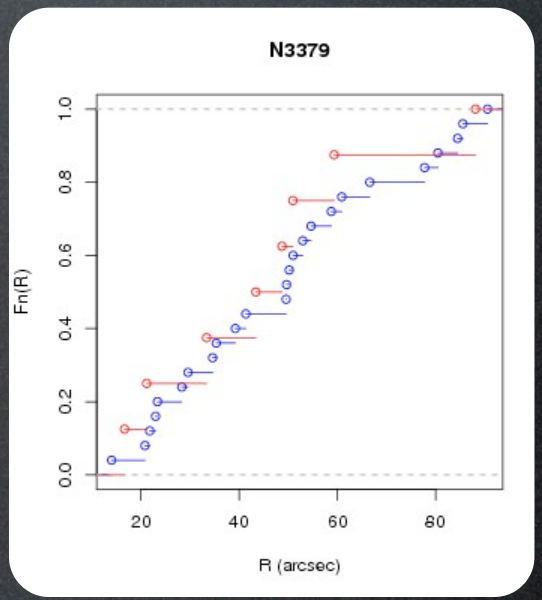
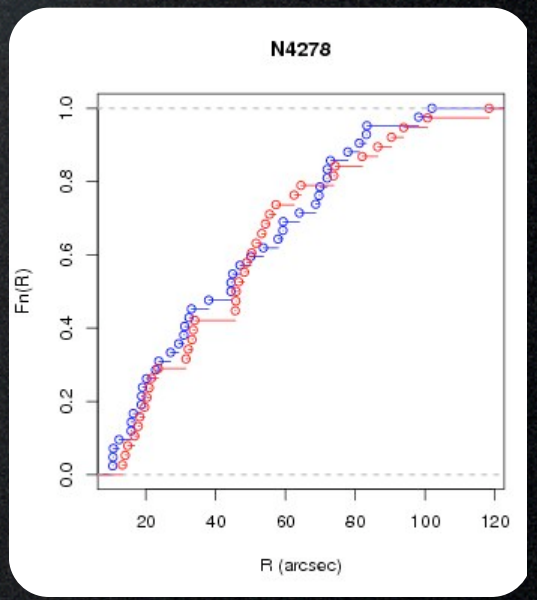
- The GC-LMXB distribution is more centrally peaked than the GC distribution.





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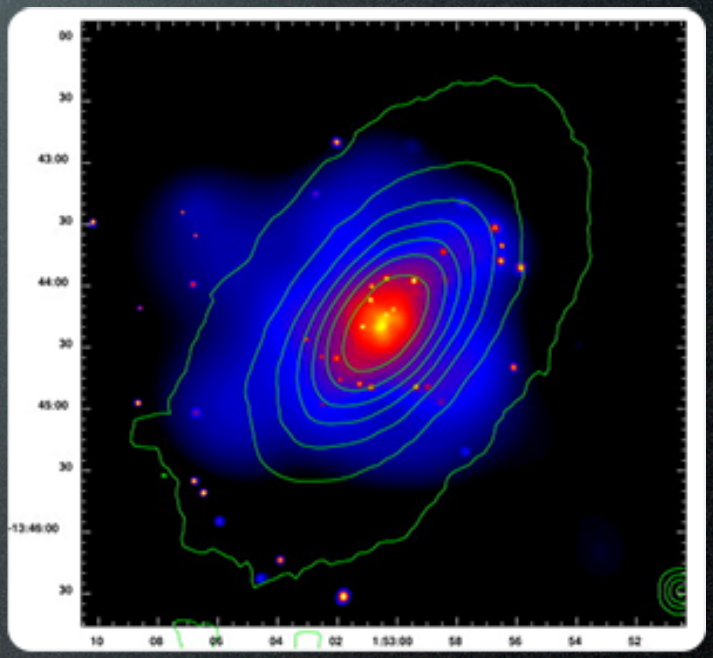

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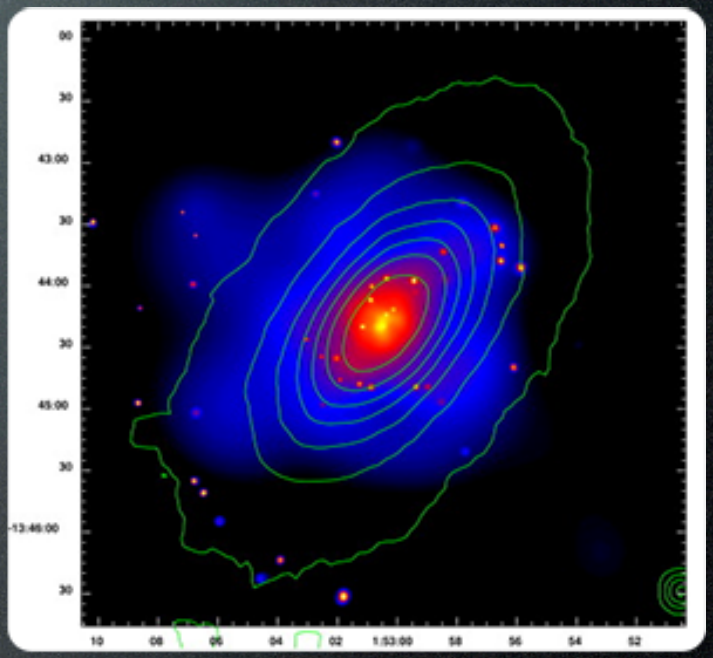

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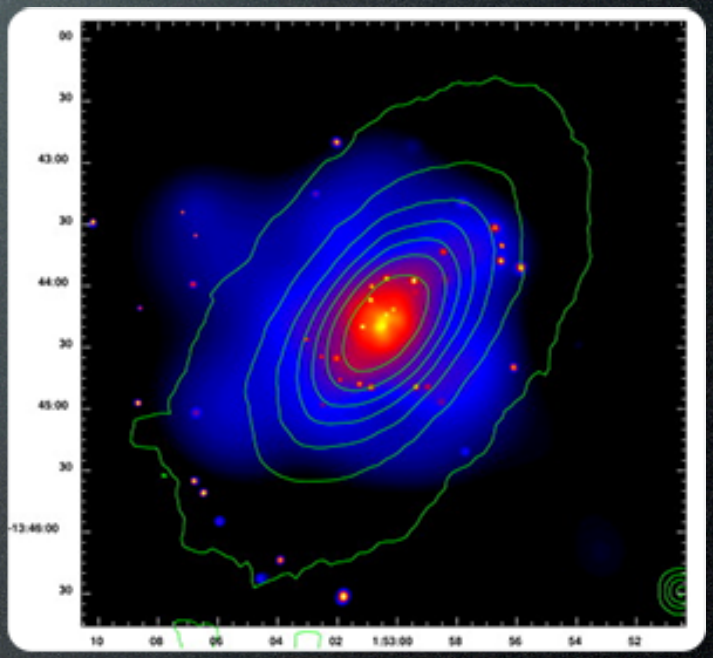

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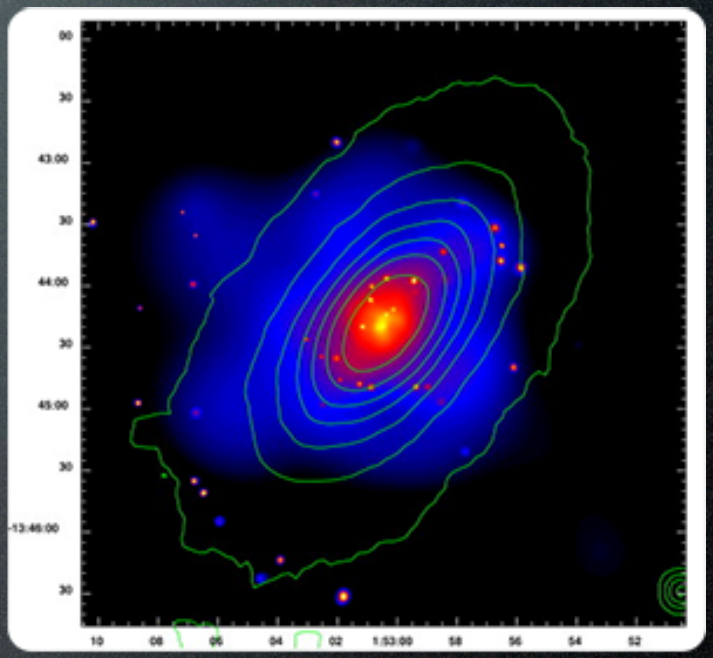

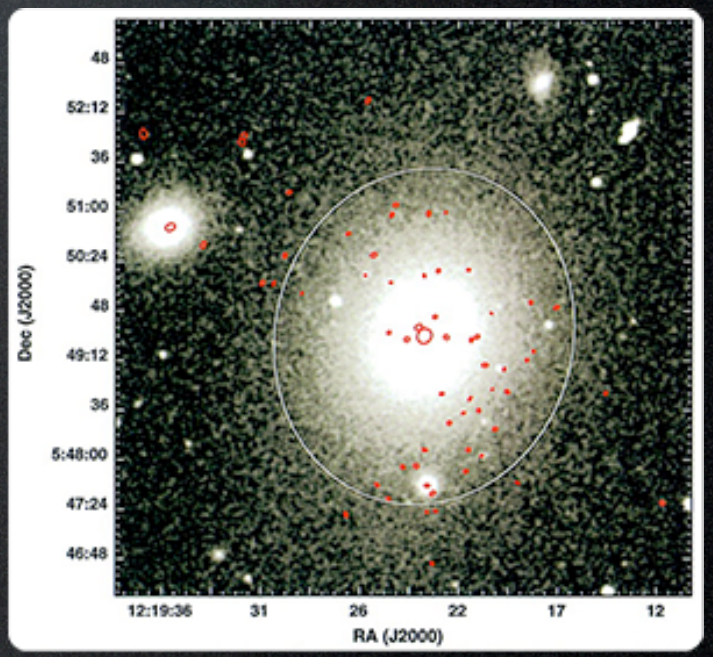

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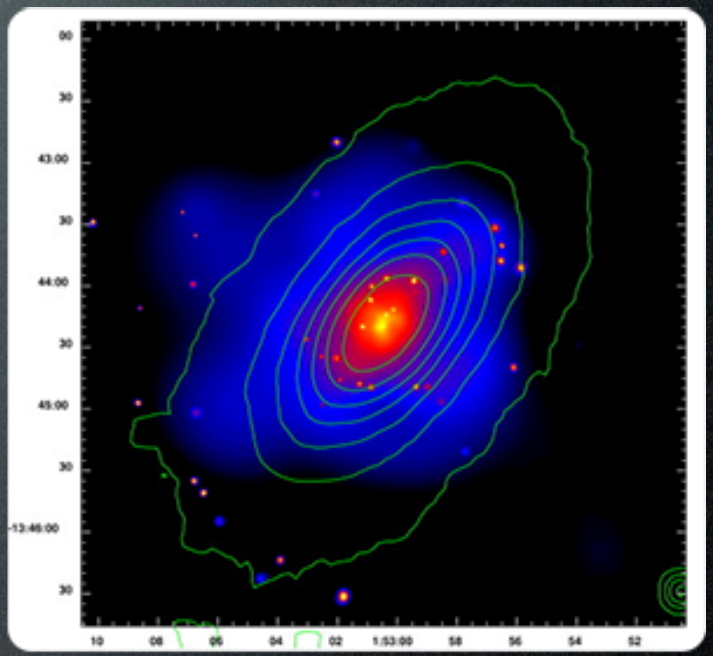
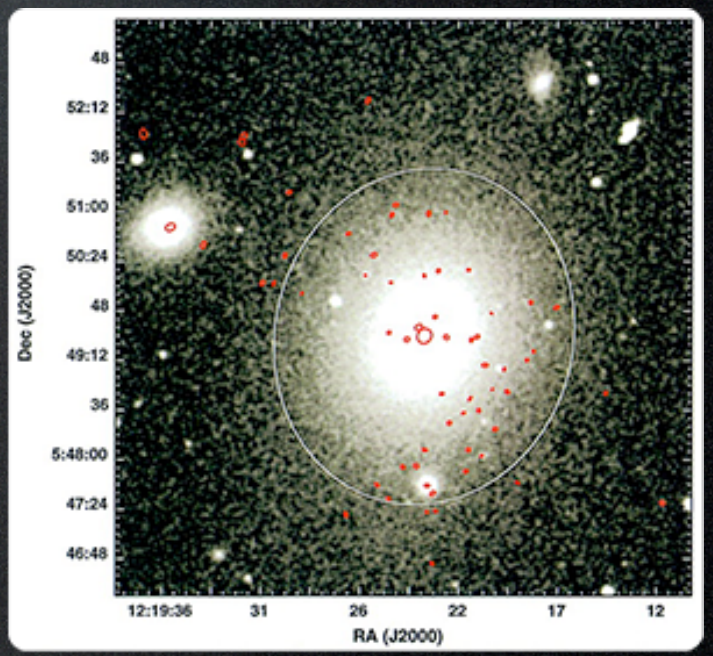
  - NGC 4697 can rule out at 98% confidence that LMXB distribution and optical profile belong to the same population.
    - See talk by Andreas later





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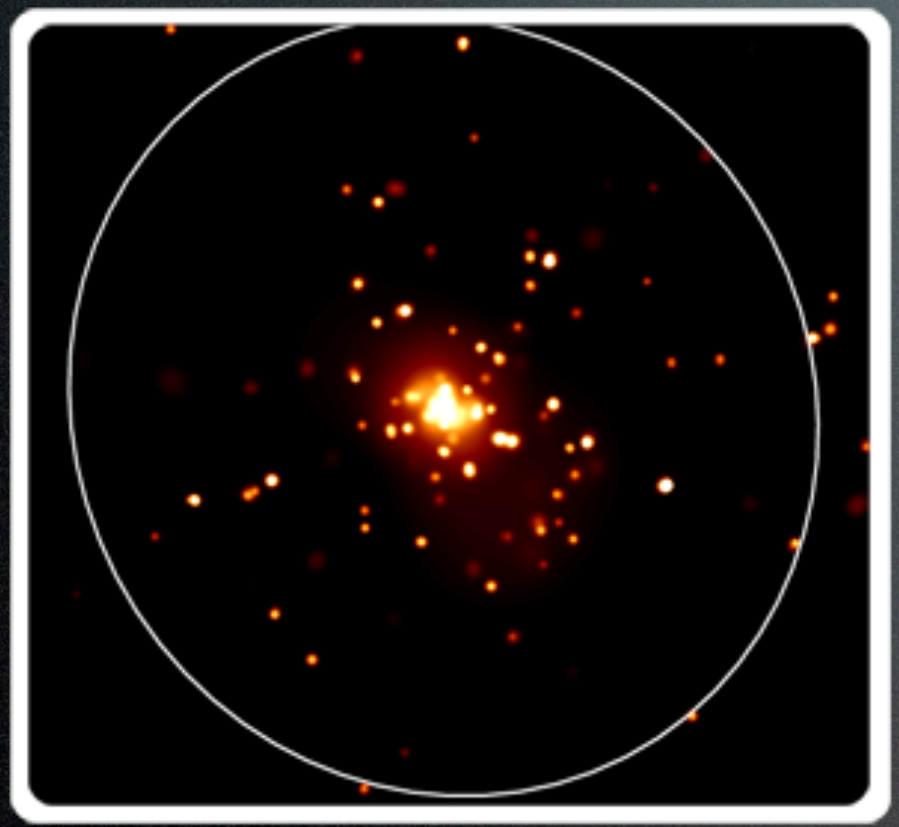

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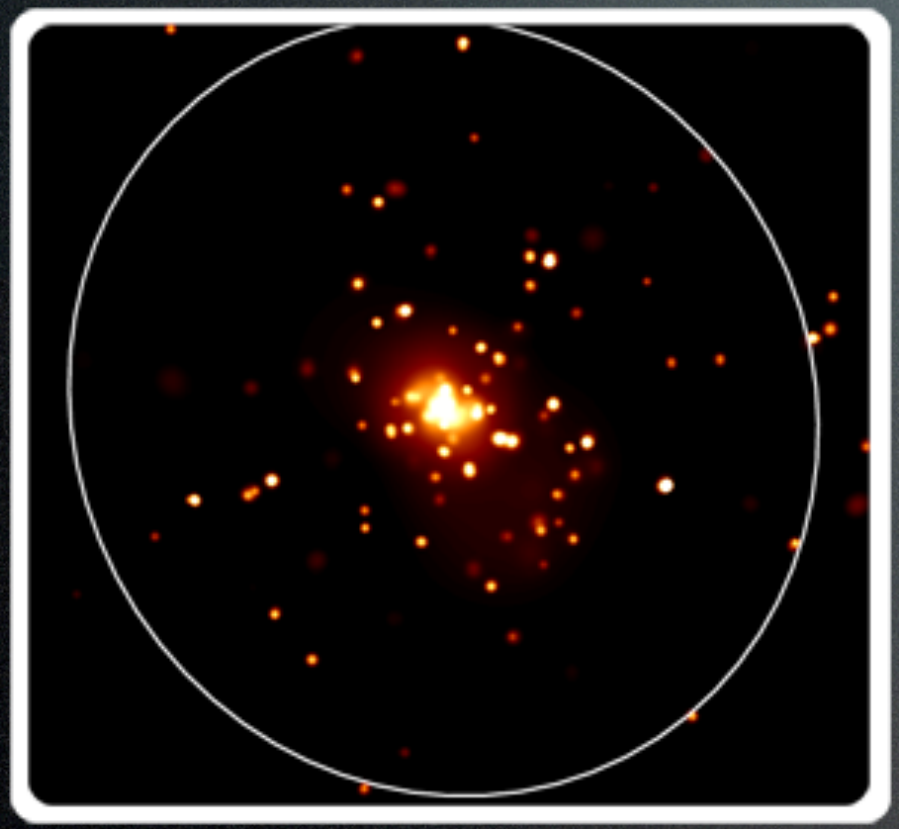

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- This observation of 37-ks detected sources to L_x~5x10^{37} erg s^{-1}.

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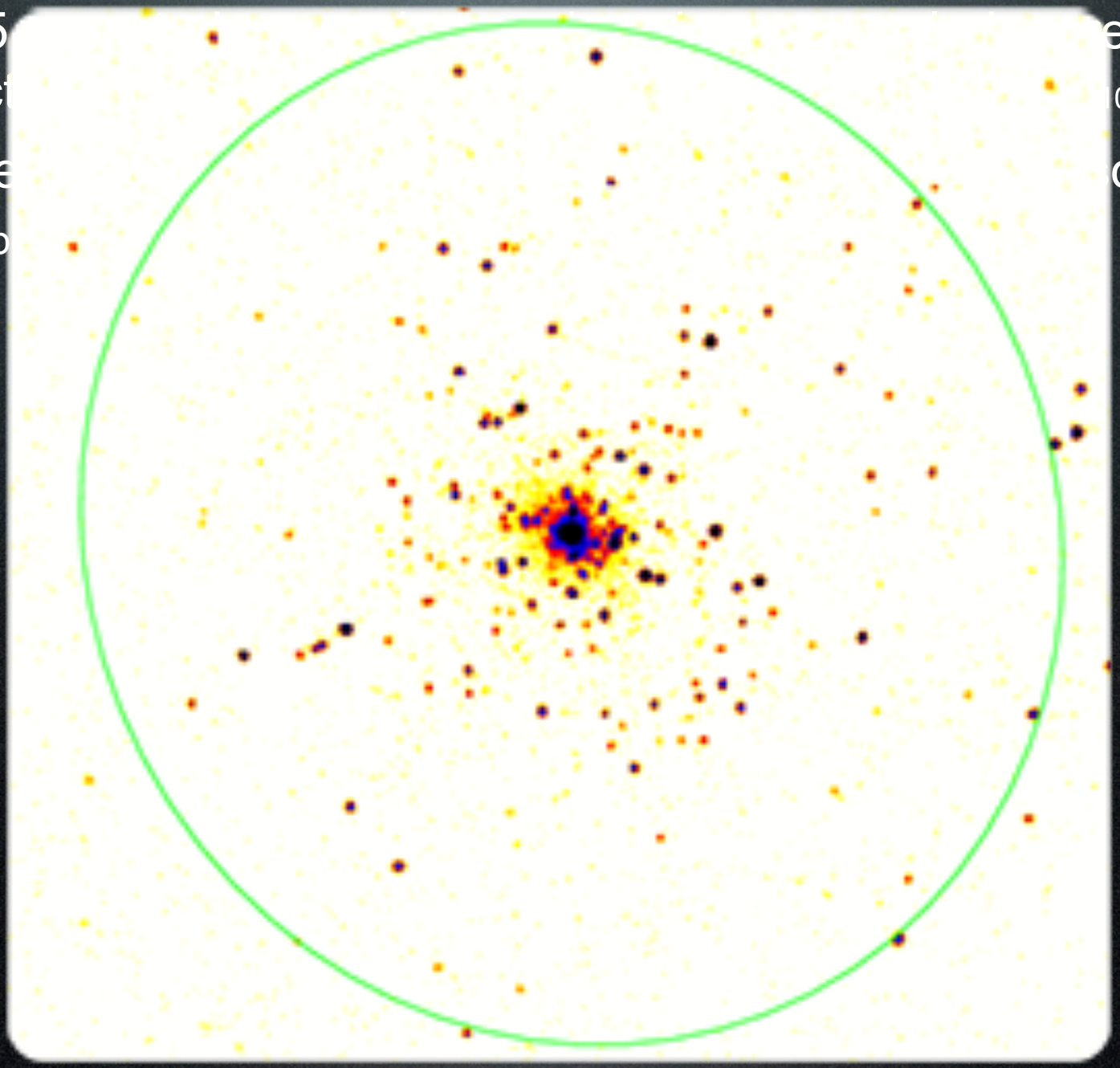

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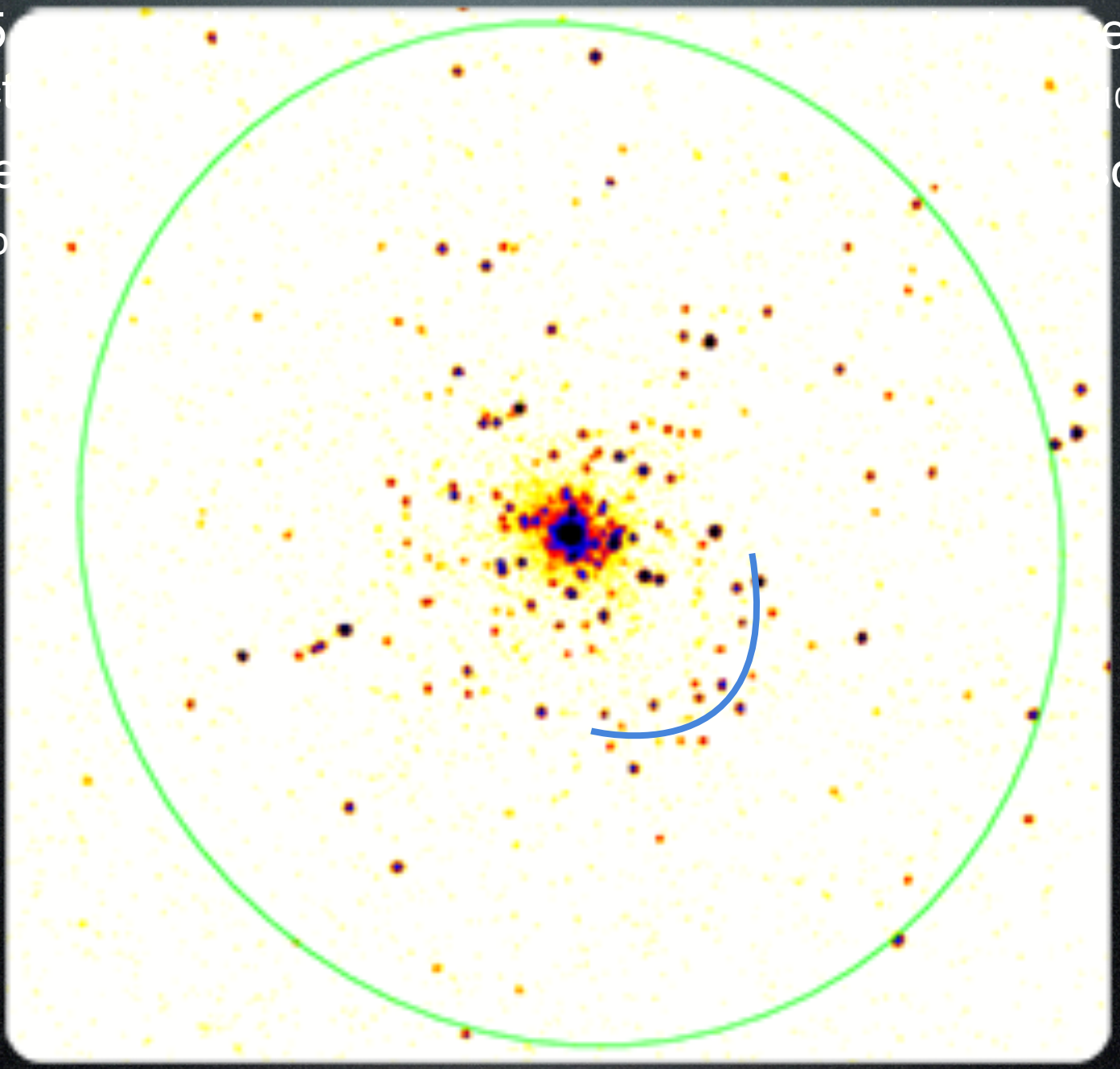

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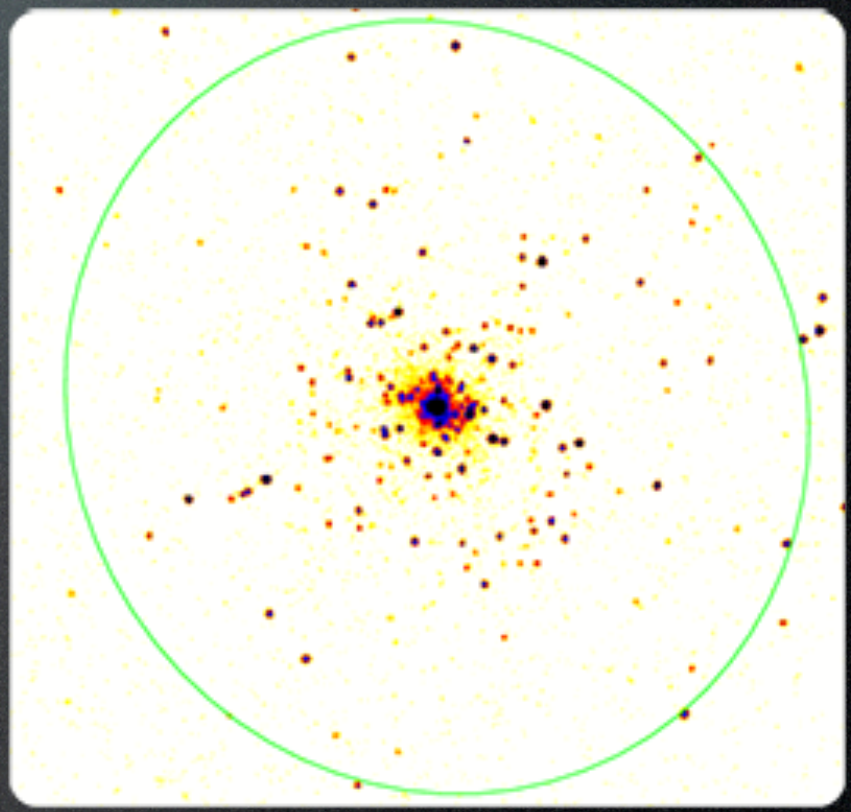

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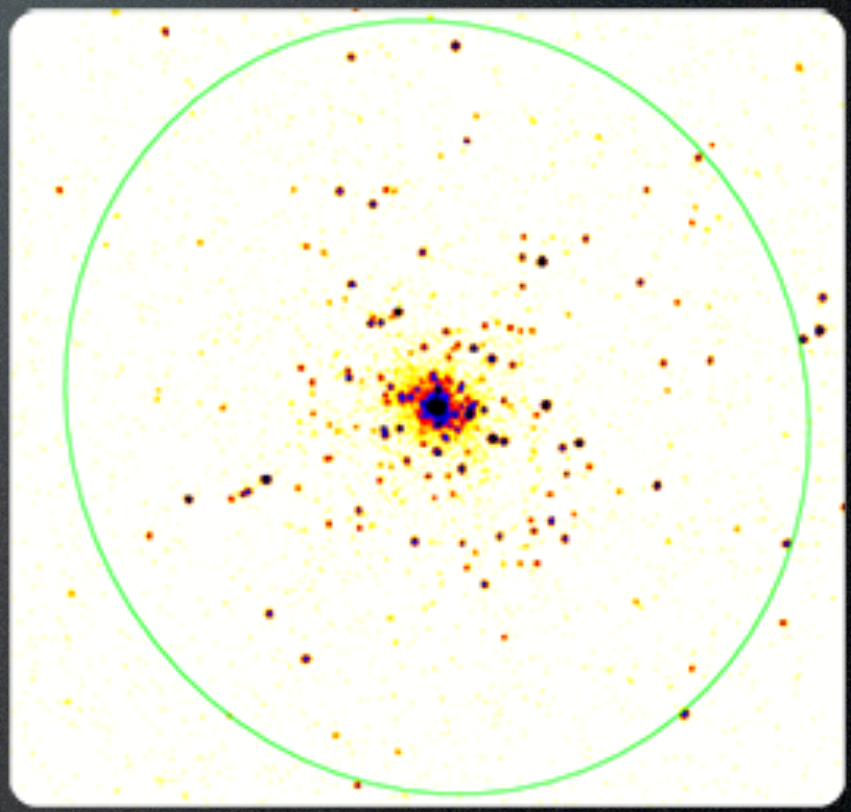

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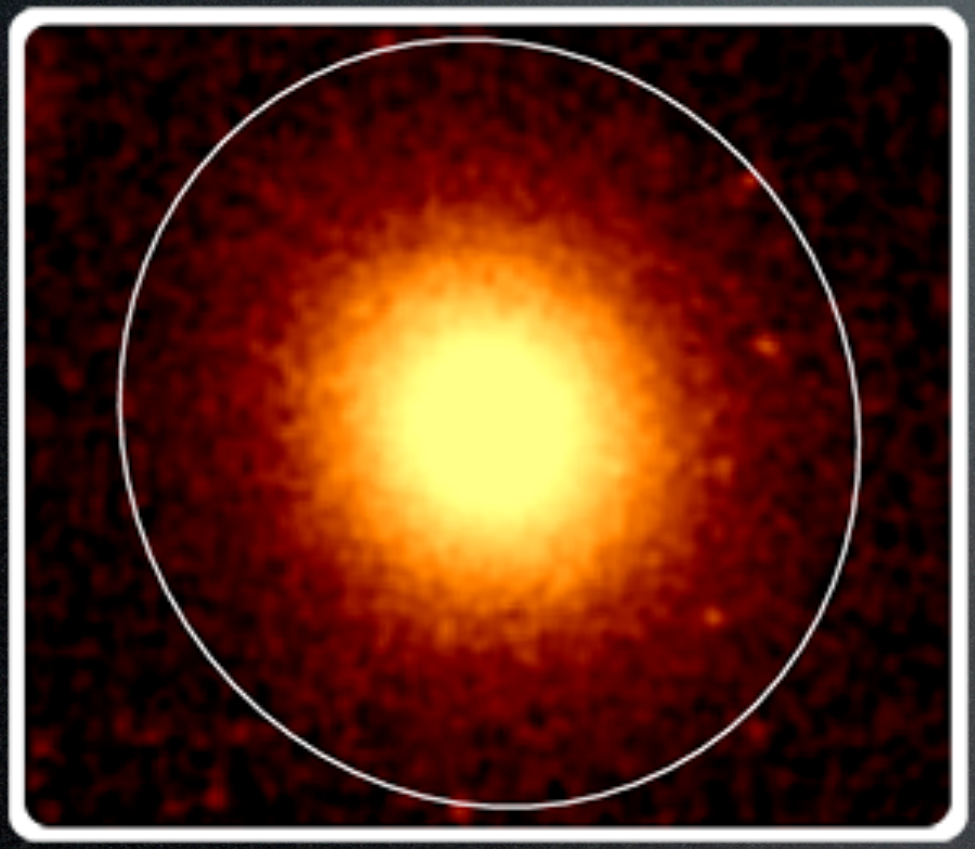

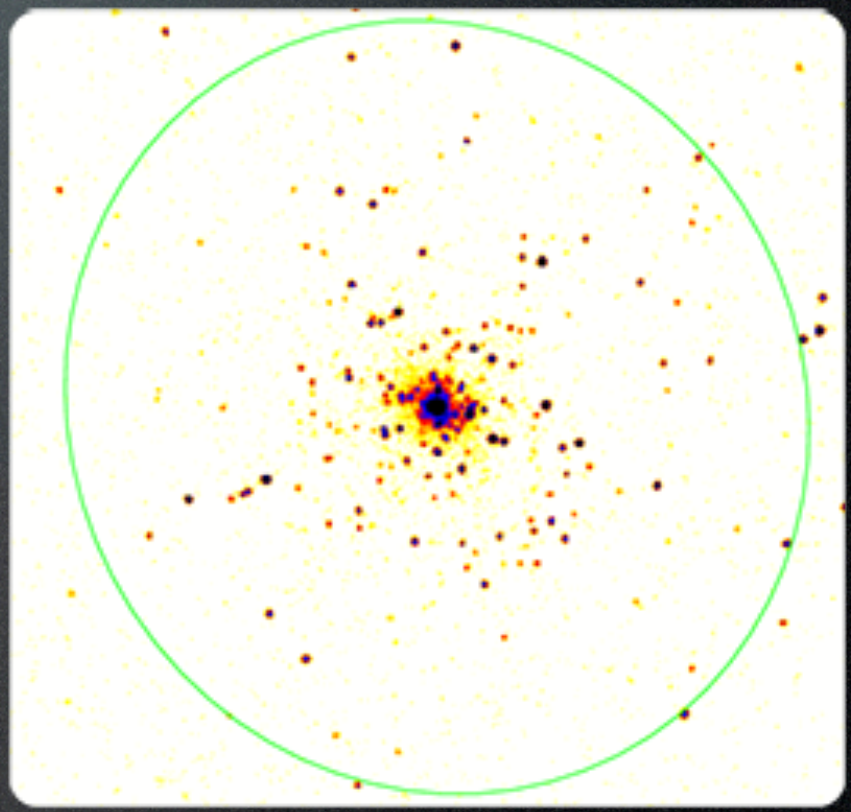

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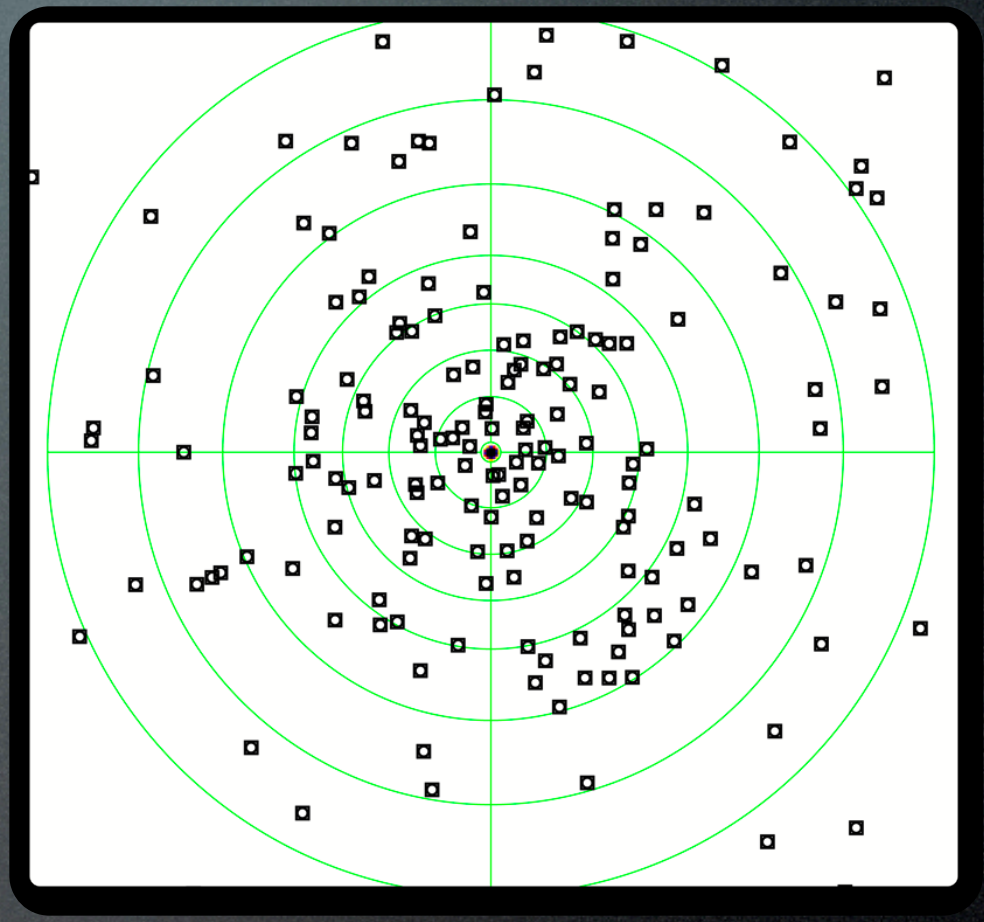

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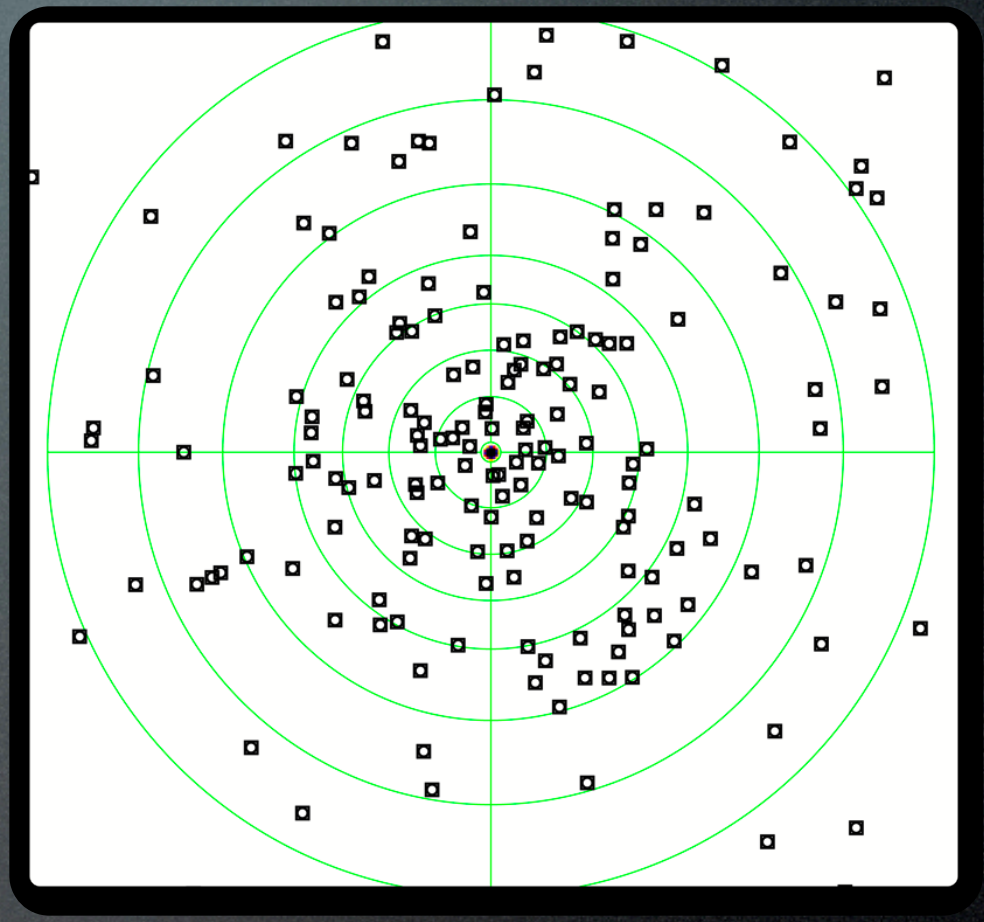

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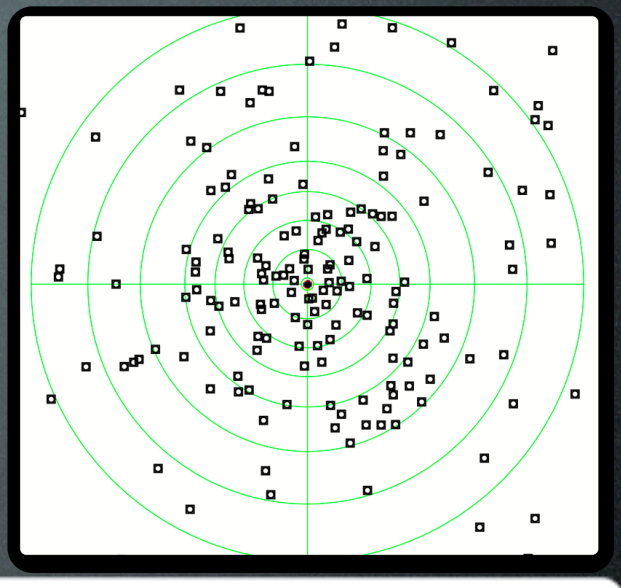

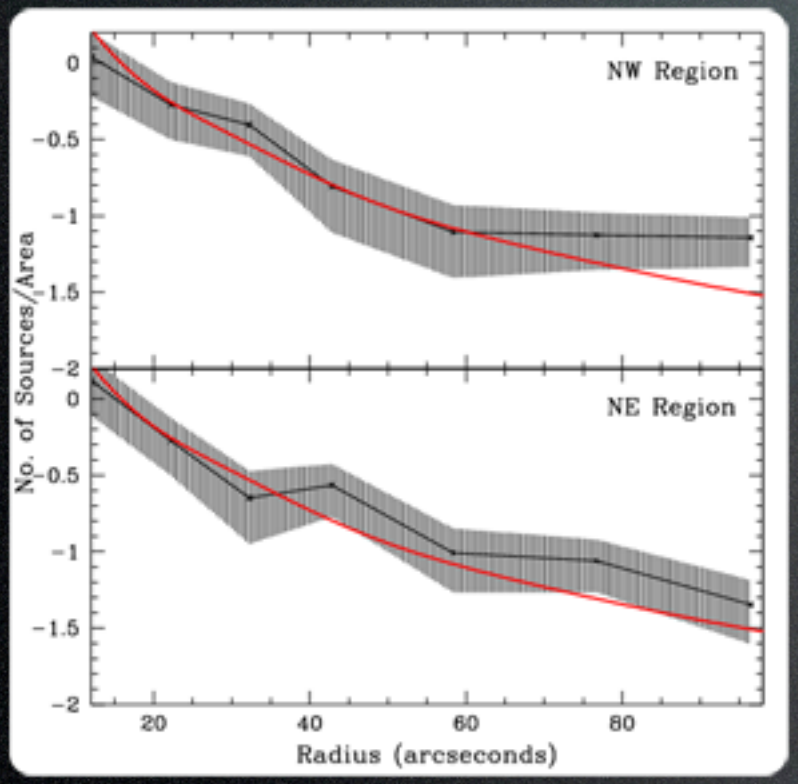

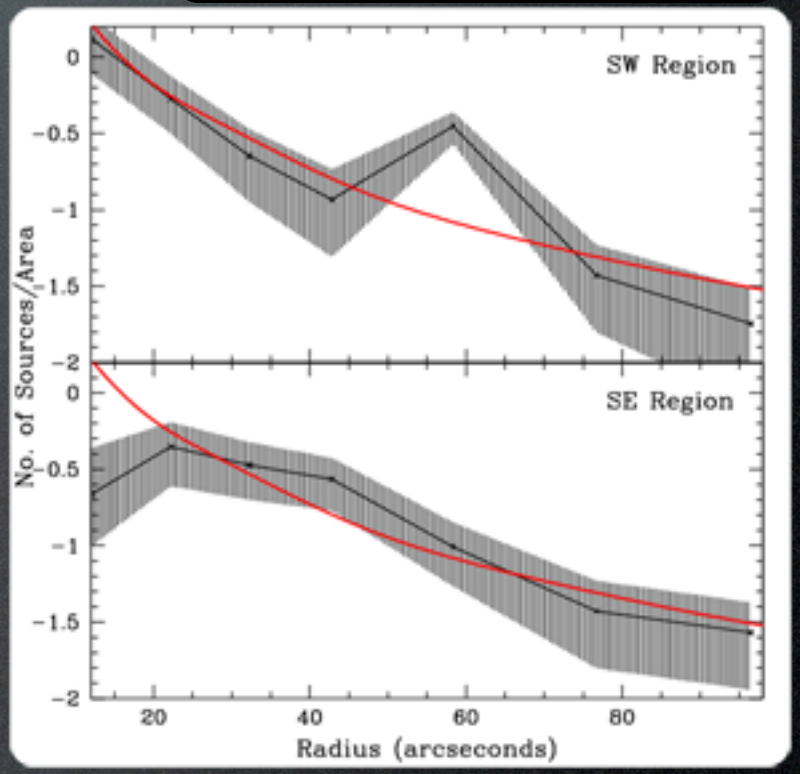

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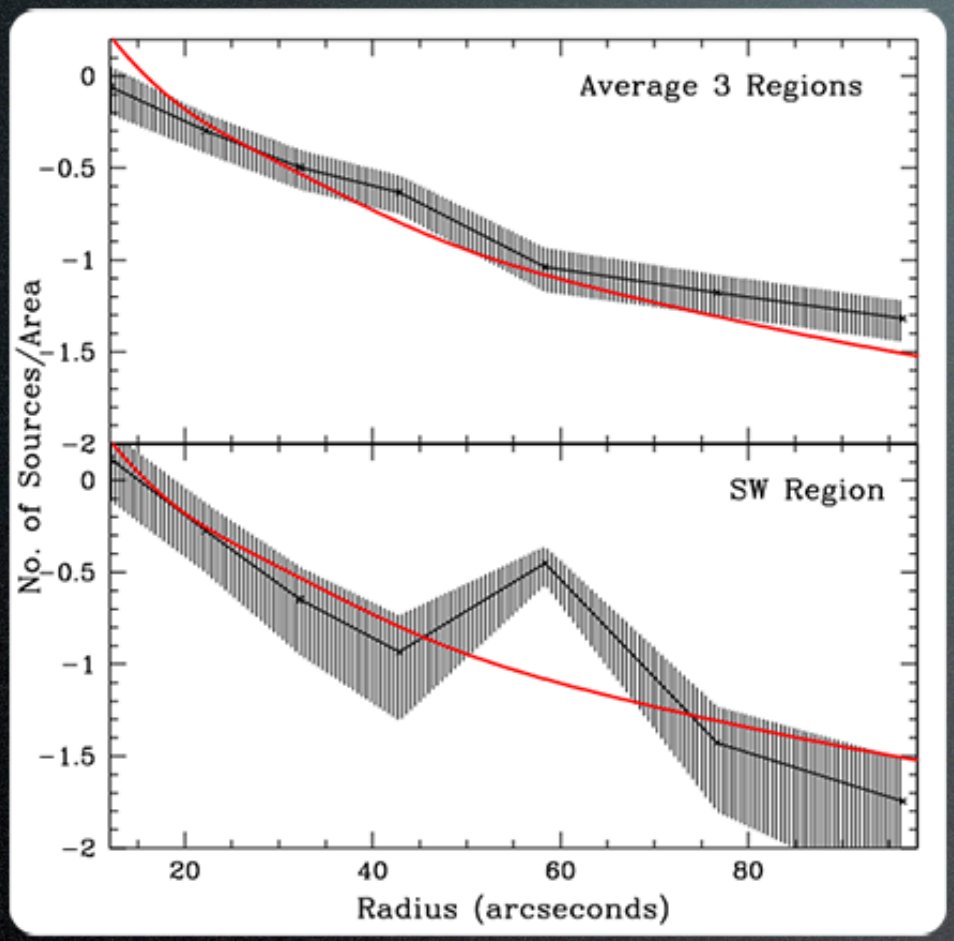

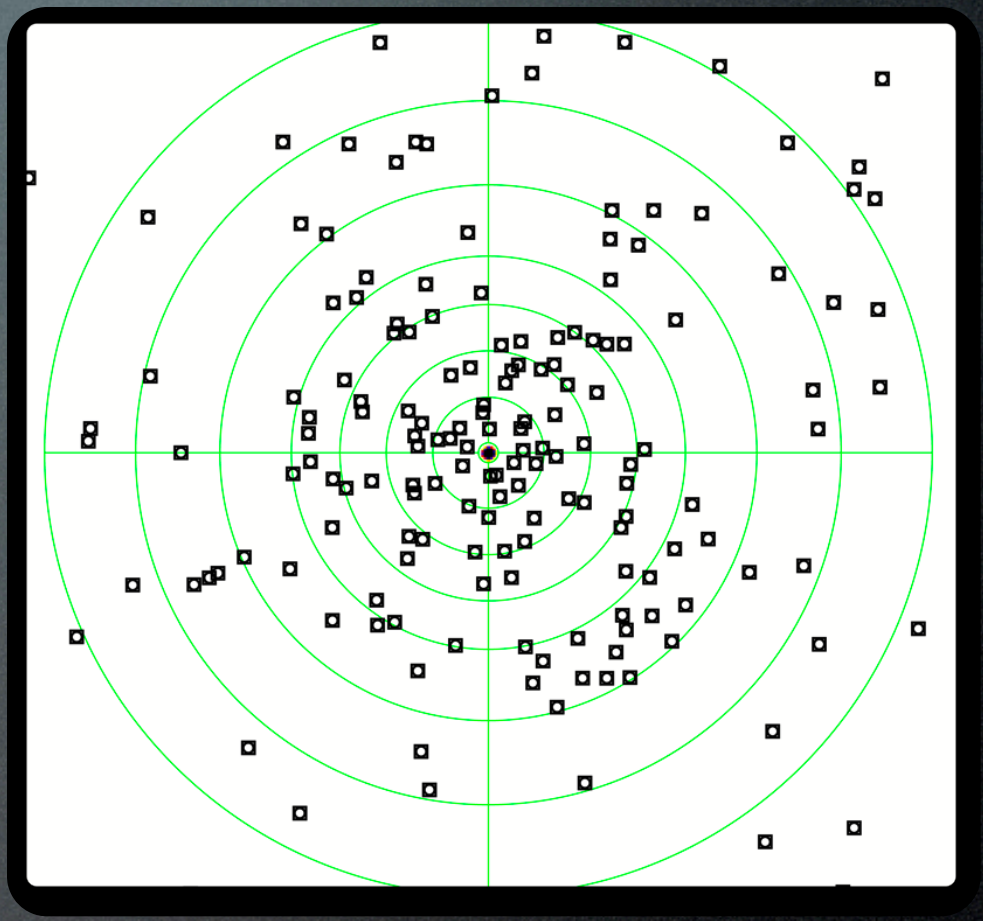

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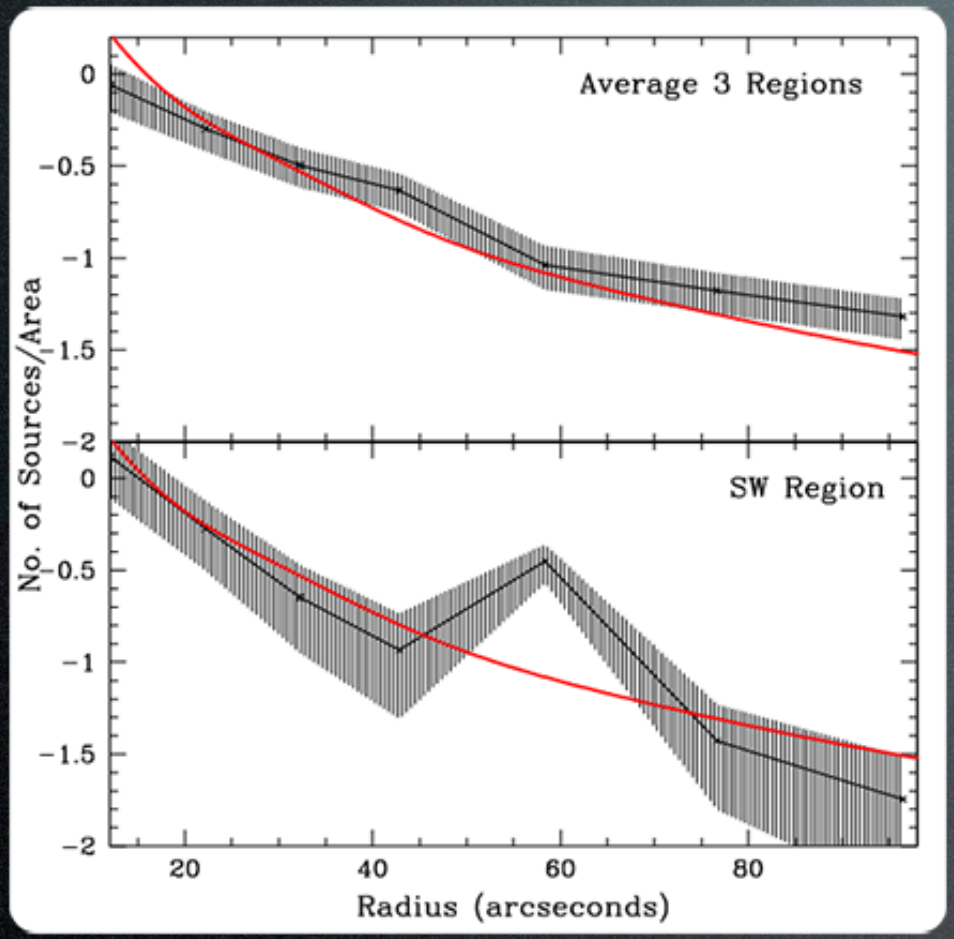

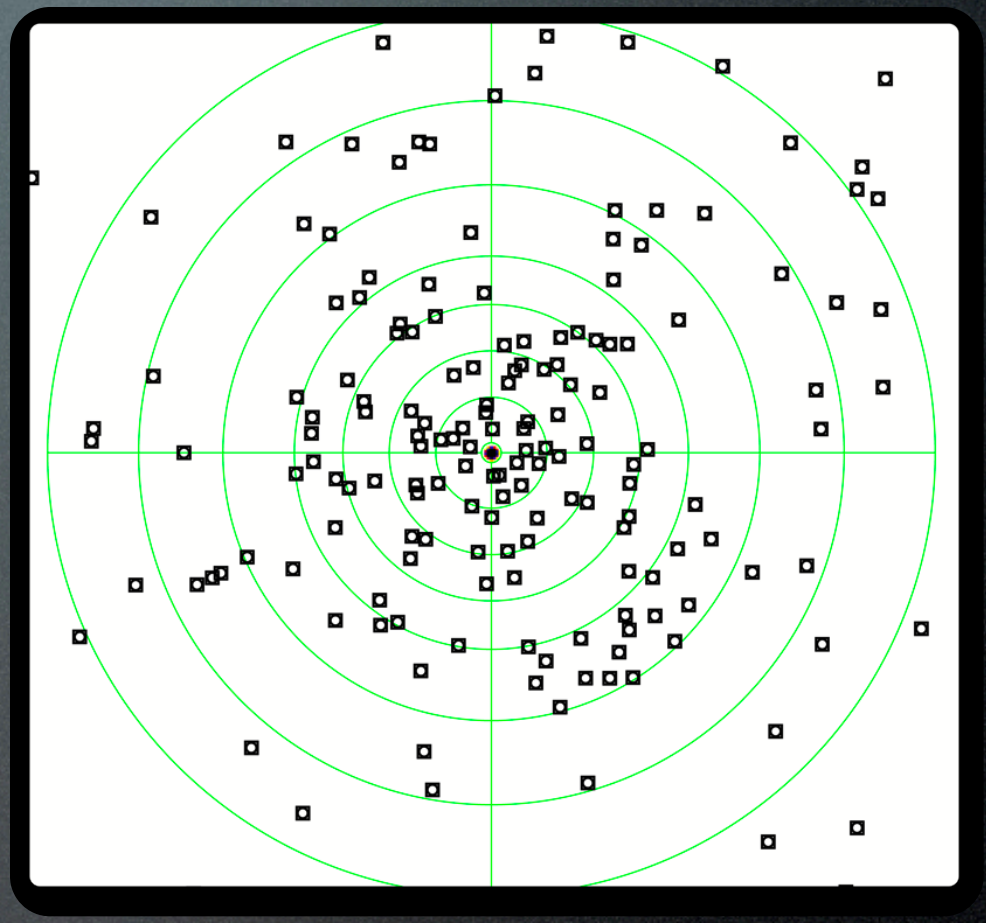

- Average of three quadrants to optical $\chi^2 = 3.5/5$
- Fitting the SW region to the optical profile $\chi^2 = 12.0/5$
- Comparing sources in same radial bin >3σ excess in SW

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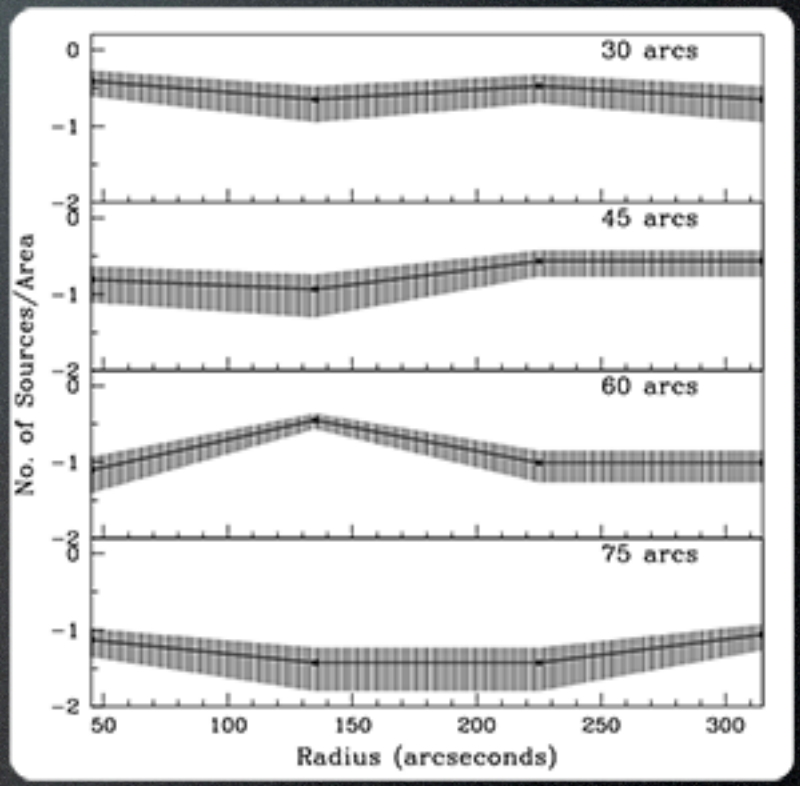

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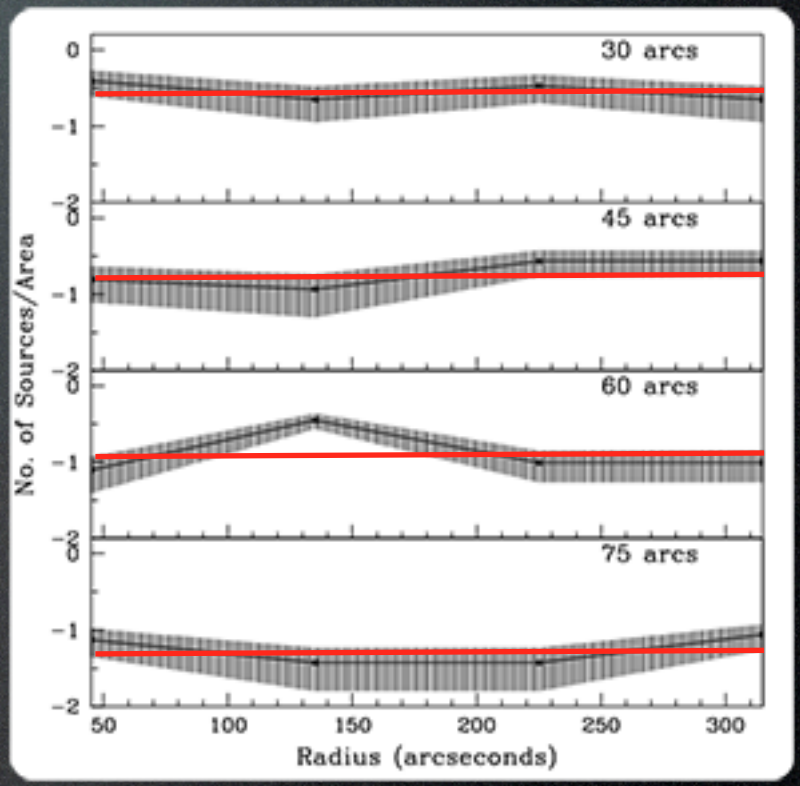

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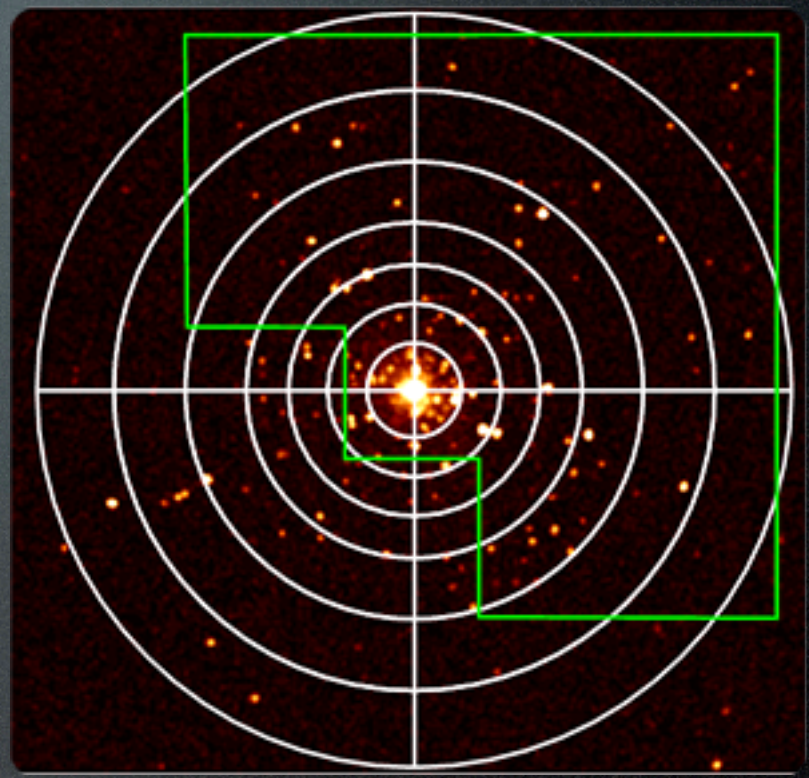

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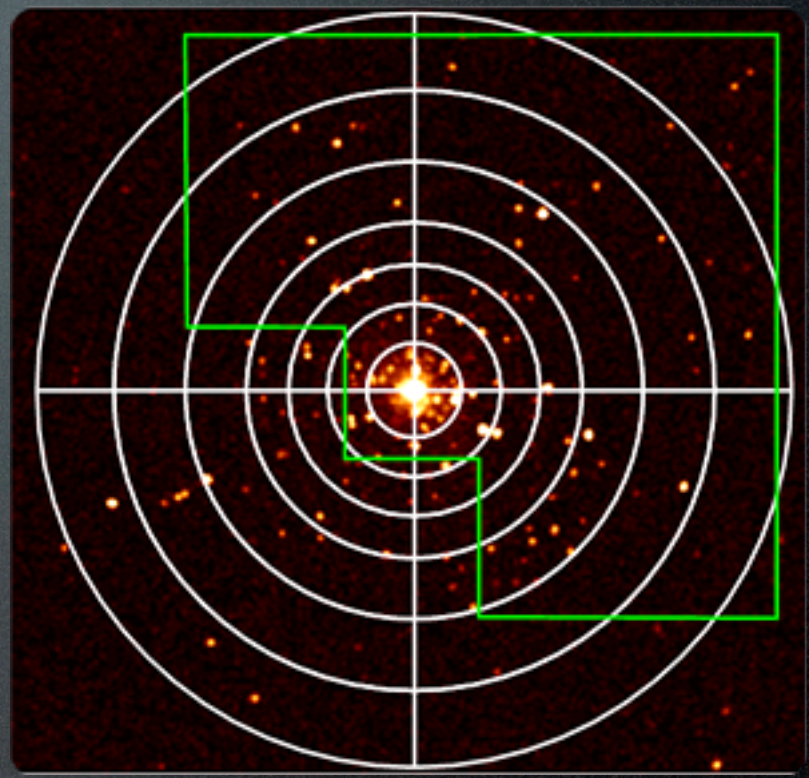

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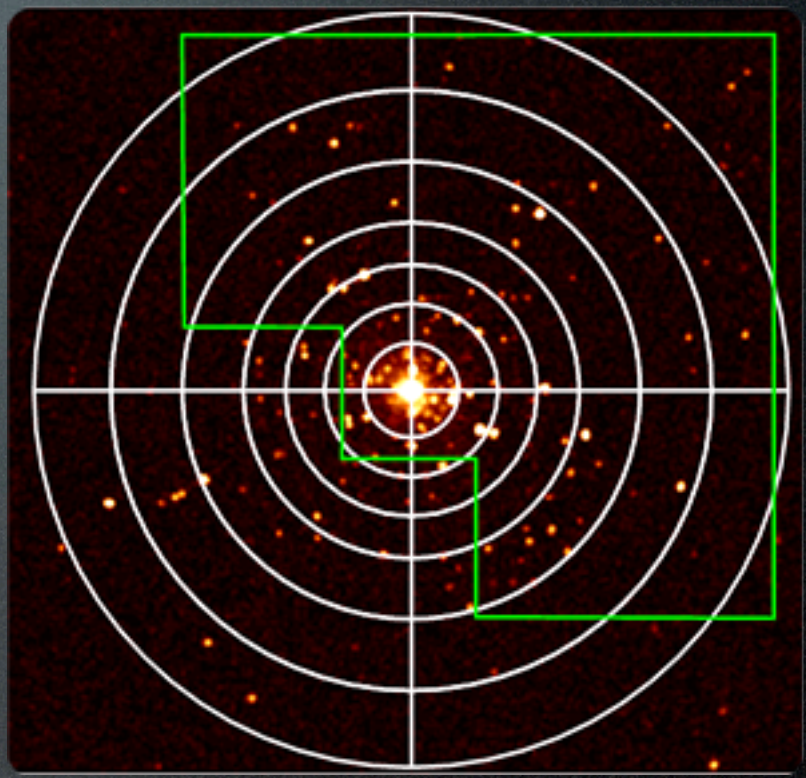

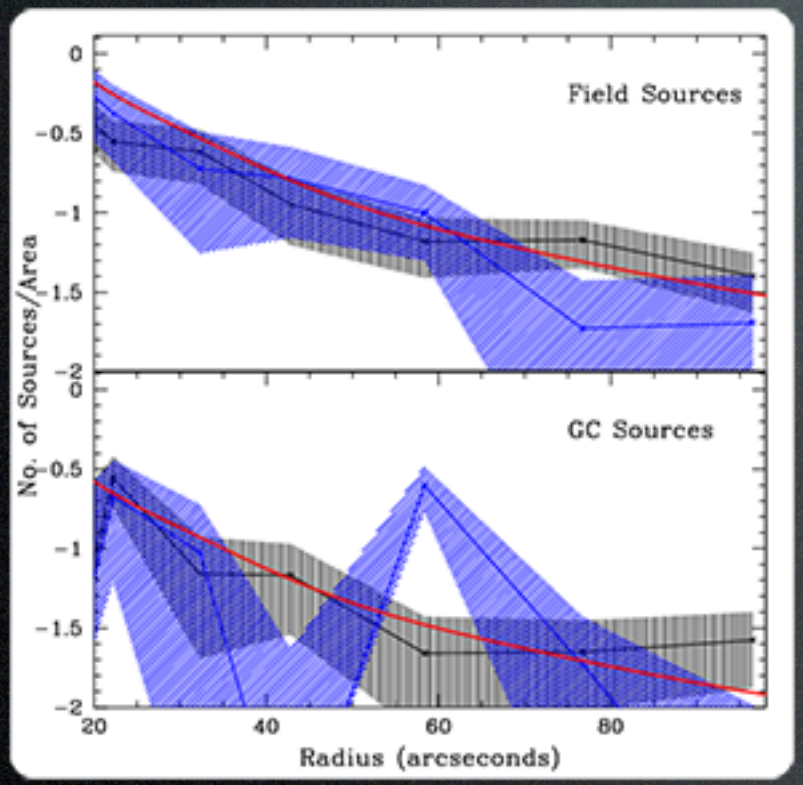

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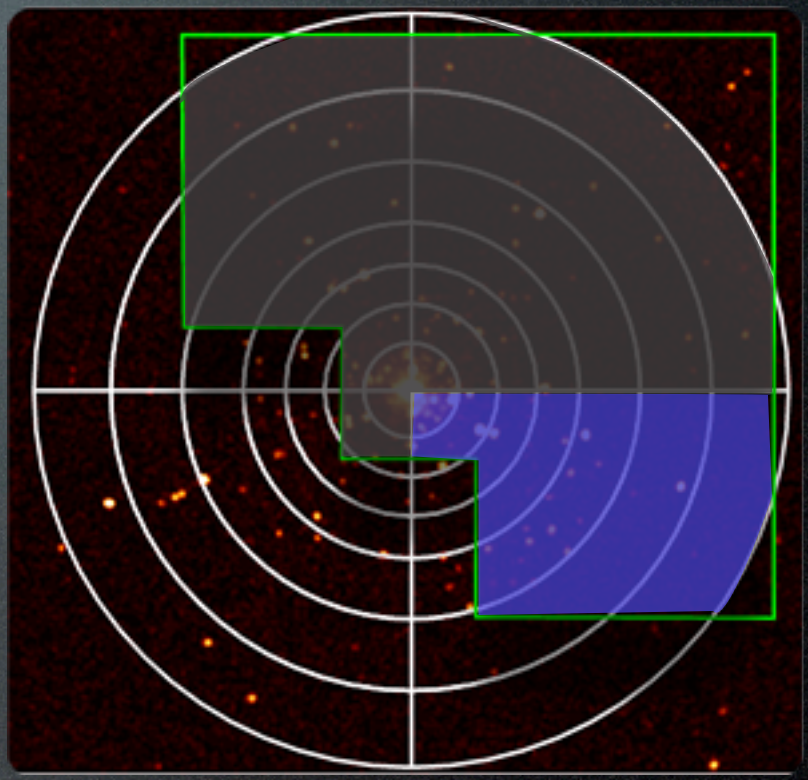

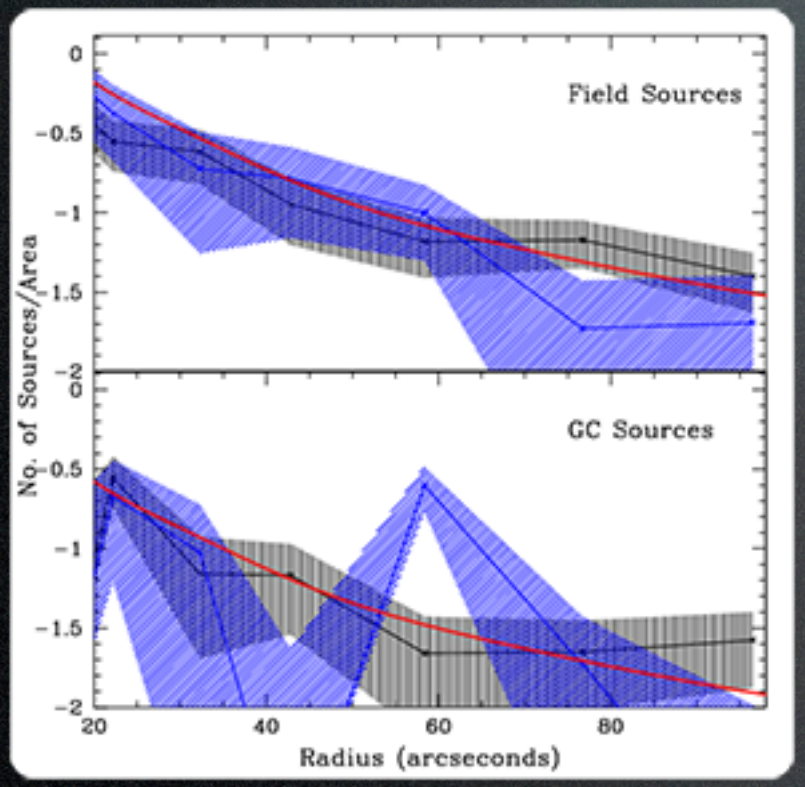

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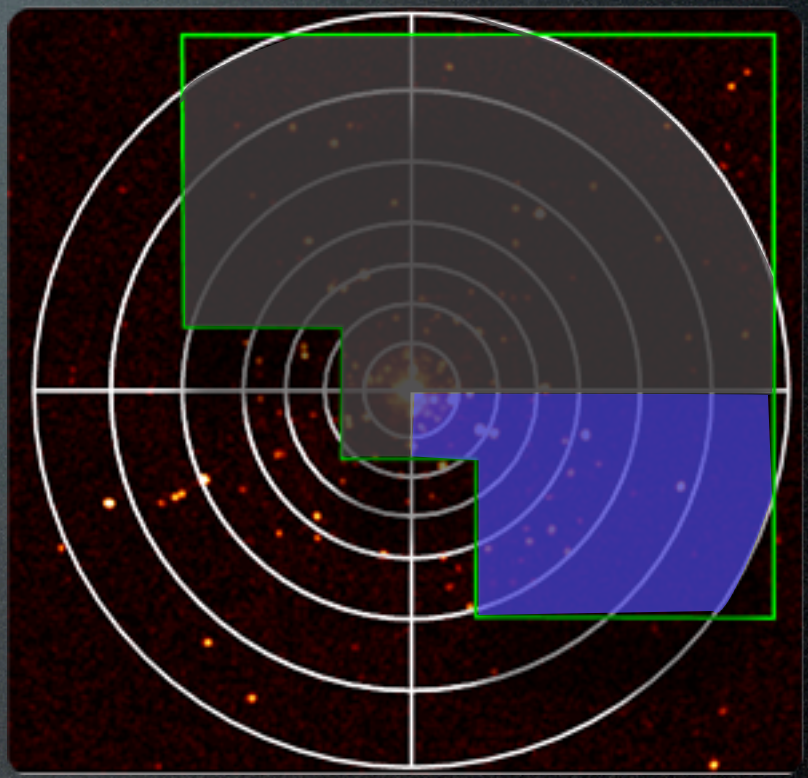

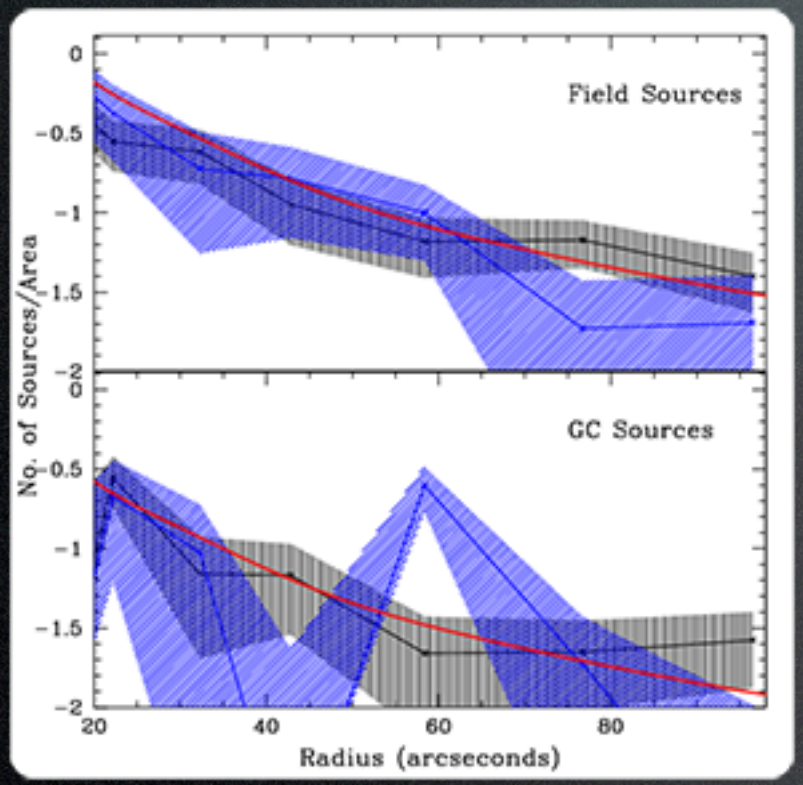

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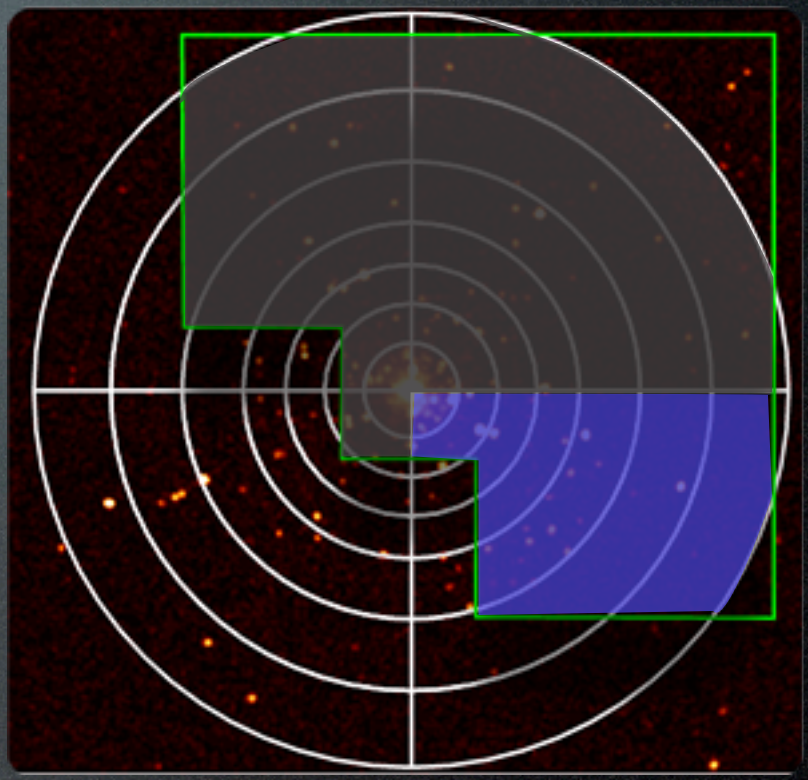

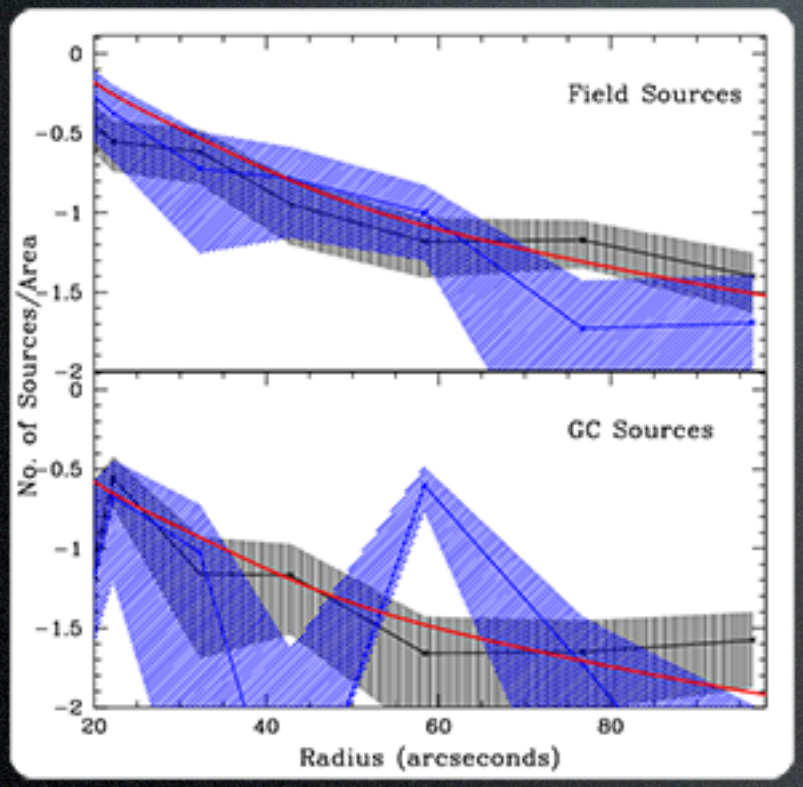

- 3 Average Field: χ^2= 4.75/5
- SW field χ^2 = 1.75/5
- 3 Average GC χ^2 = 3.0/5
- SW GC χ^2 = 11.8/5

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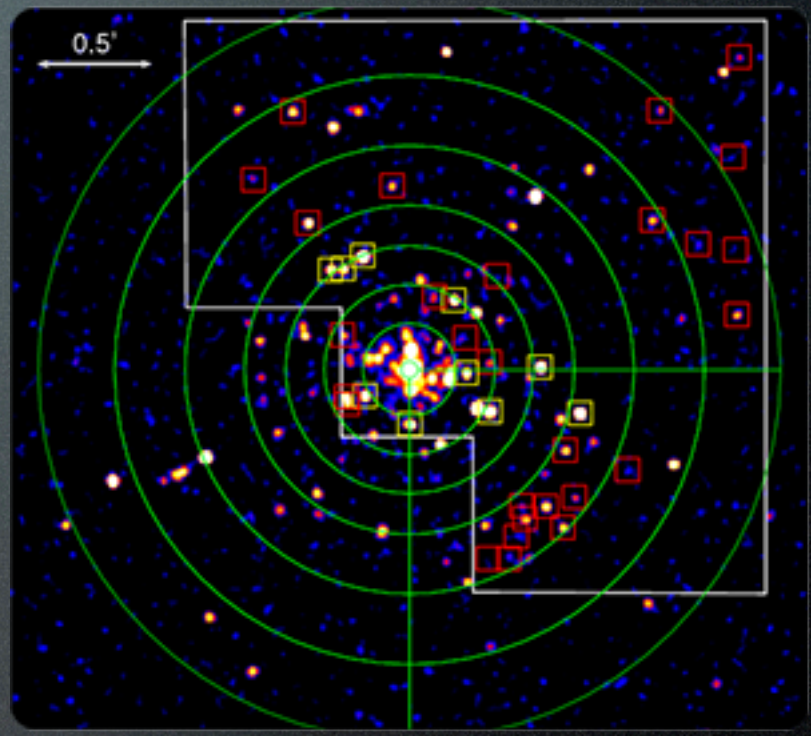

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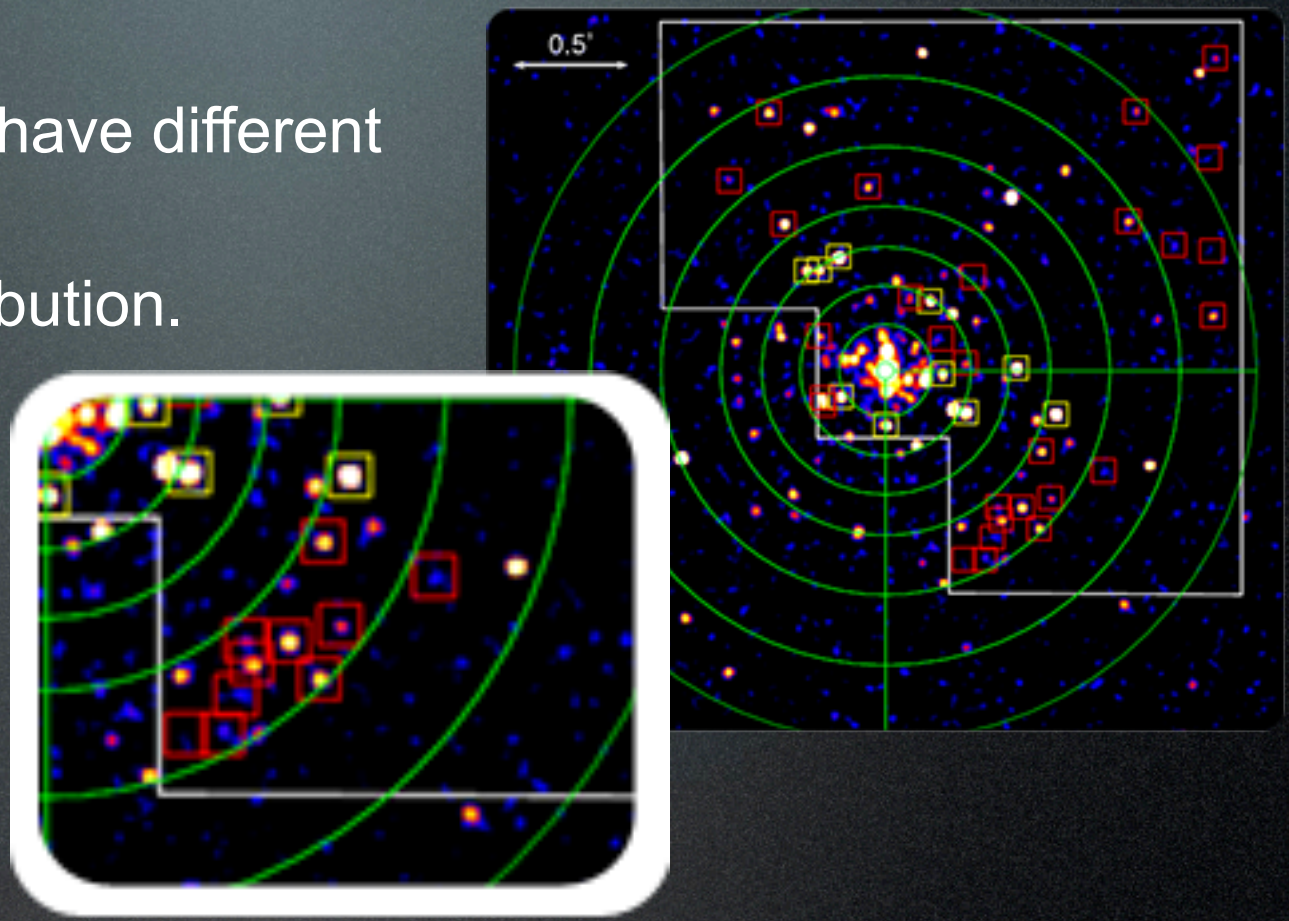

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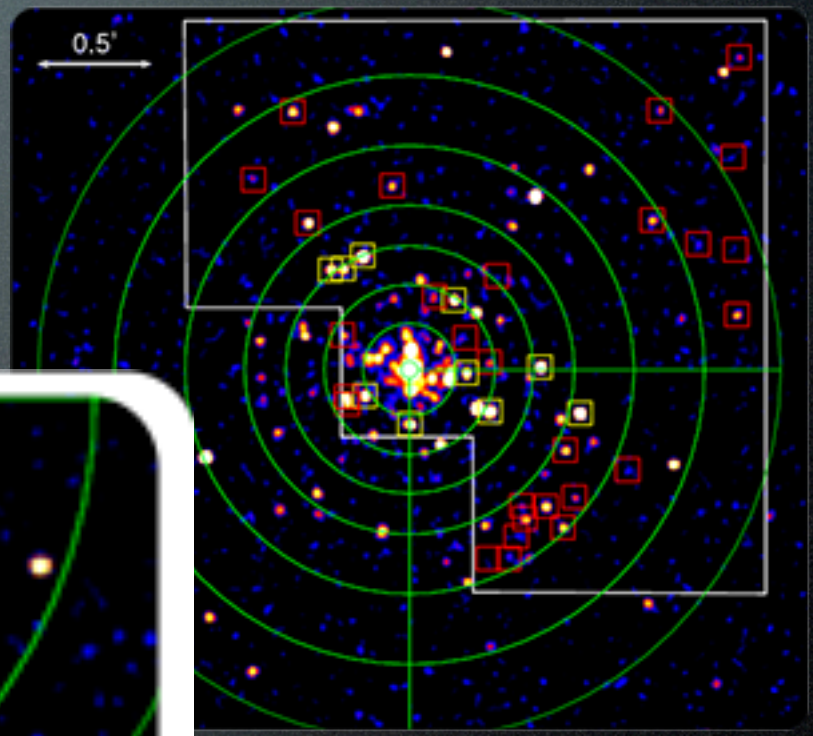

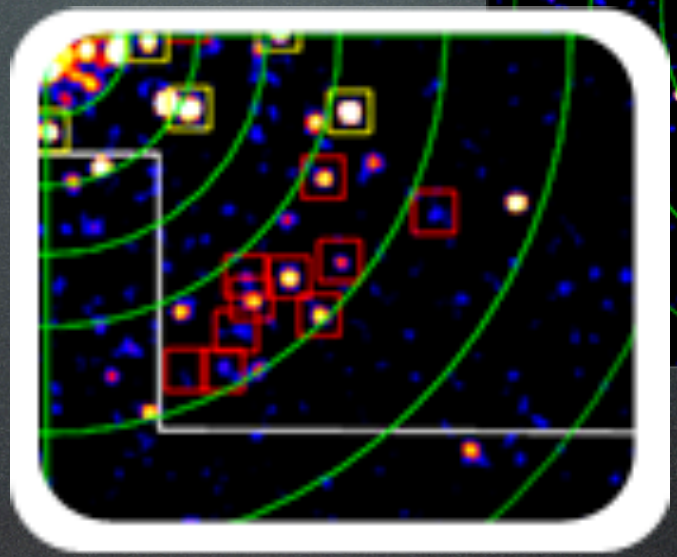

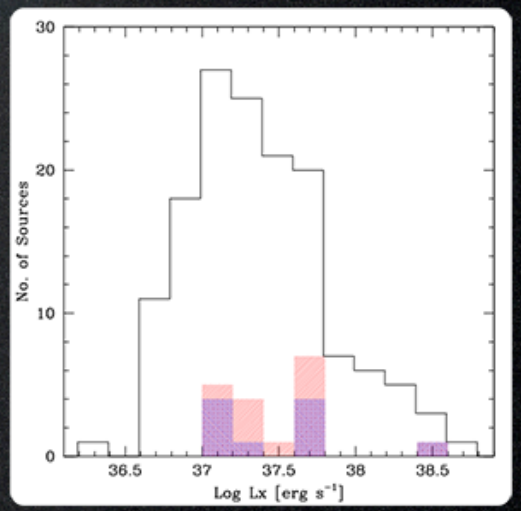

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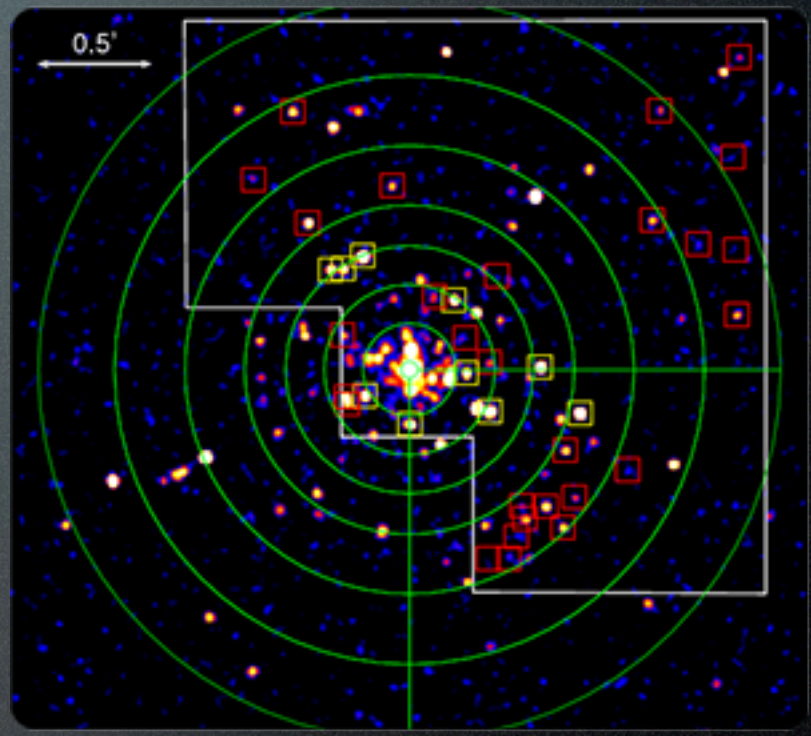

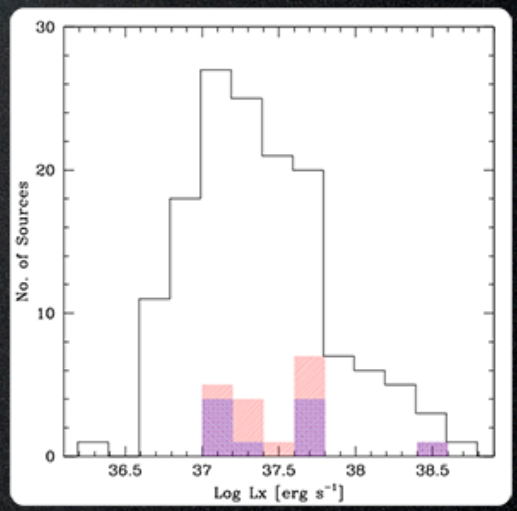

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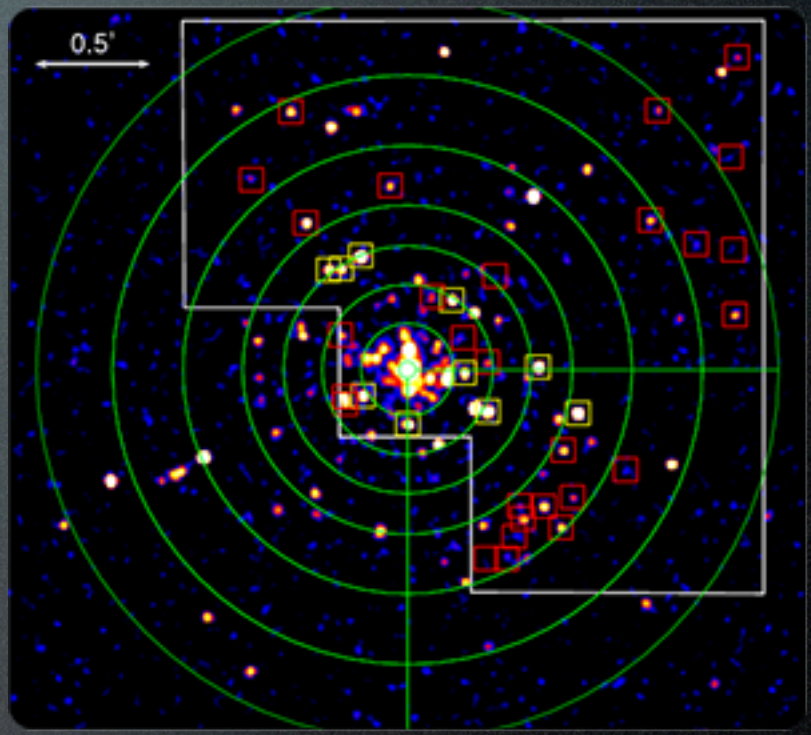

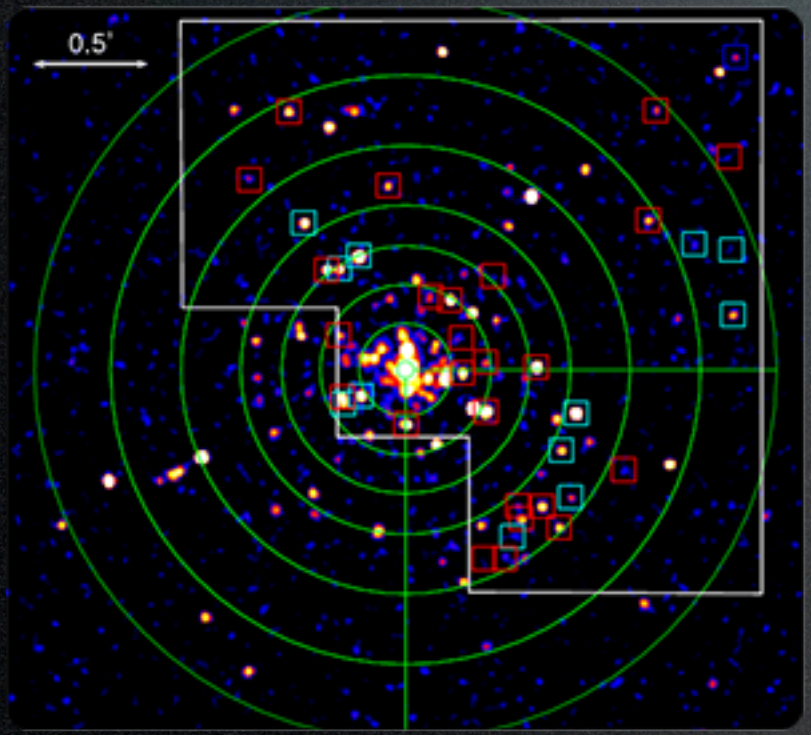

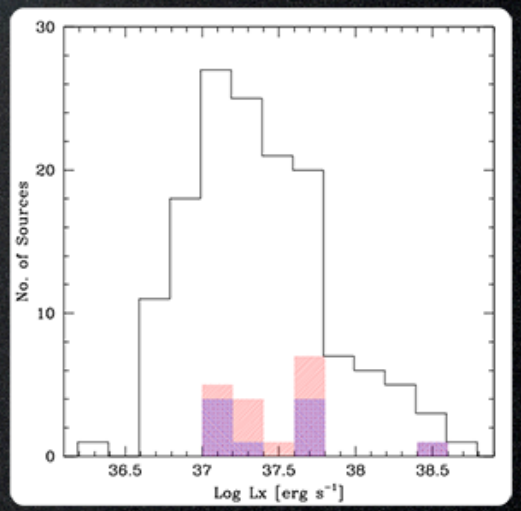

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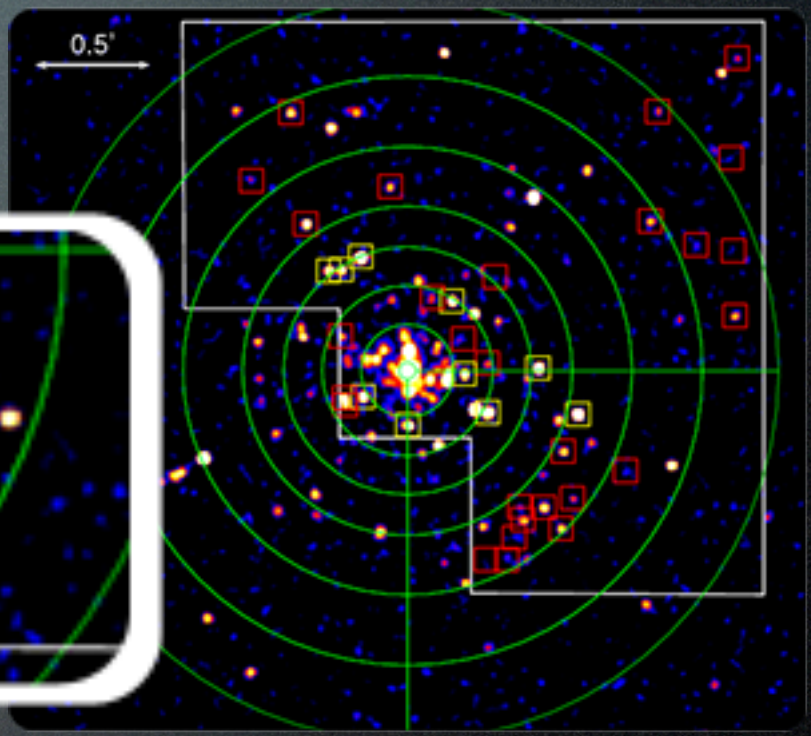

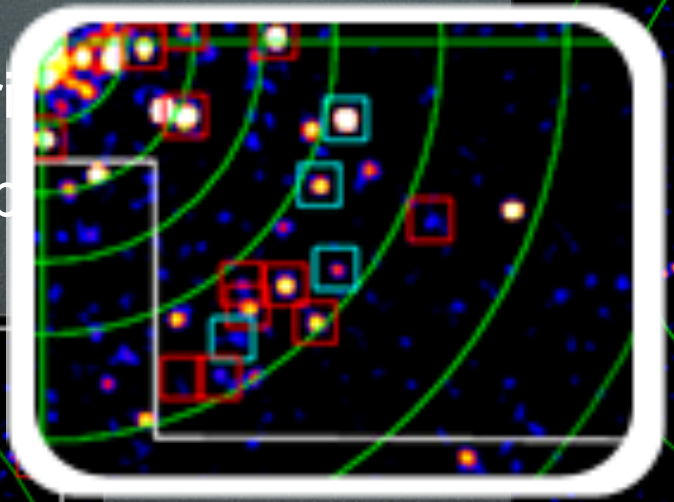

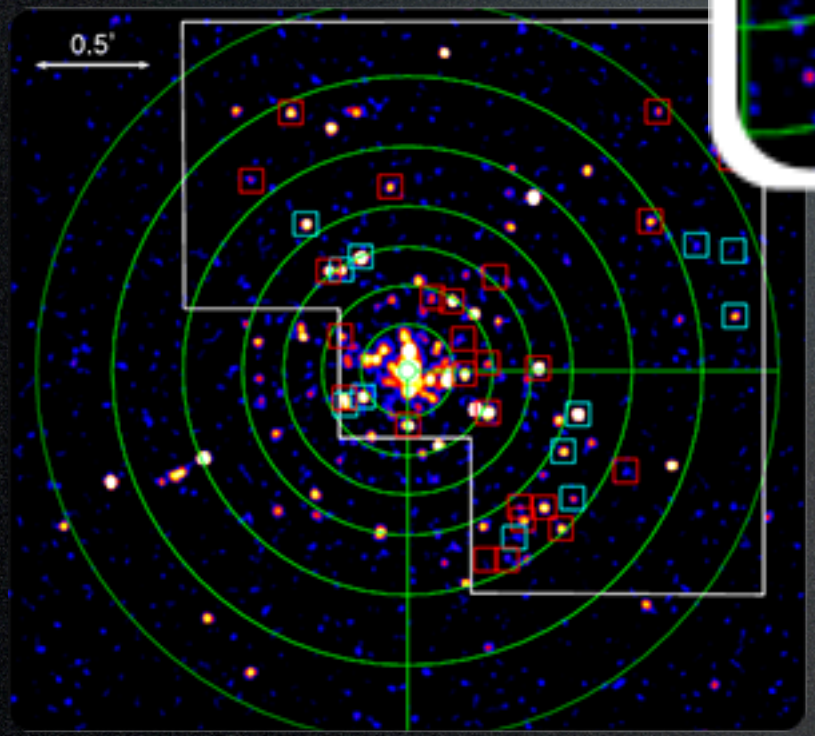

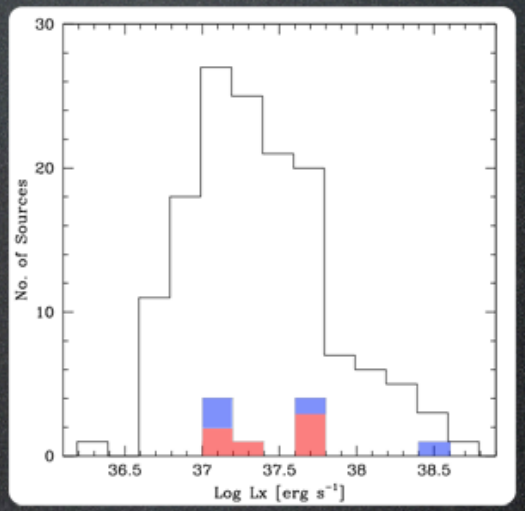

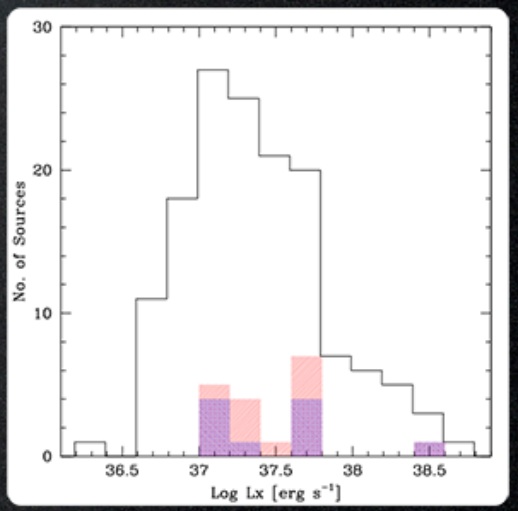

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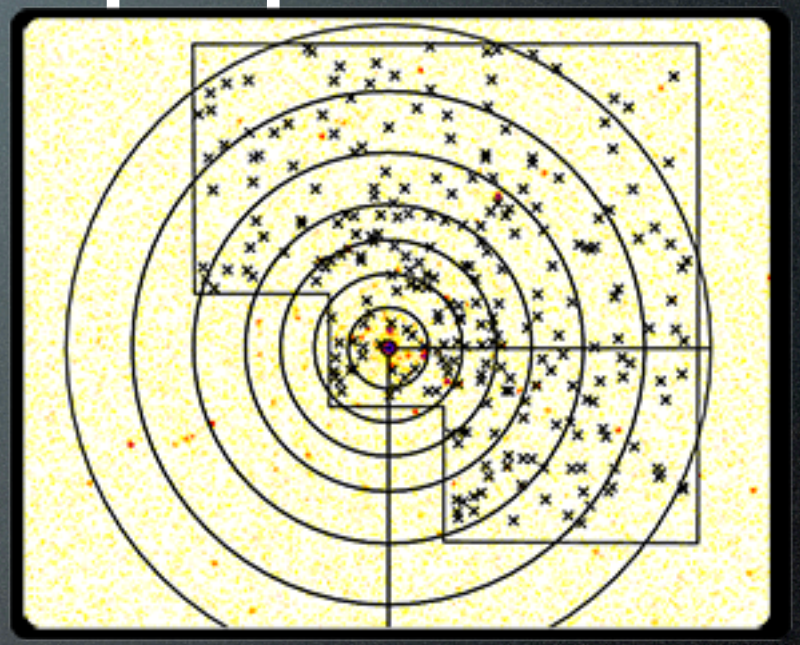

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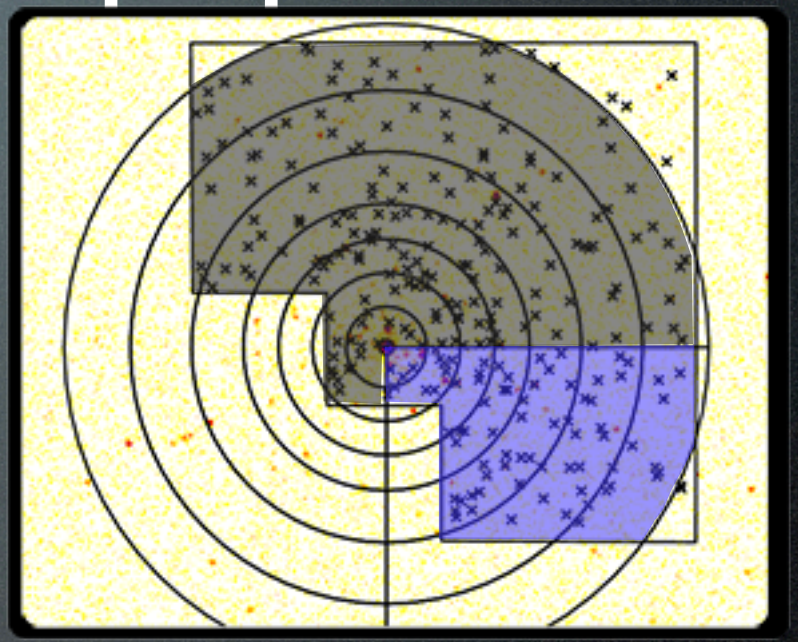

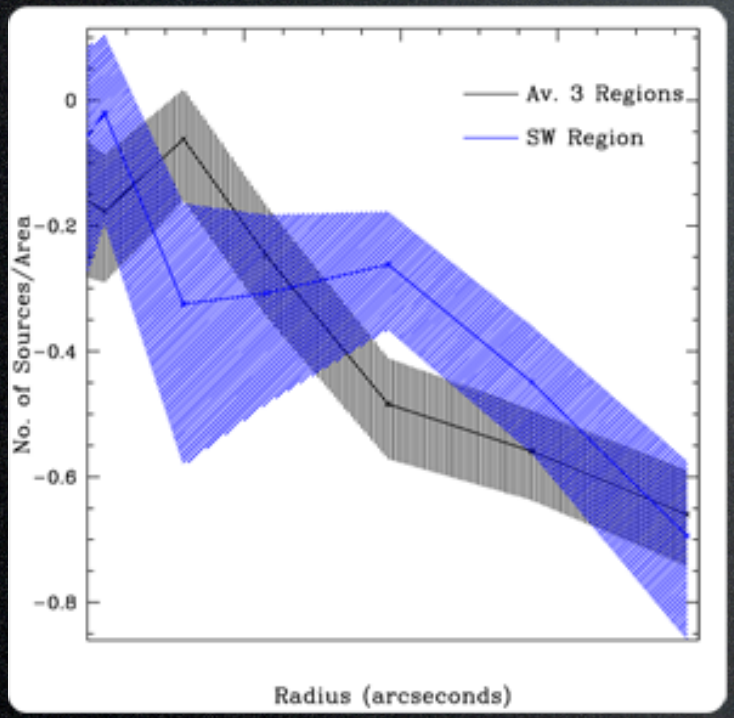

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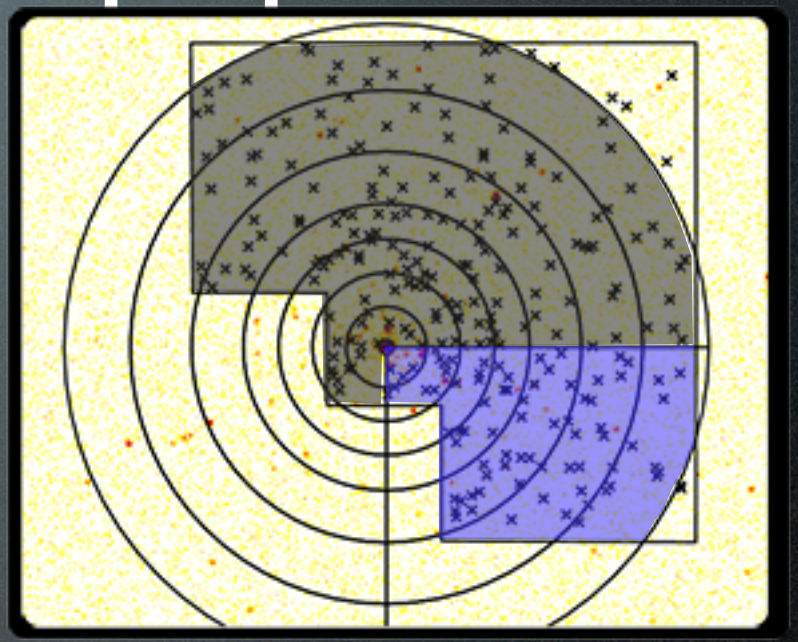

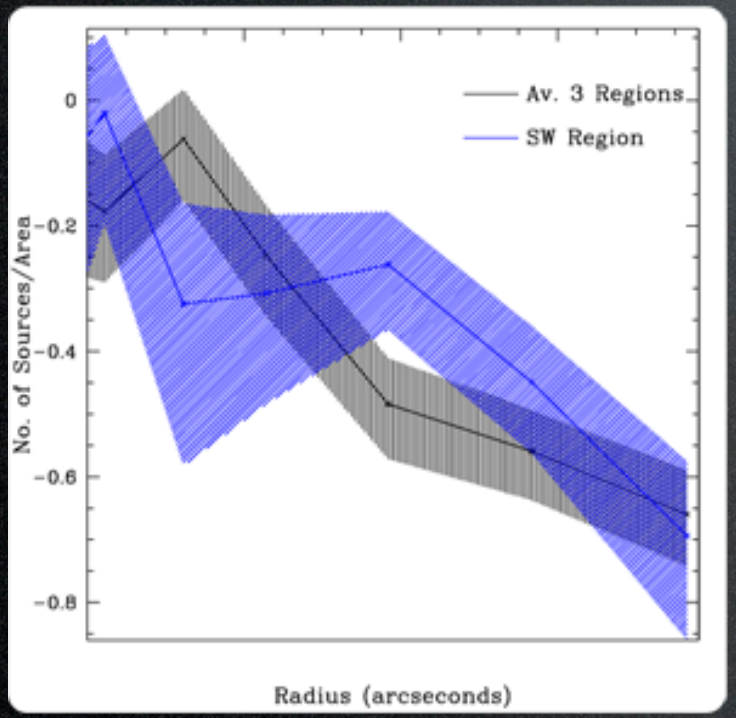

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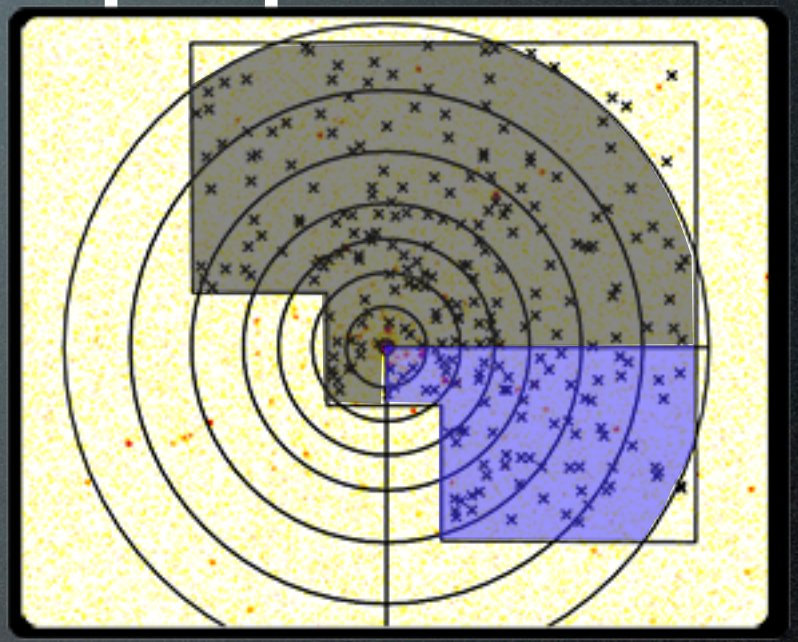

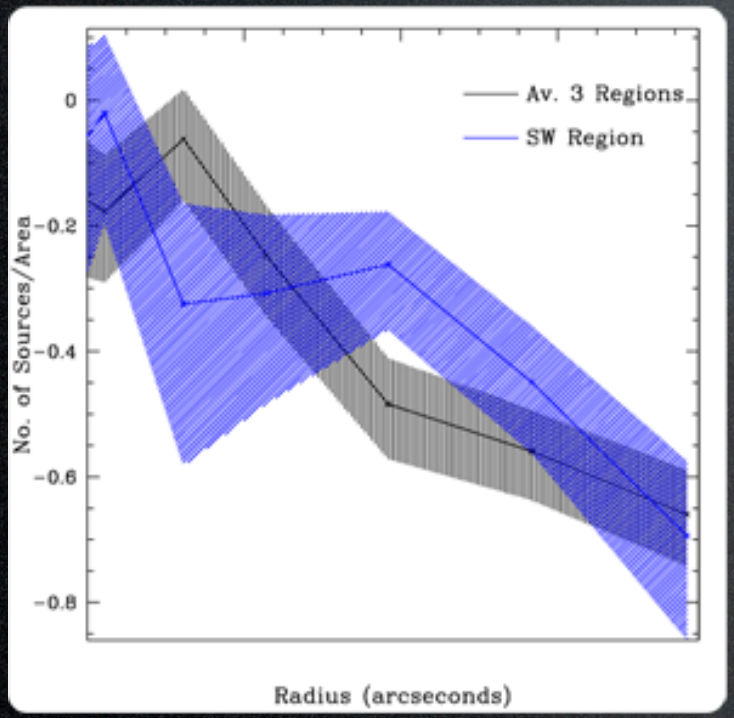

- Similar situation to NGC 4261; LMXB anisotropy has close association with the GC population, which also has a peculiar distribution (Giordano et al. 2005).

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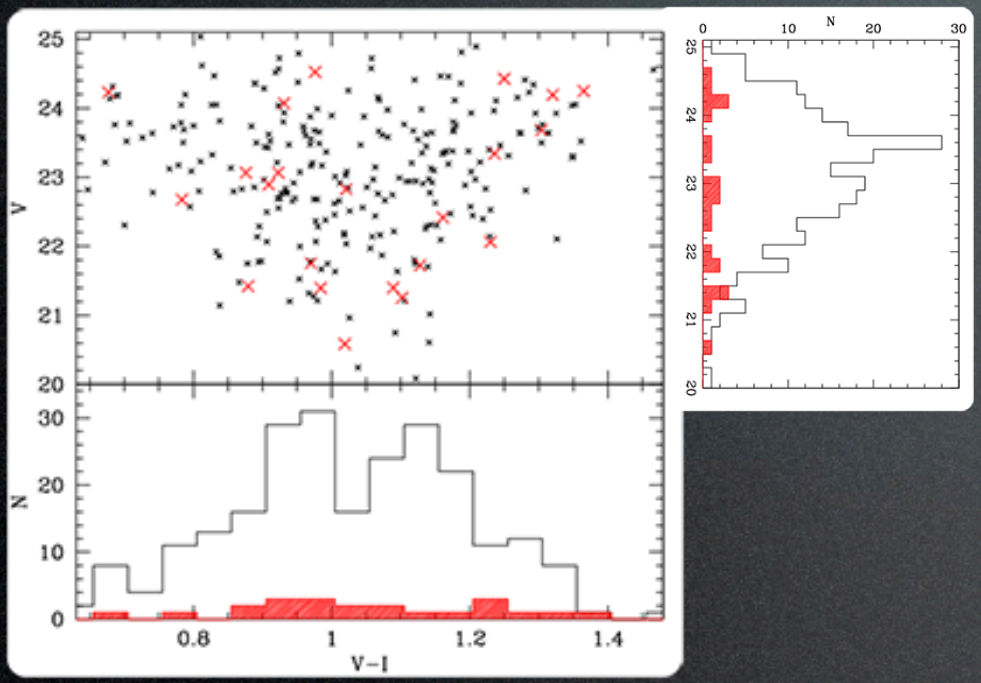

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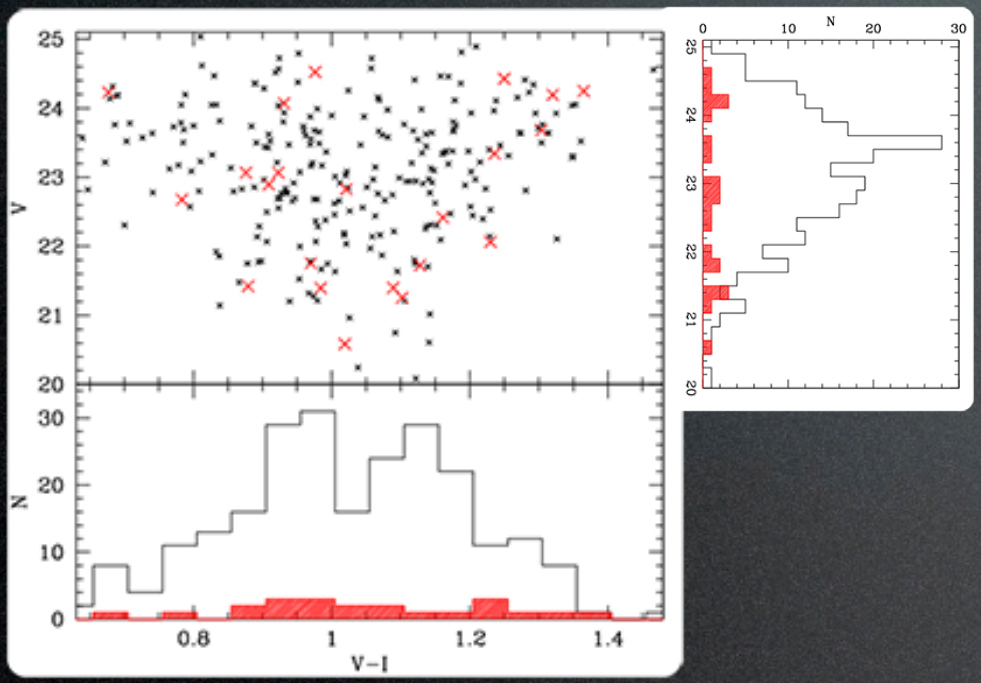

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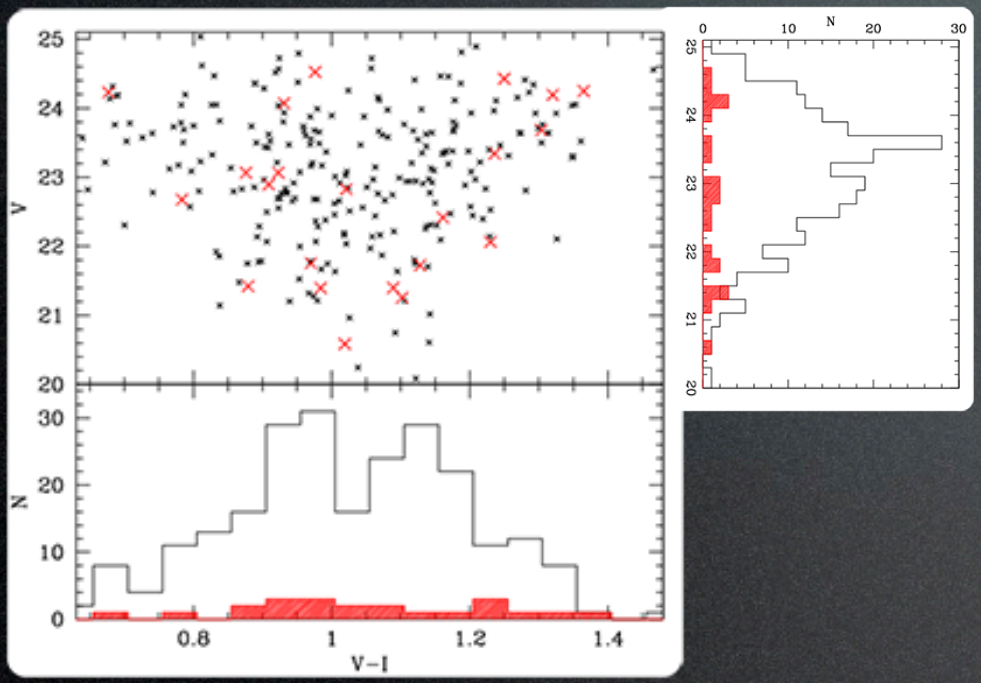

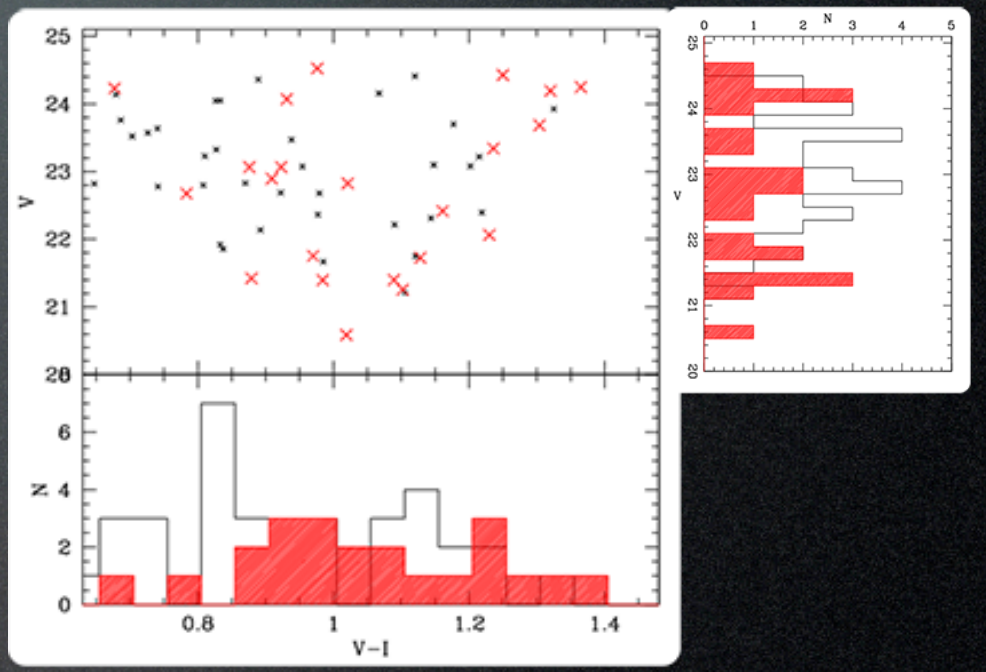

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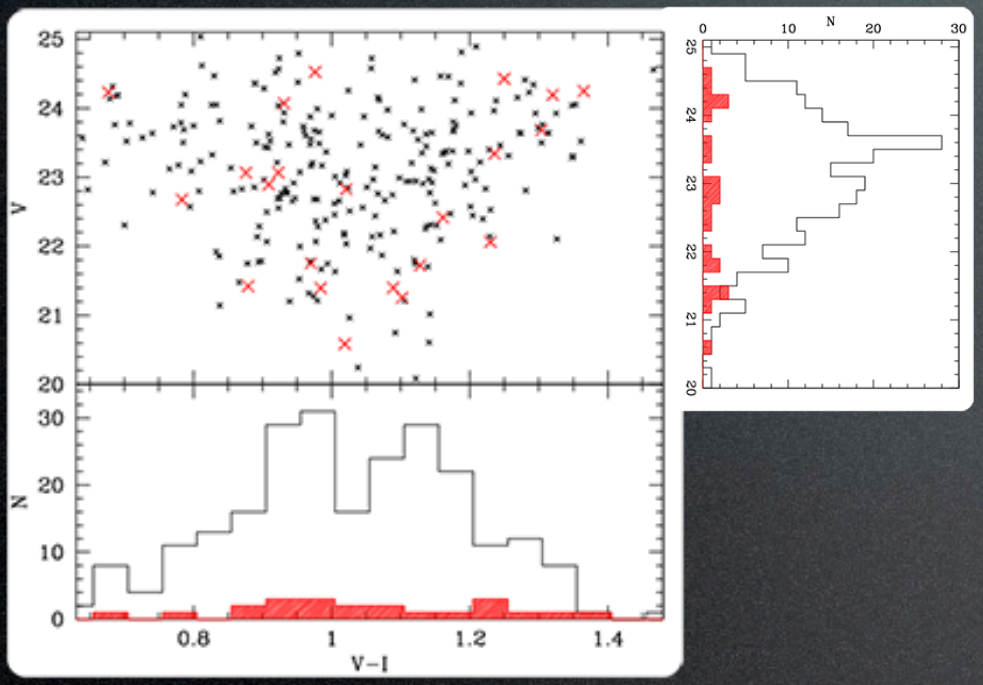

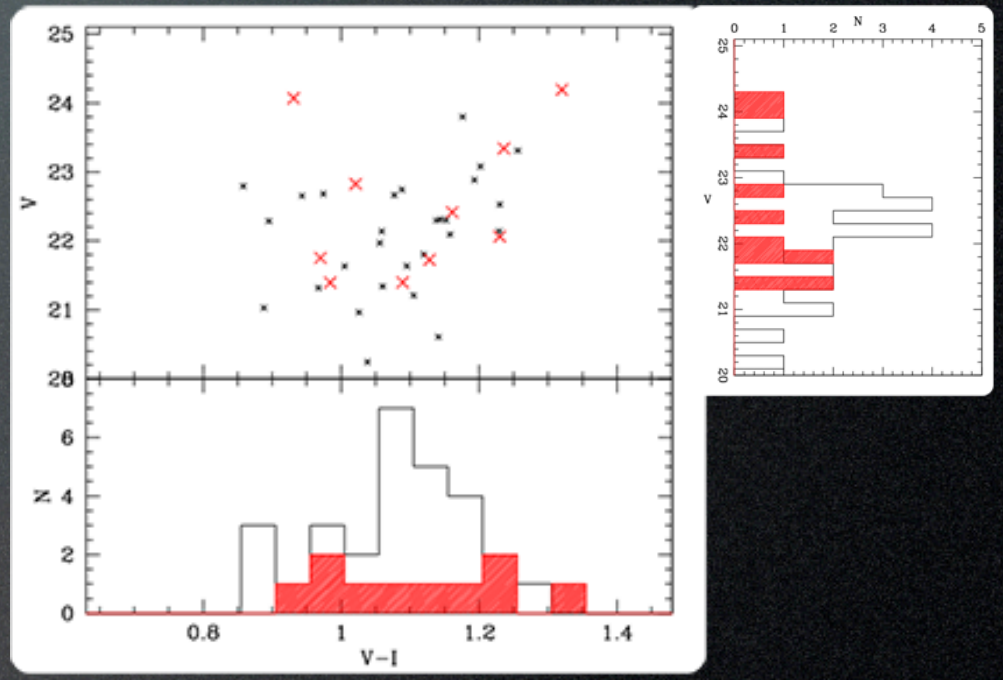

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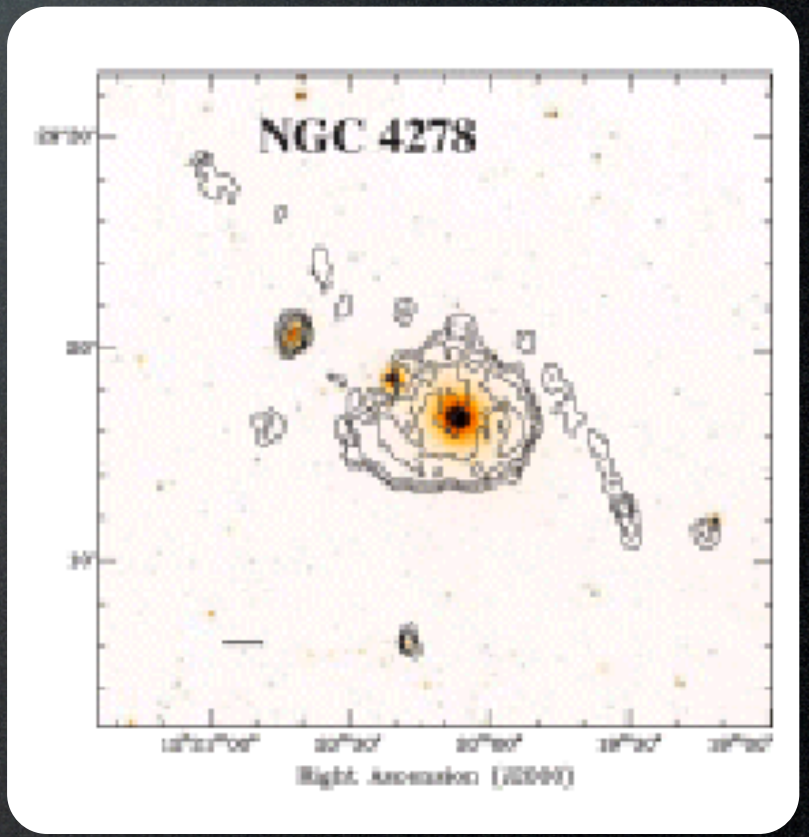

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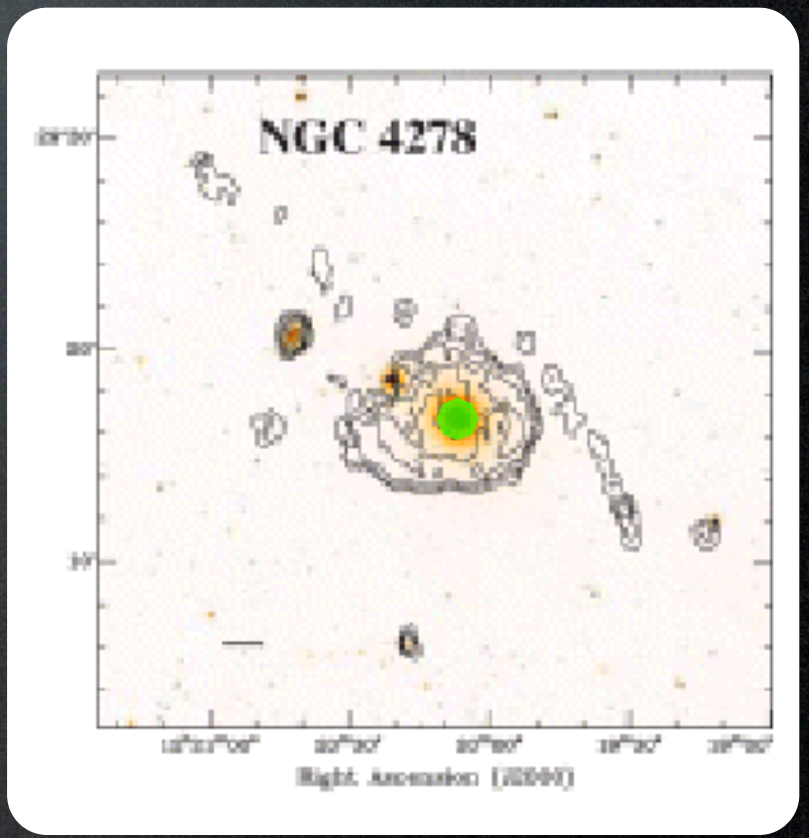

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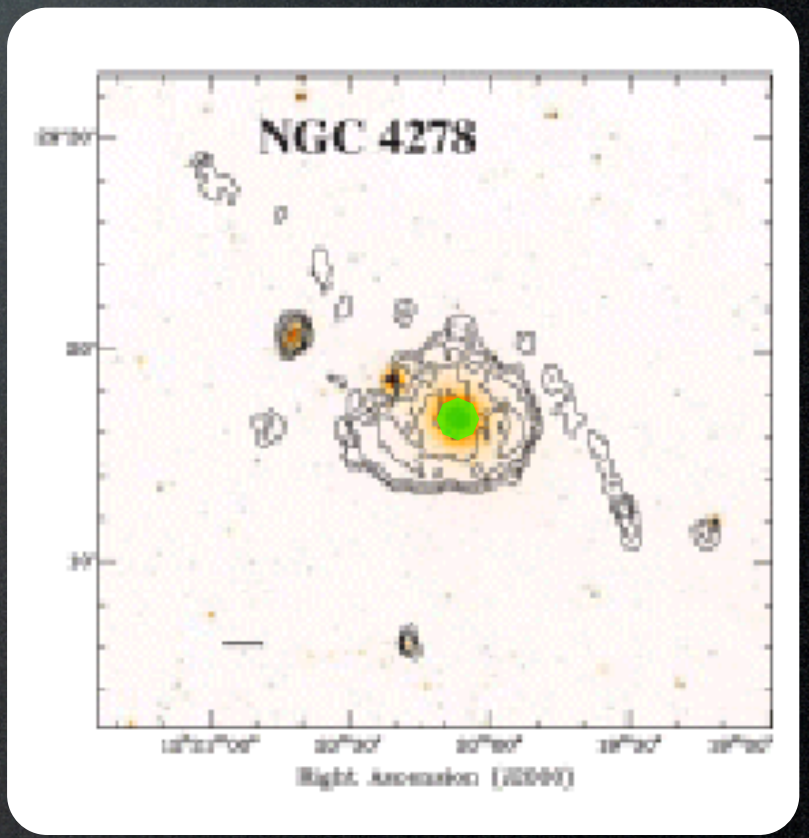

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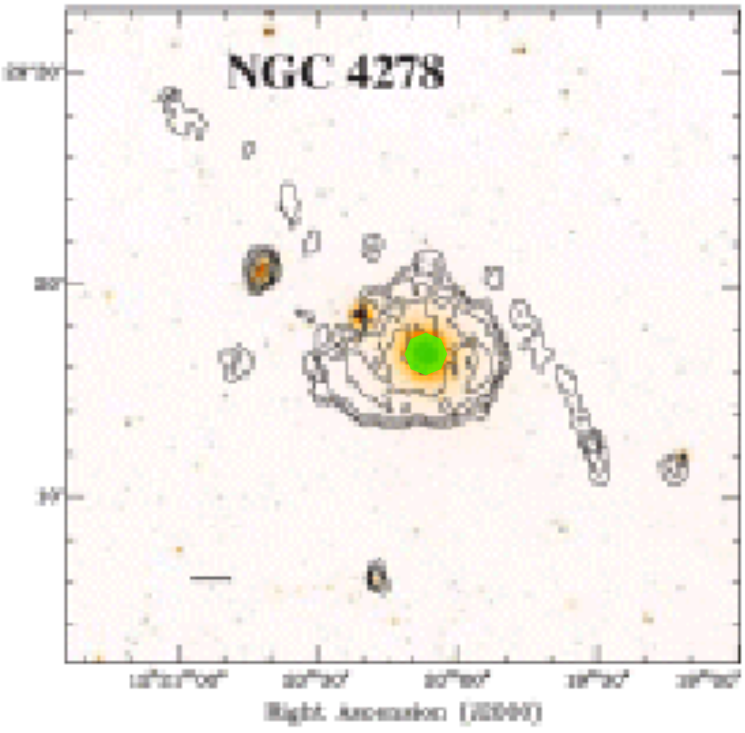
- Therefore, this observed excess could be the result of merging activity (>1 Gyr < ??).



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- Thought that SSCs can form from merging events, leading to over-abundance of LMXBs in that region (e.g. NGC 3310).

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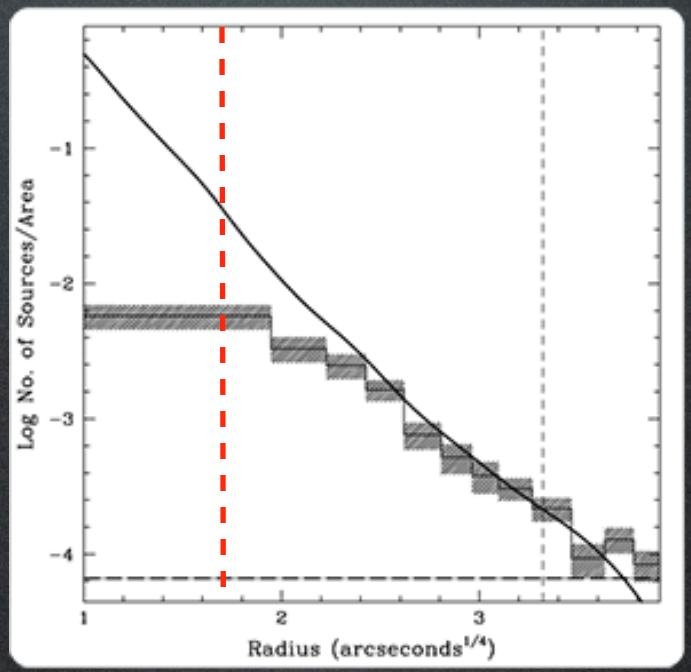

Optical profiles from multi-Gaussian expansions of I-band data (Cappellari 2006).

Flattening in central bins due to source confusion.