

THE CLASSIFICATION AND ANALYSIS OF DISTINCT X-RAY BINARY POPULATIONS IN M81

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ABINGOS

Accreting Binaries in Nearby Galaxies: Observations and Simulations

Background Image Credit: X-ray: NASA/CXC/Wisconsin/D.Pooley & CfA/A.Zezas;
Optical: NASA/ESA/CfA/A.Zezas; UV: NASA/JPL-Caltech/CfA/J.Huchra et al.; IR: NASA/JPL-Caltech/CfA



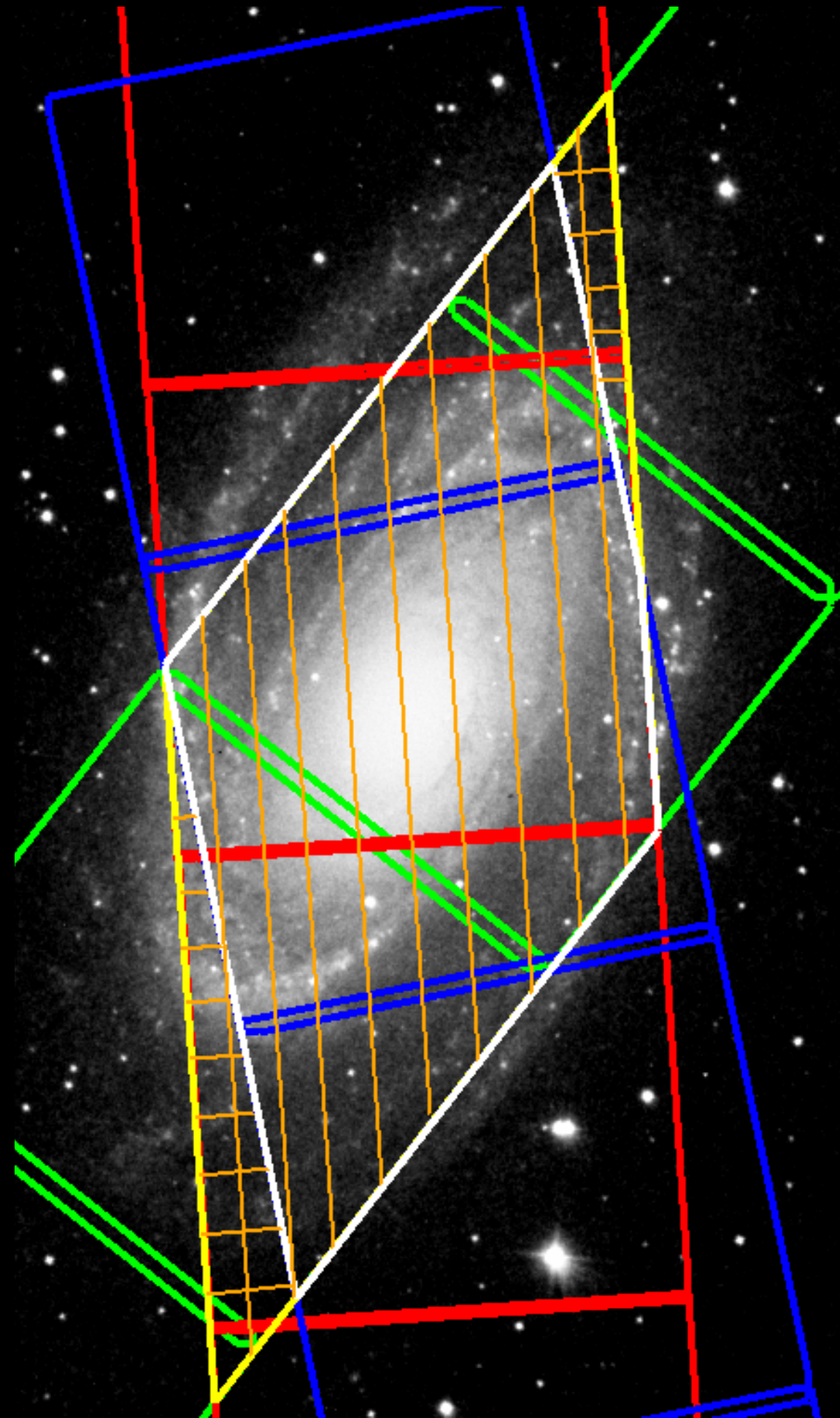
M81

A Good Match for Chandra

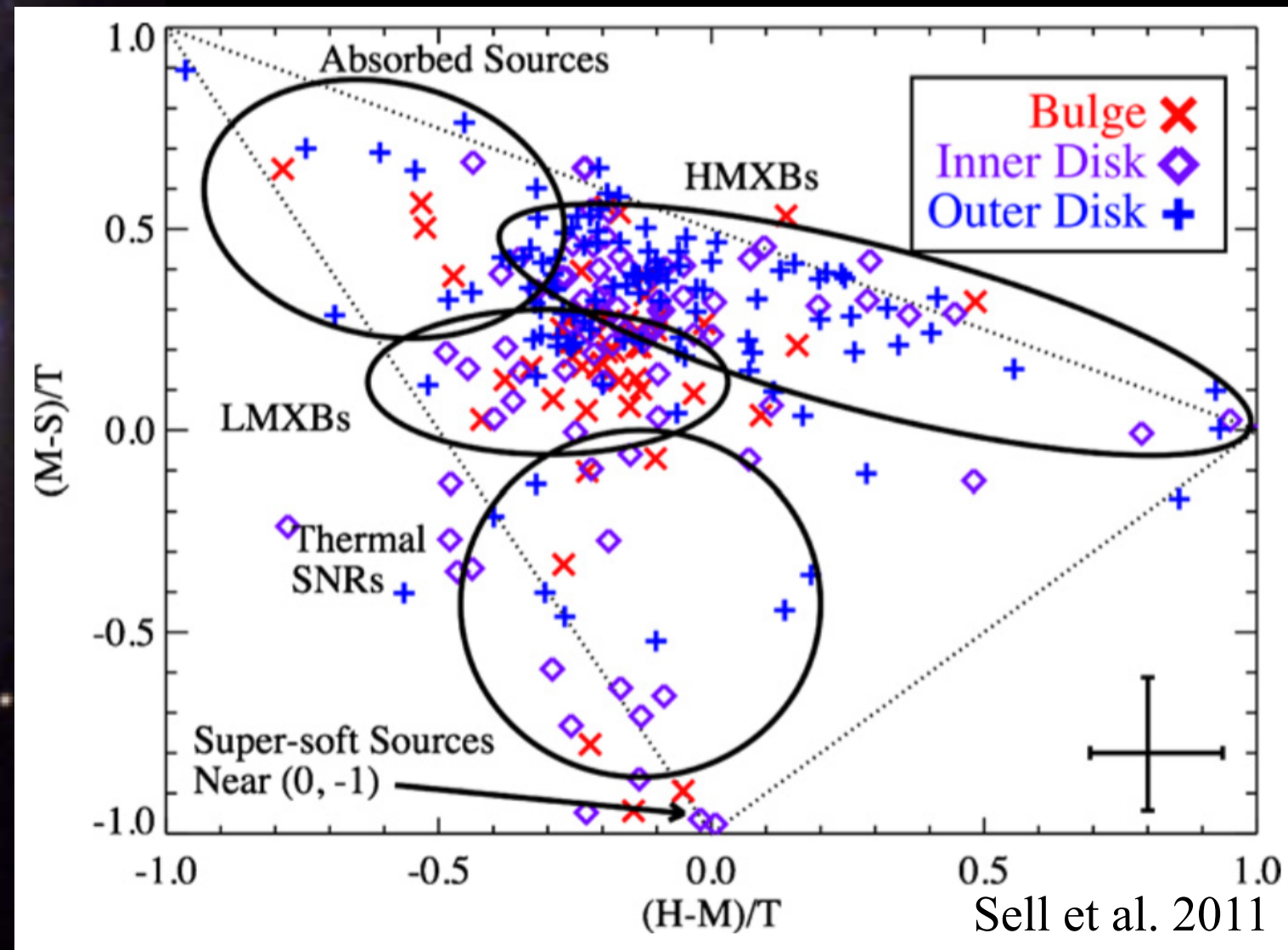
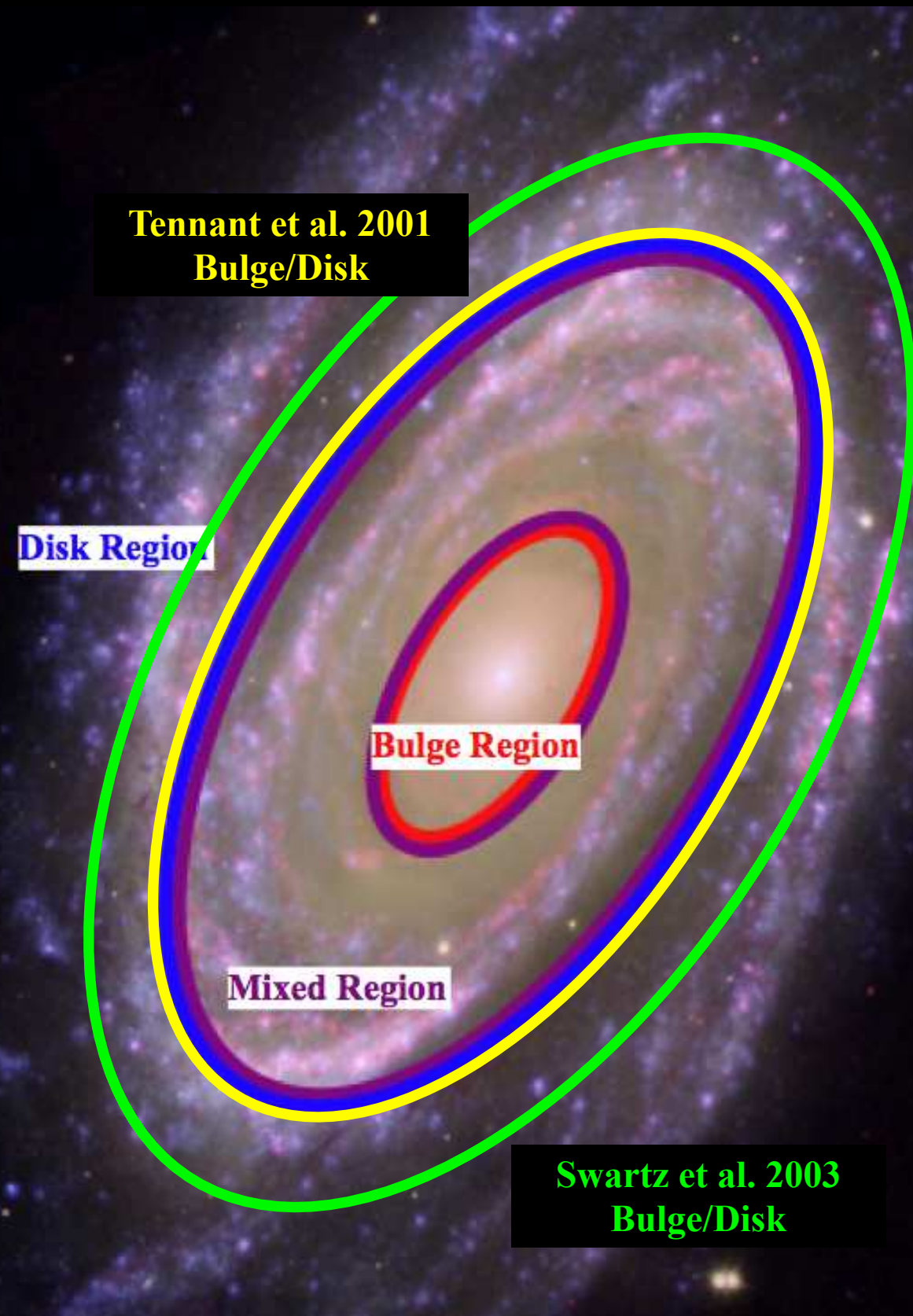
- Nearby: 3.63 ± 0.34 Mpc
- Angular size matches Chandra FOV well

Observations:

- Fifteen 11-ksec observations (May 26 - July 6, 2005) at ~ 3 -day intervals
- $L_X \simeq 2 \times 10^{36}$ erg/s (merged)
- One 50-ksec observation from May 7, 2000 (Swartz et al. 2003)
- 265 known point sources (Sell et al. 2011)

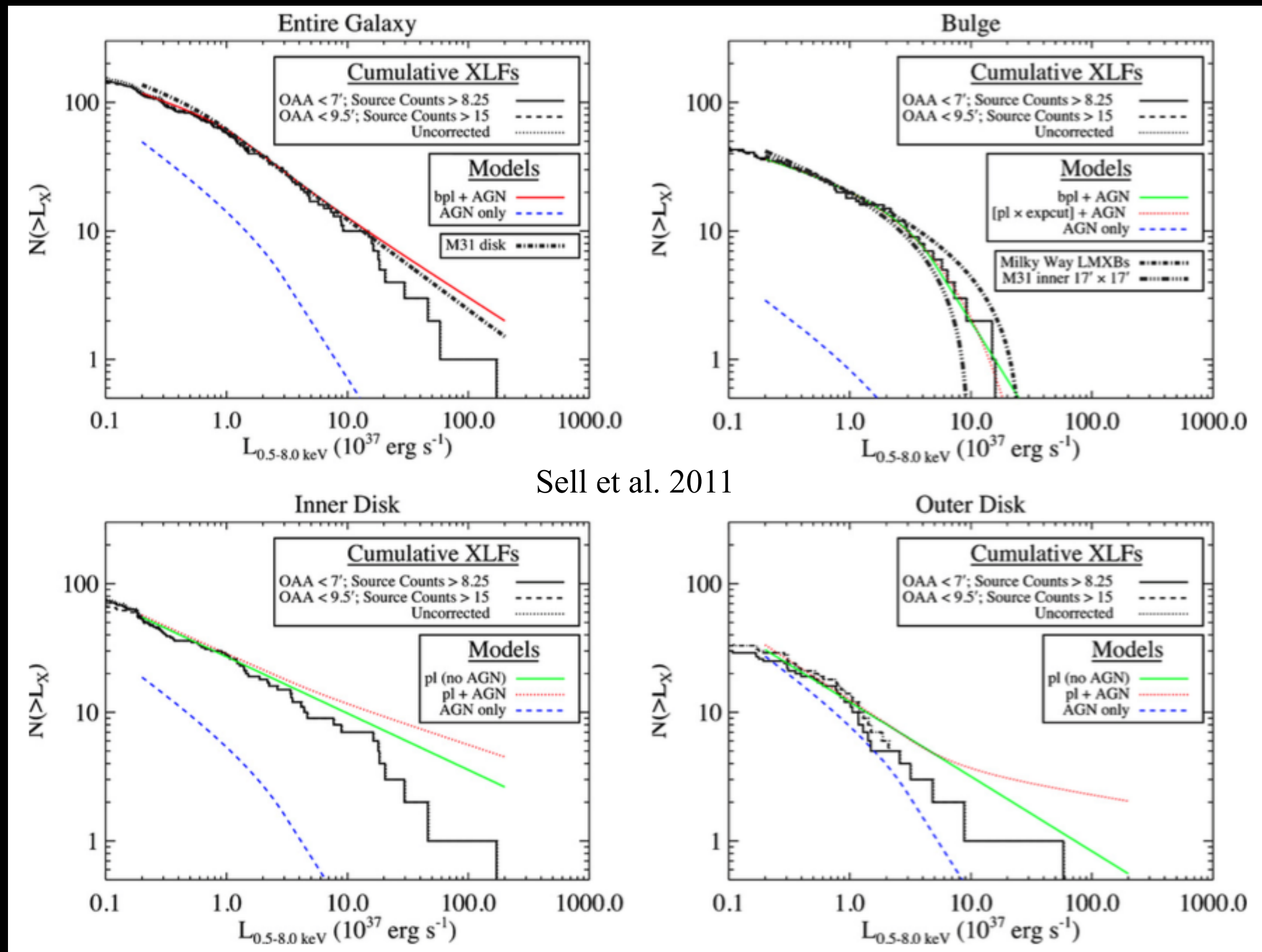


Previous Work on M81 XRB Populations



Based on Prestwich et al. 2003

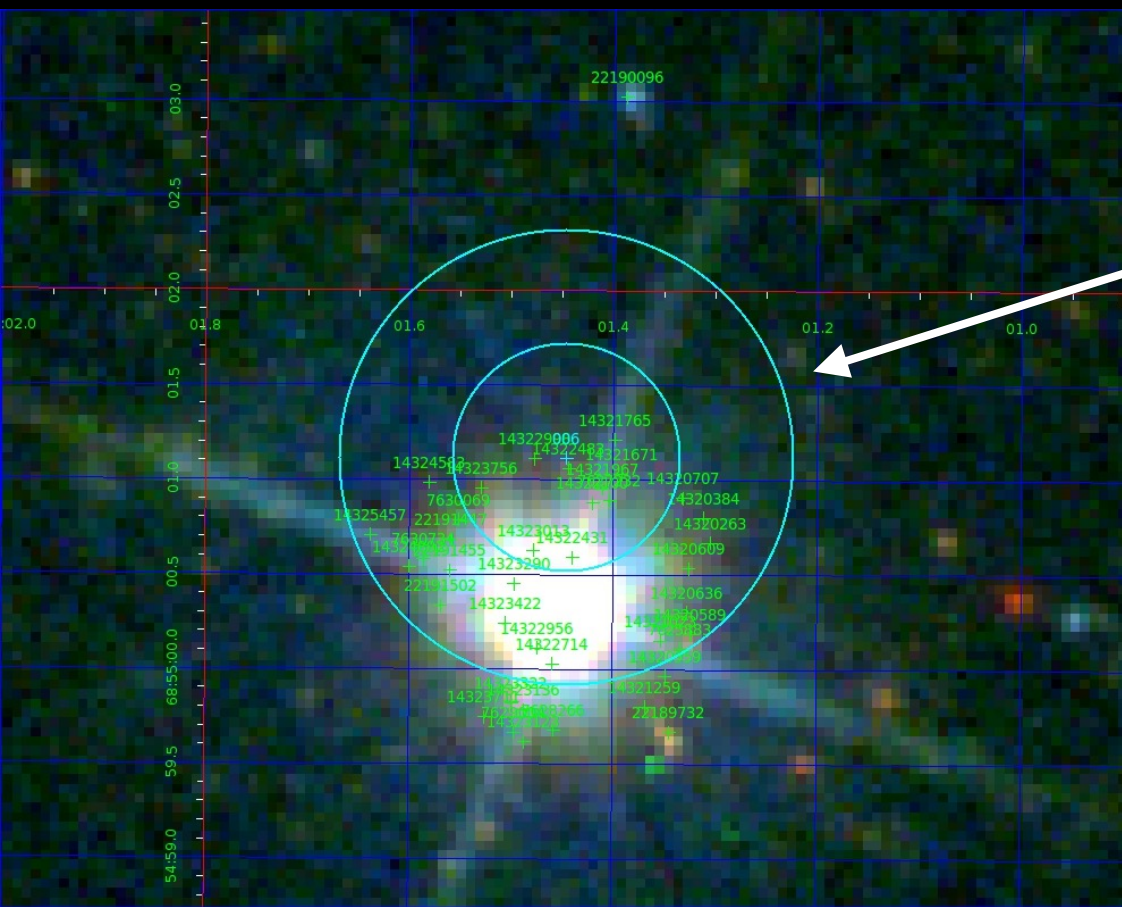
Previous Work on M81 XRB Populations



Sell et al. 2011

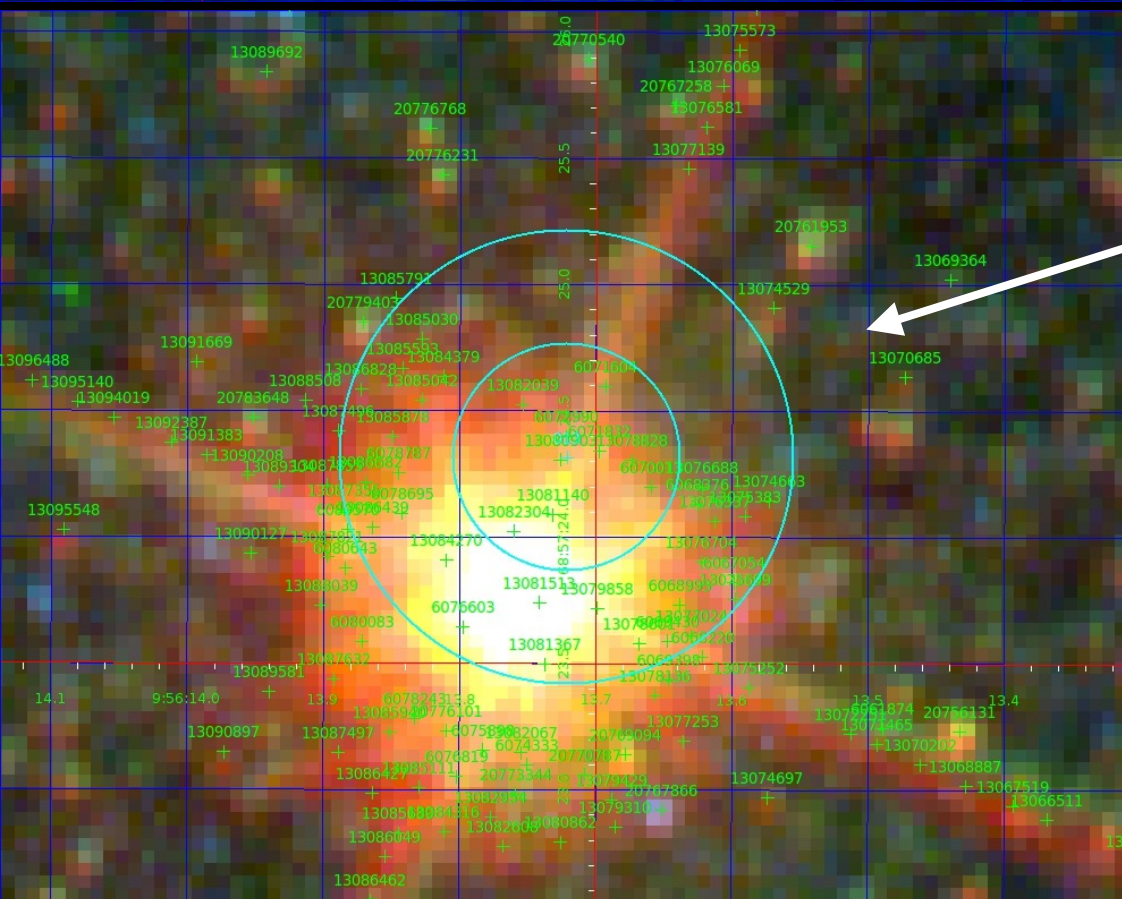
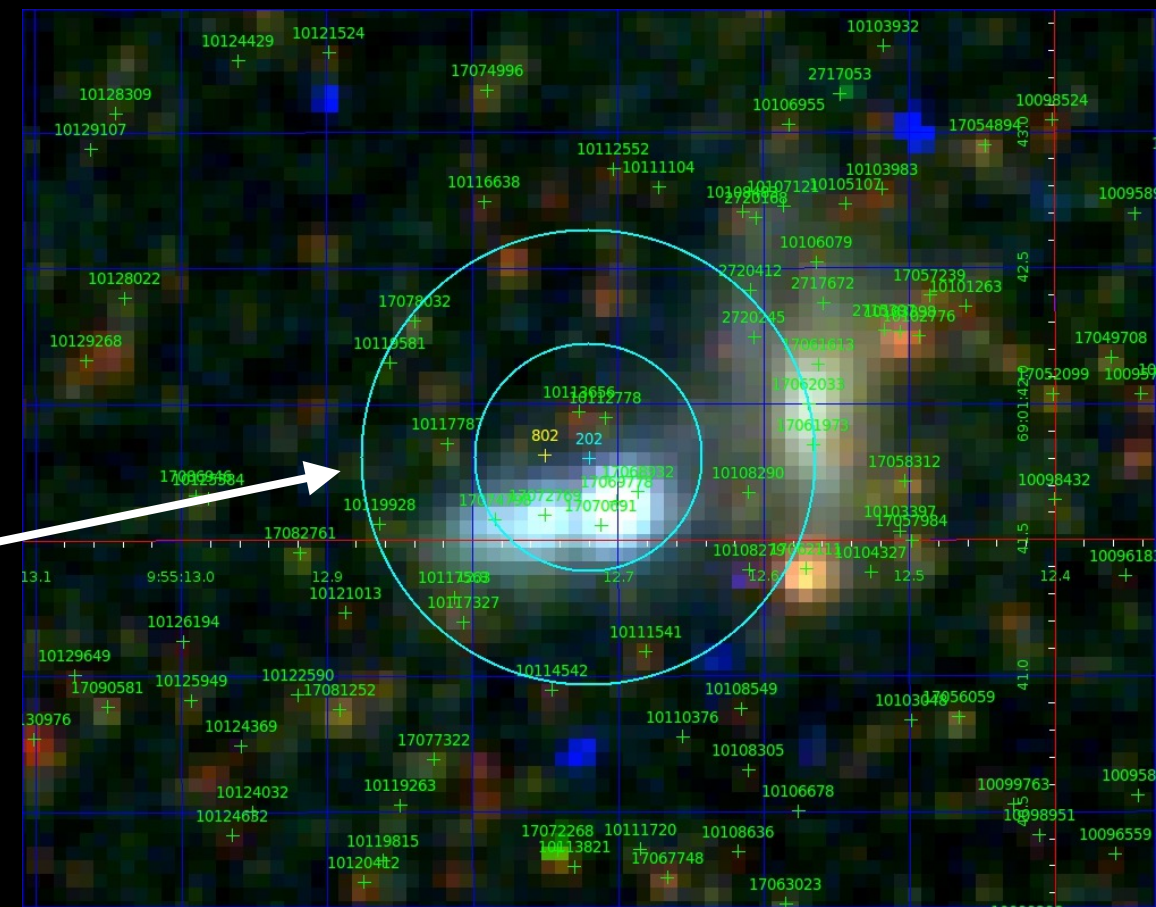
What do these results look like when we have individual source classifications?

Source Classification in M81—by eye



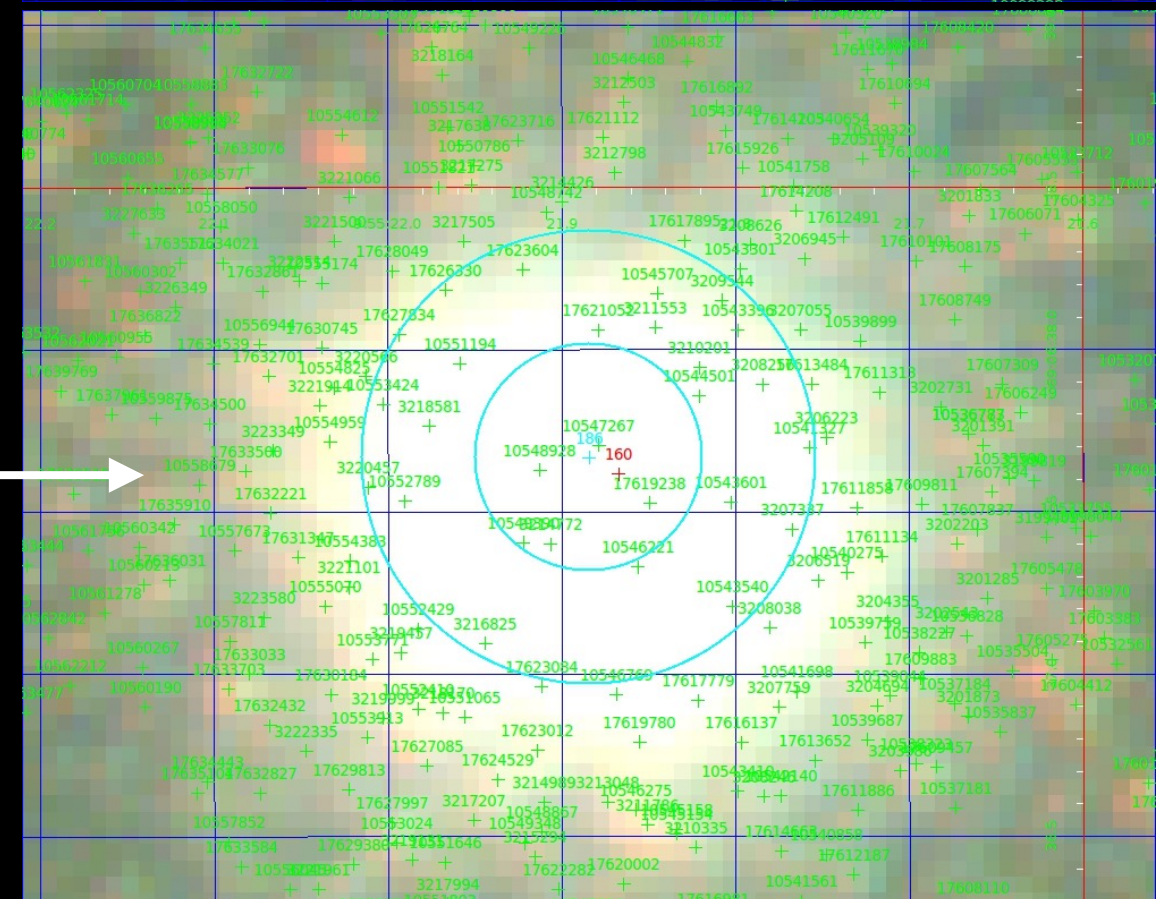
Background
Quasar
(2XMMi J095701+685500)

Background
Galaxy

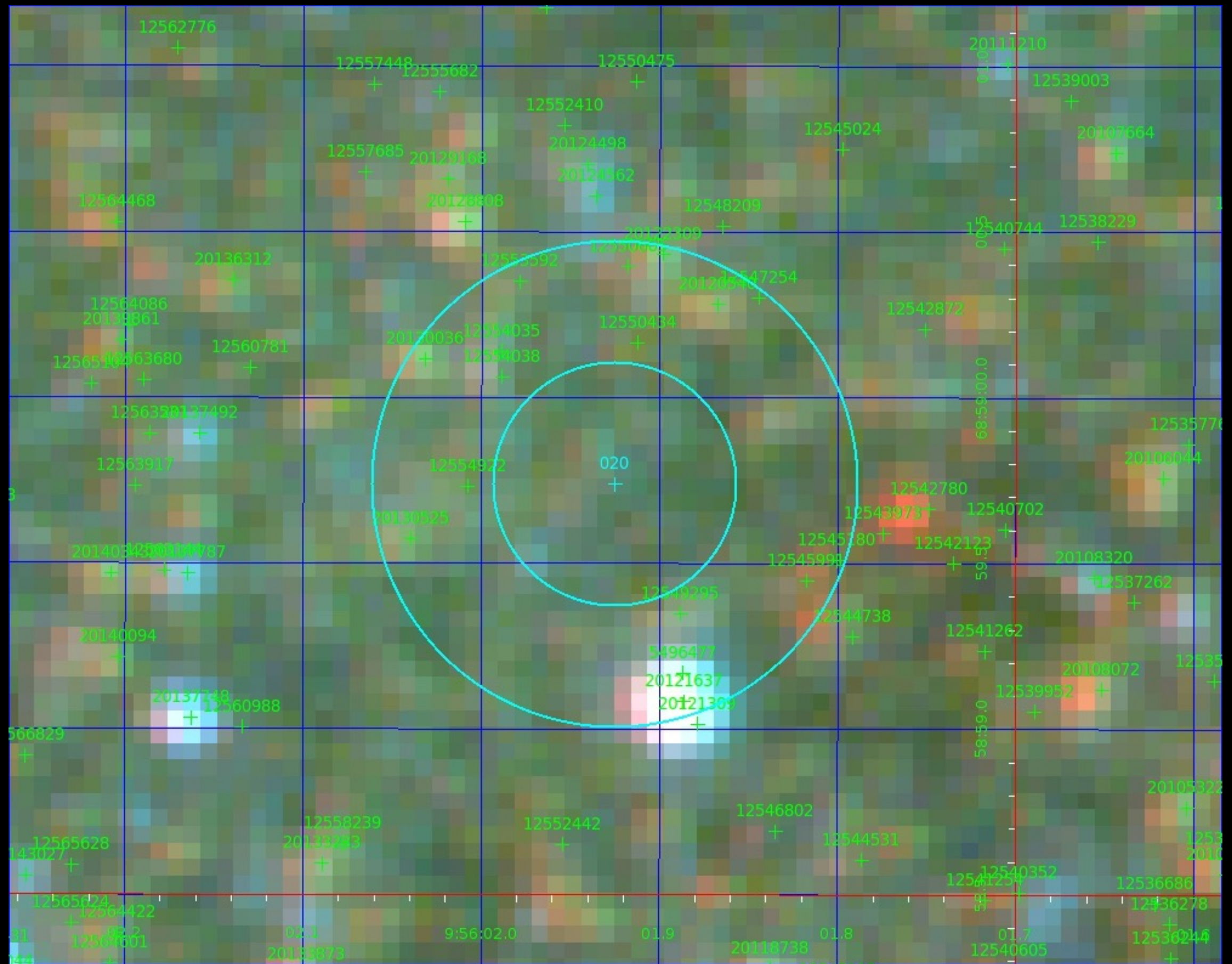


Foreground
Star

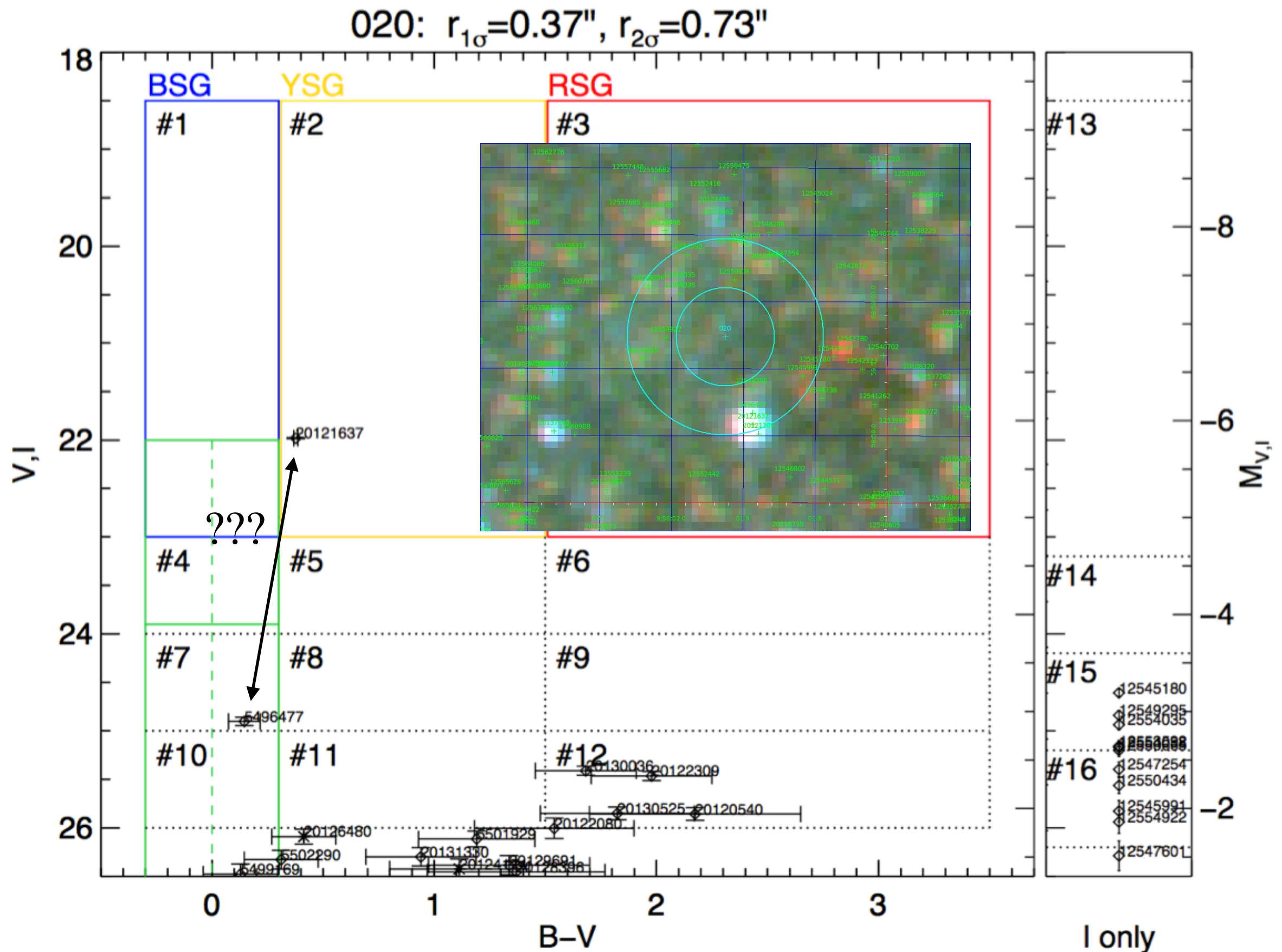
Globular
Cluster



Source Classification in M81–CMD



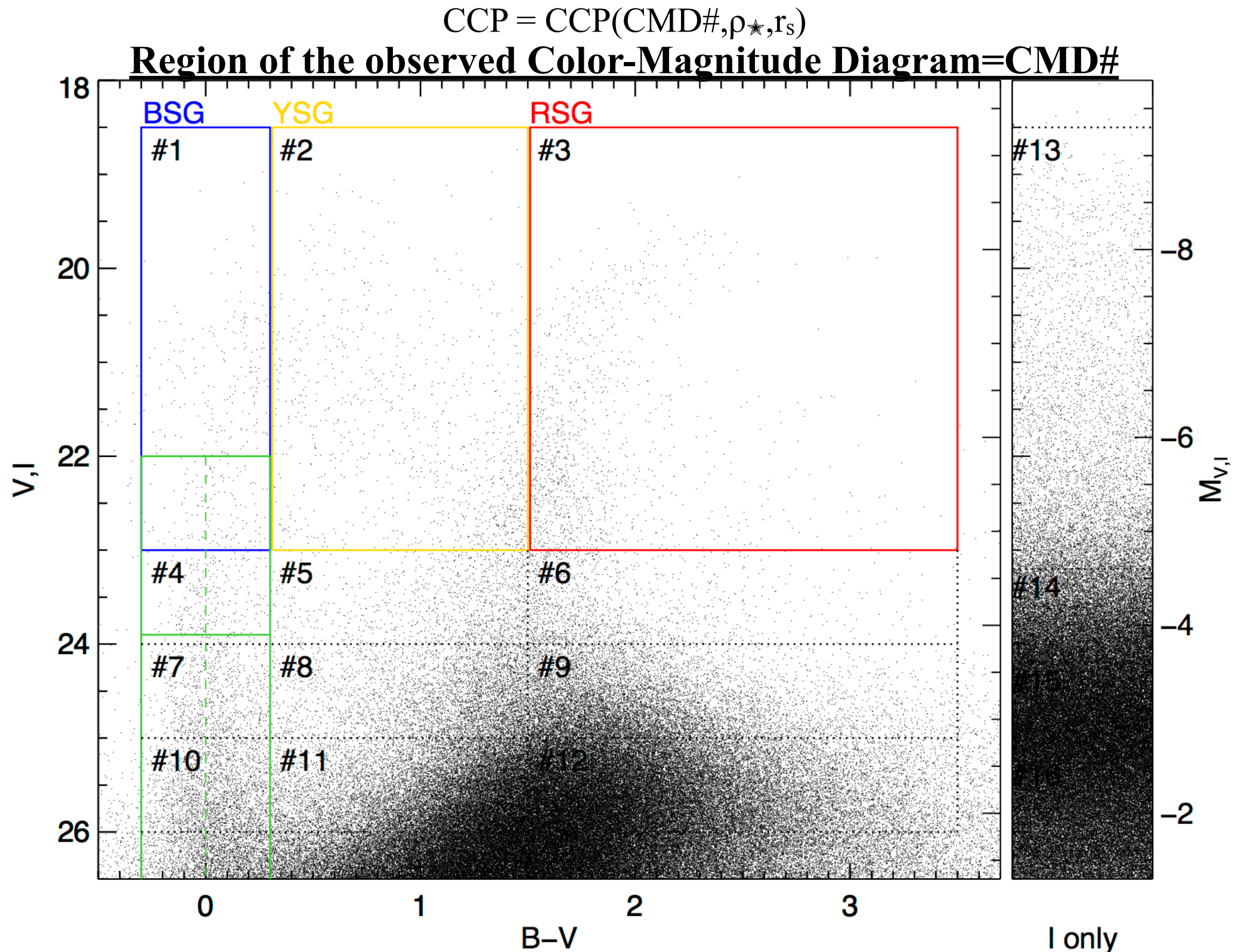
Source Classification in M81–CMD



Chance Coincidence Probability (CCP)

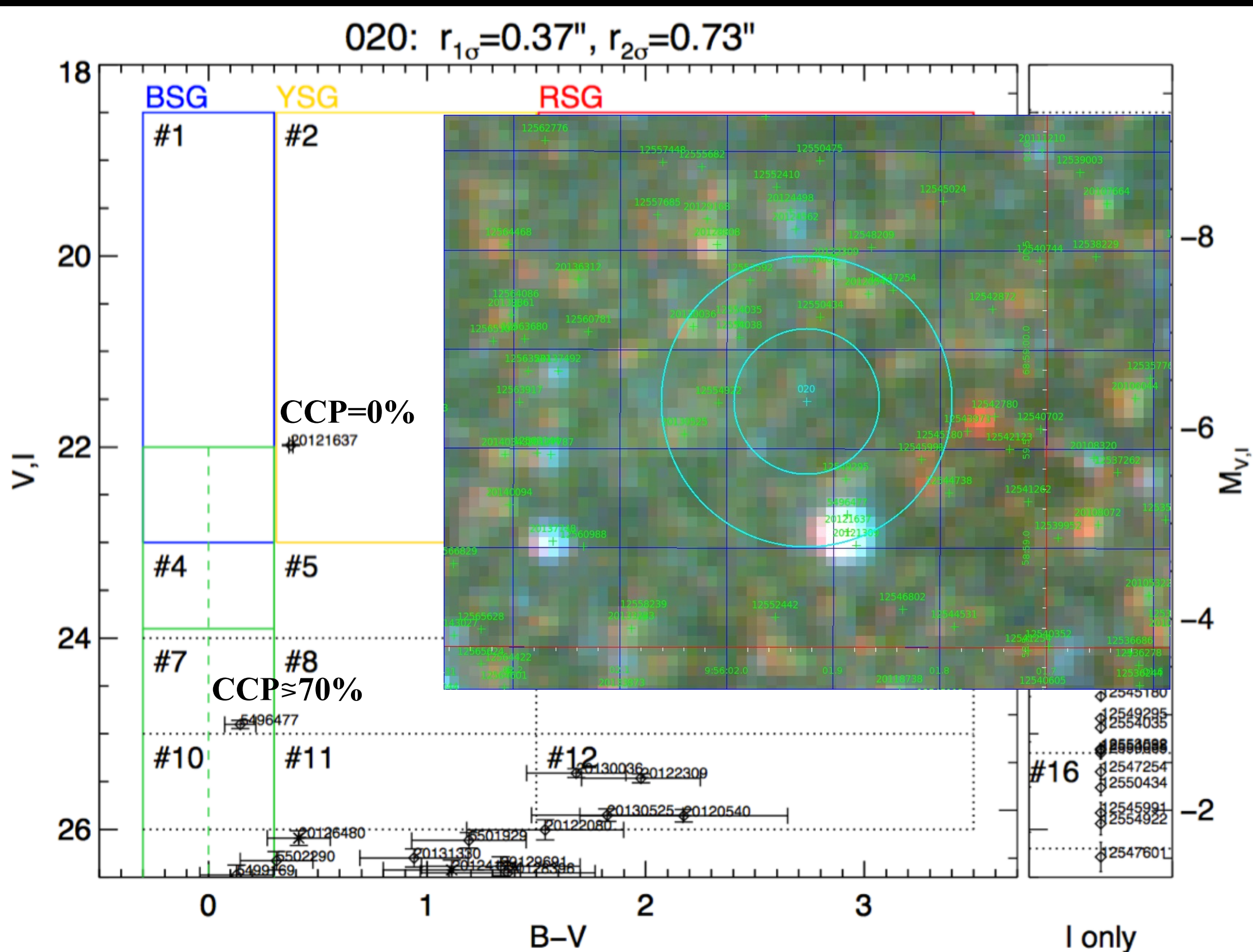
“the probability that an HST source is randomly associated with a Chandra source”

= # of Chandra sources matched after random shifts / # of Chandra sources matched without shifting



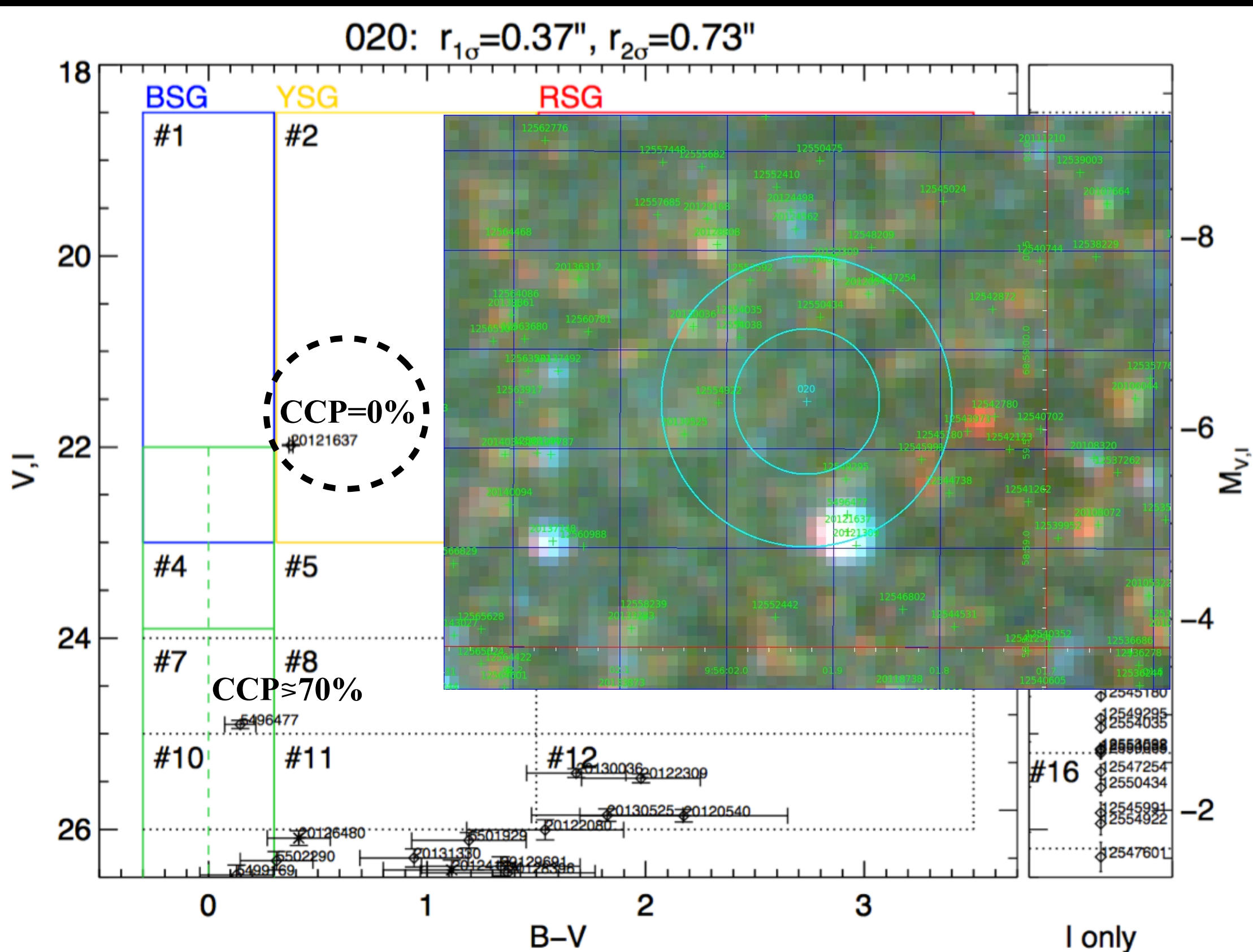
Source Classification in M81

Yellow Supergiant



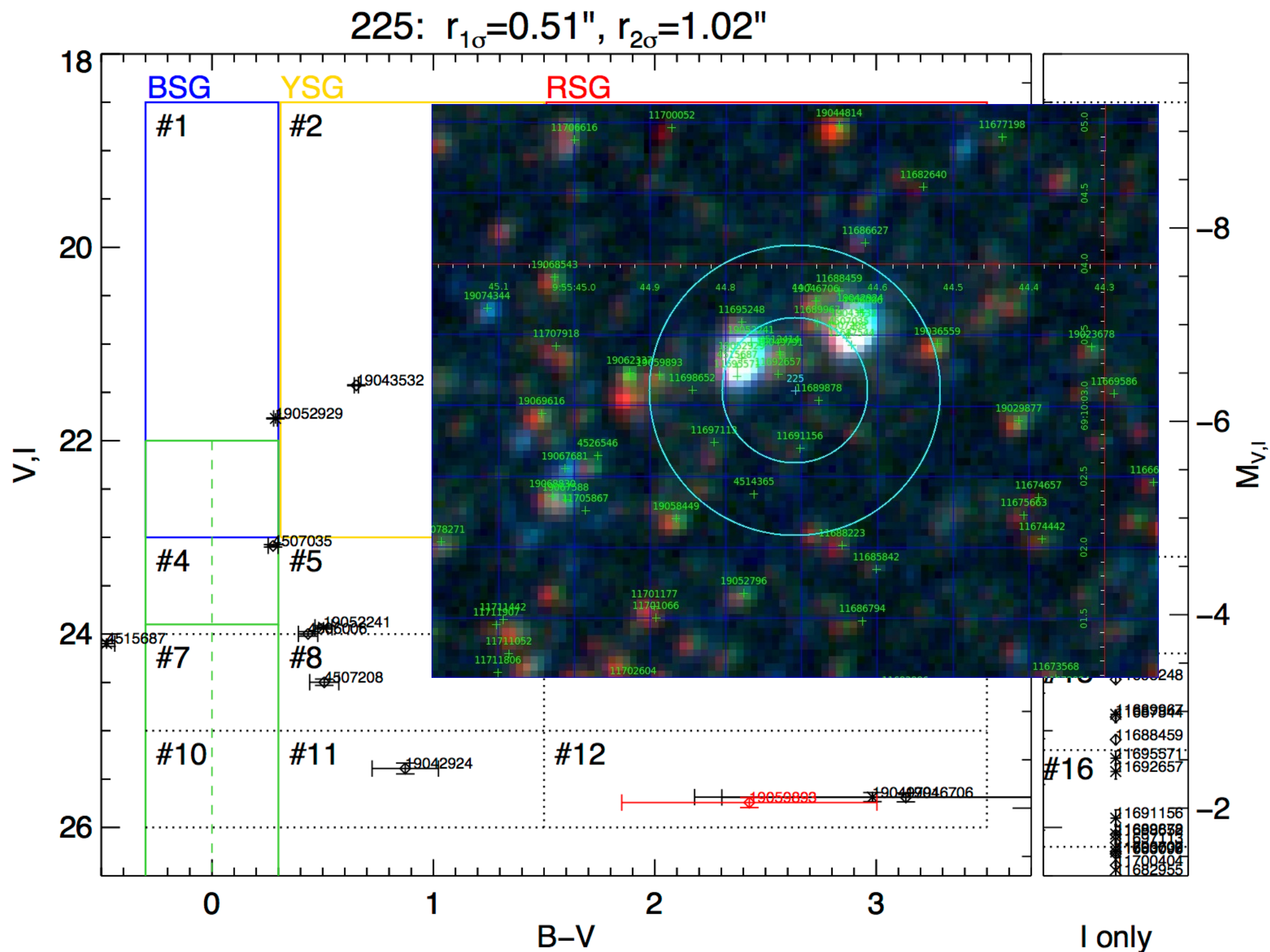
Source Classification in M81

Yellow Supergiant



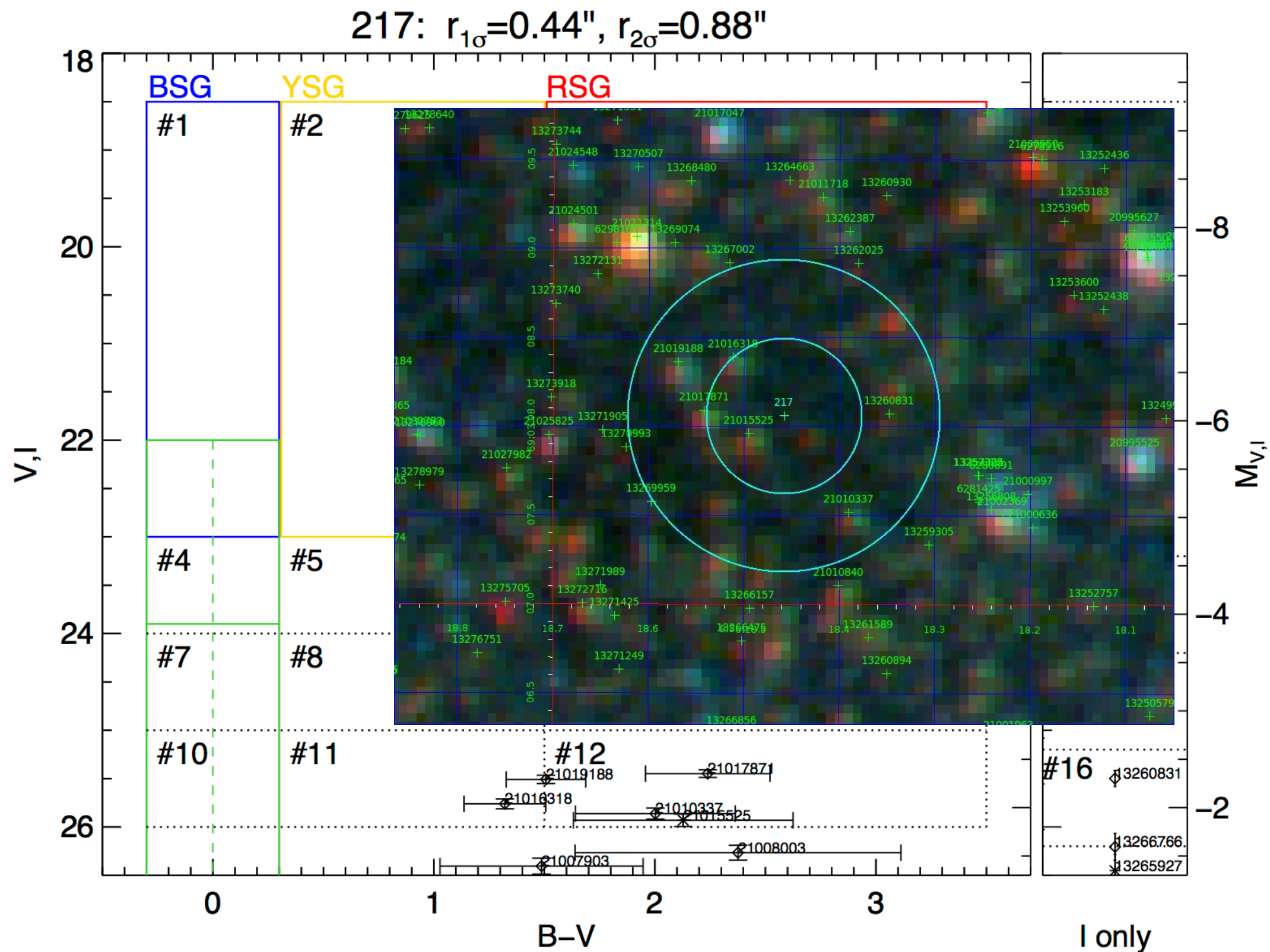
Source Classification in M81

Unknown HMXB



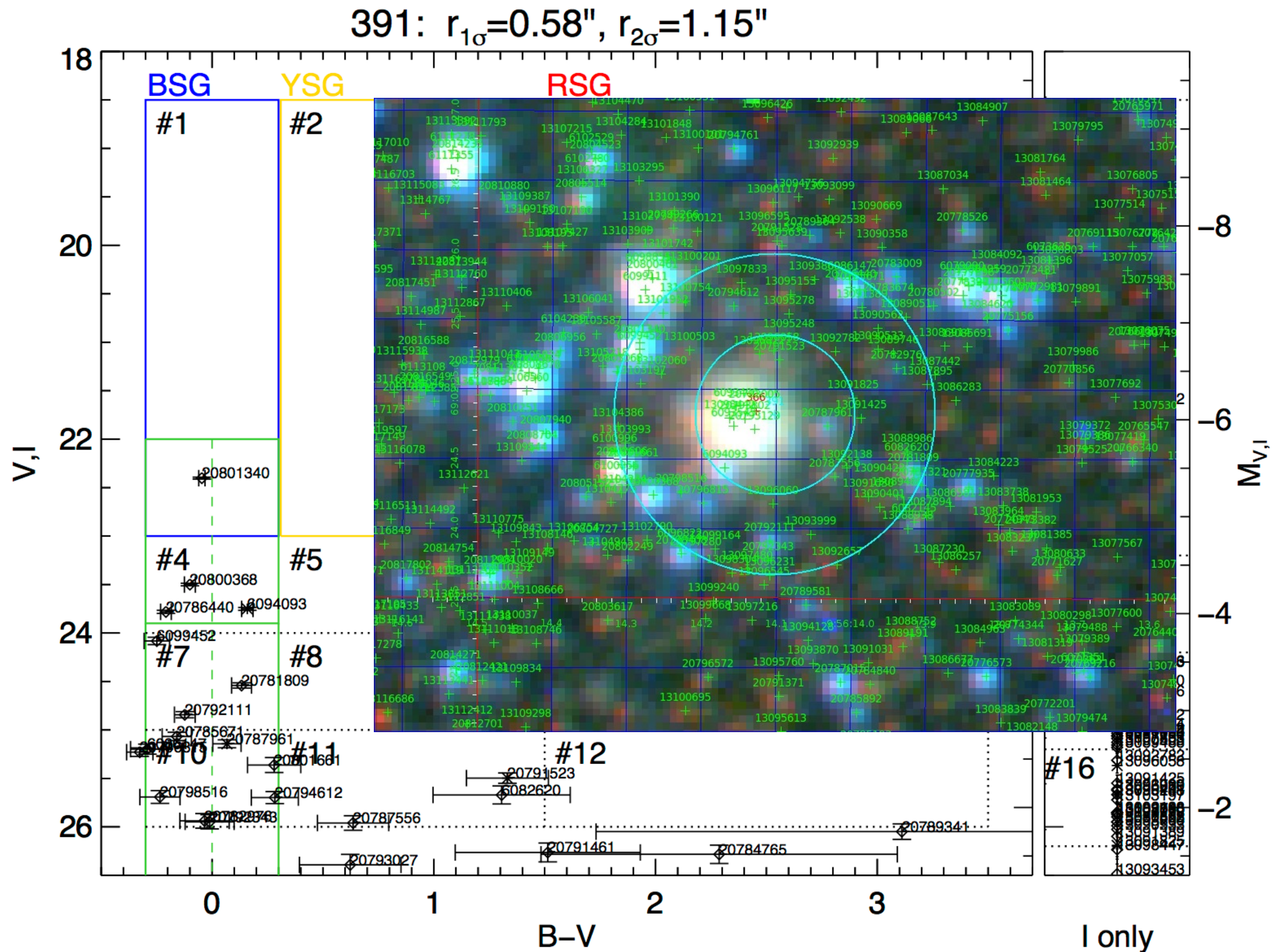
Source Classification in M81

Unknown LMXB

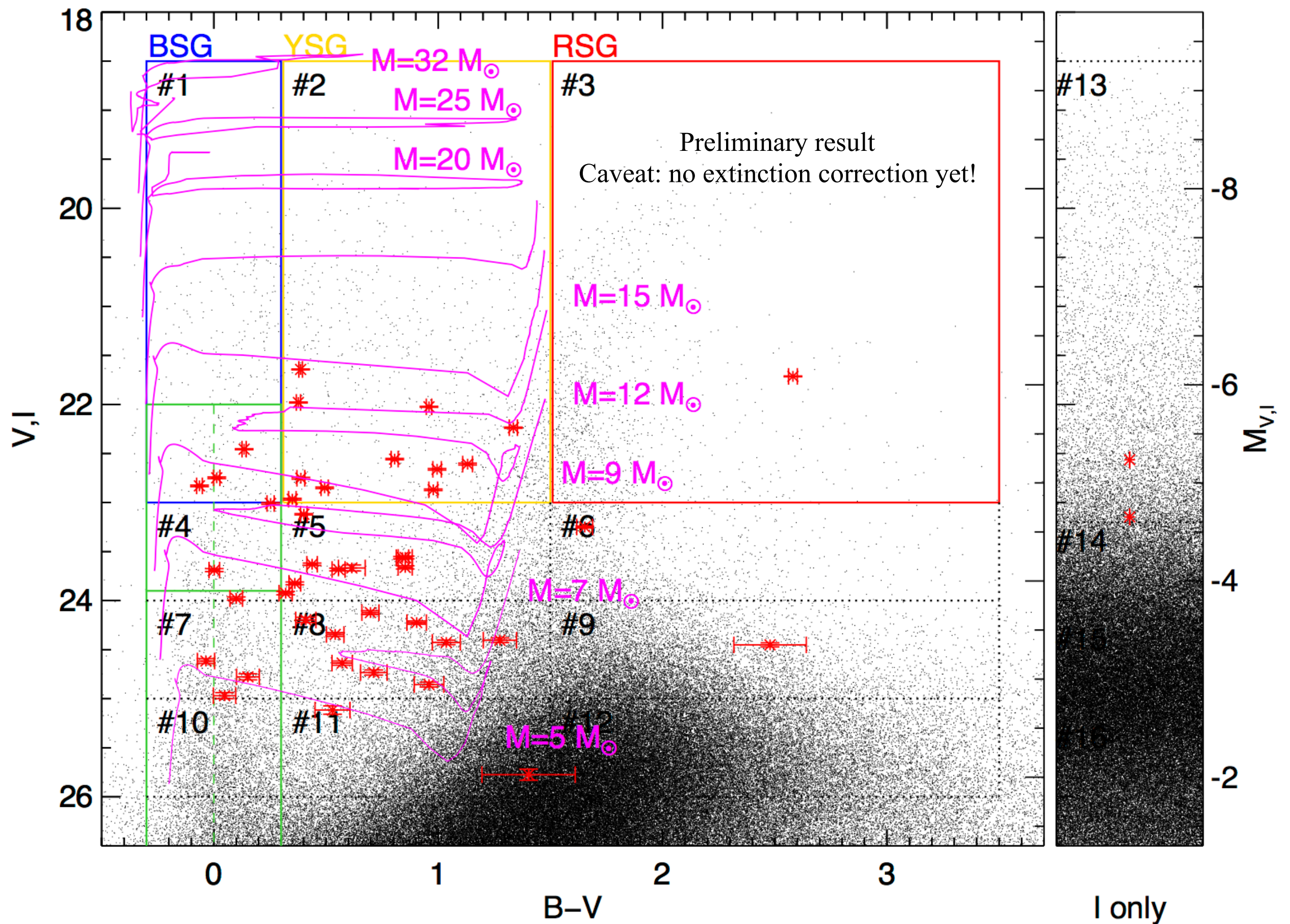


Source Classification in M81

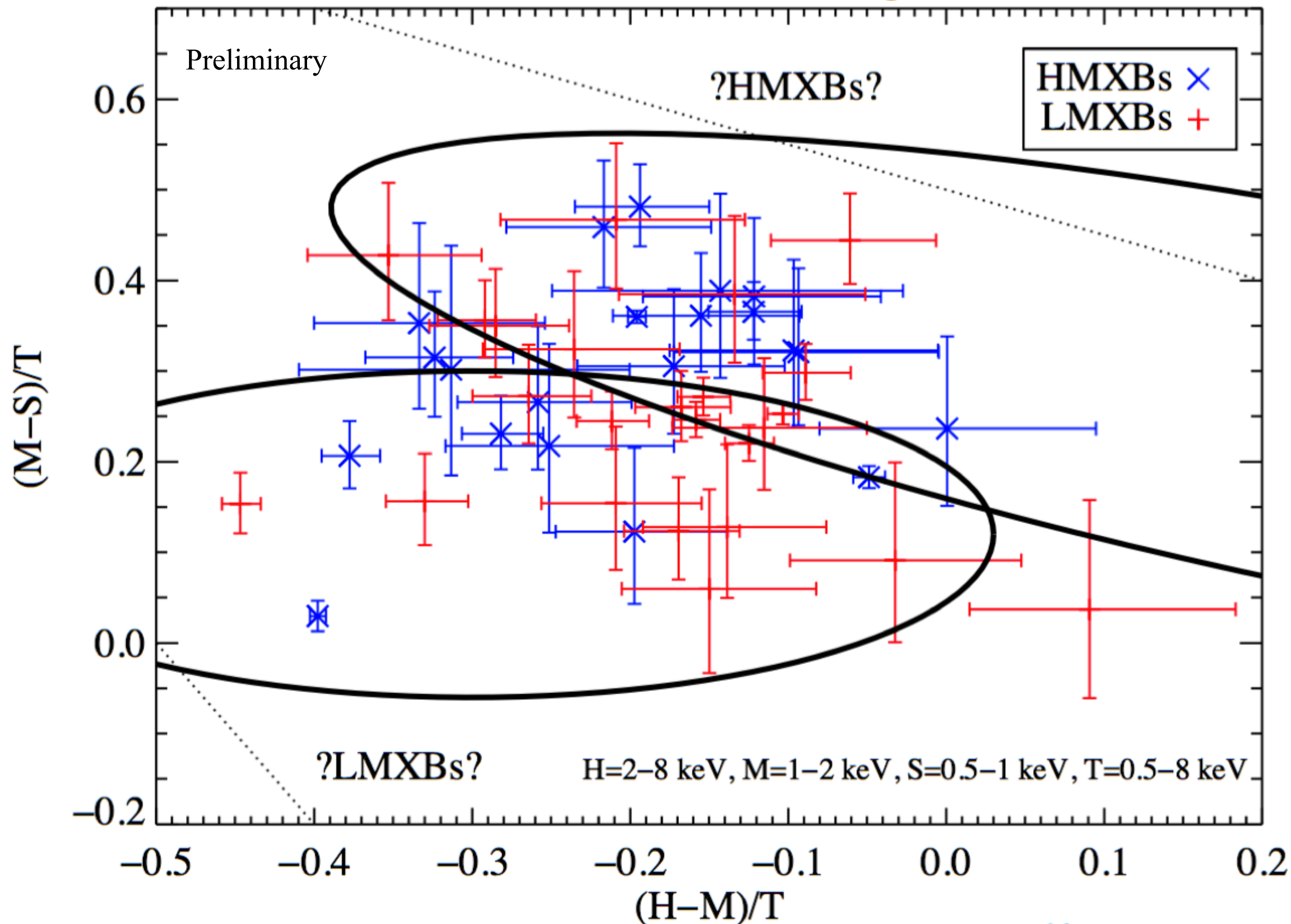
Indeterminate



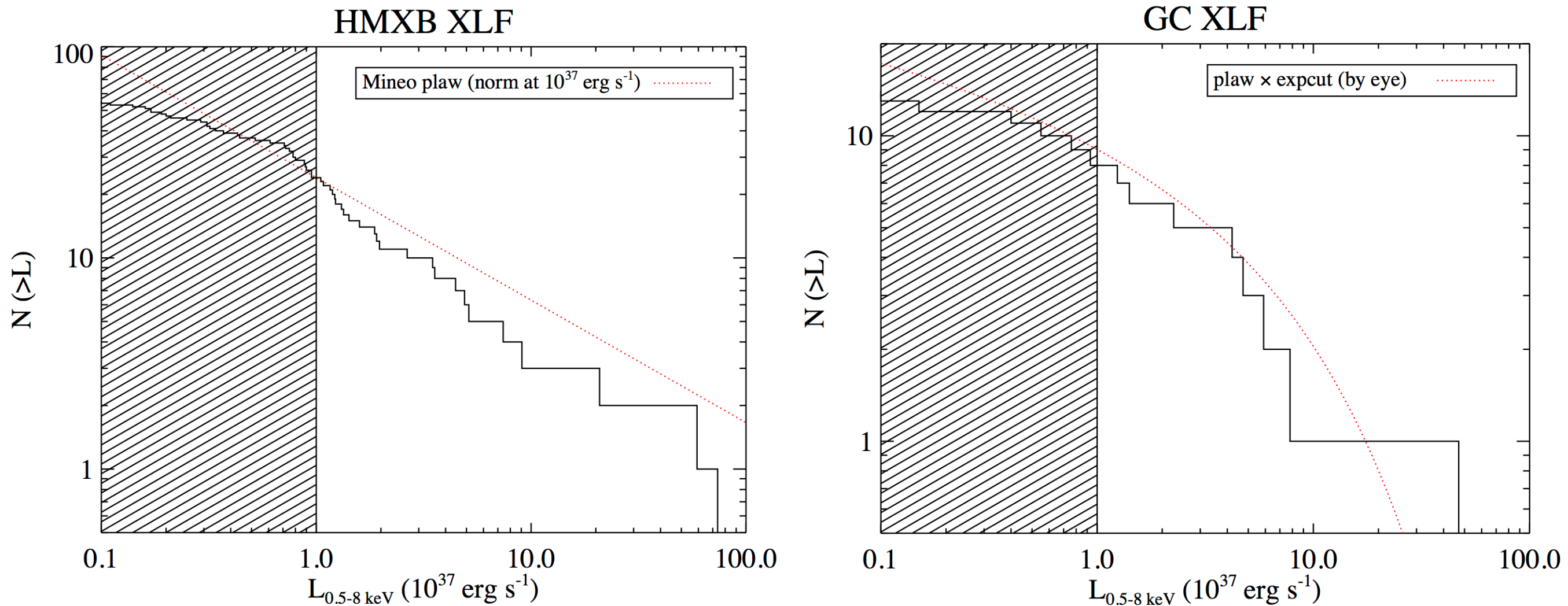
CMD of All Uniquely Classified Sources



Prestwich et al. 2003 Diagnostics



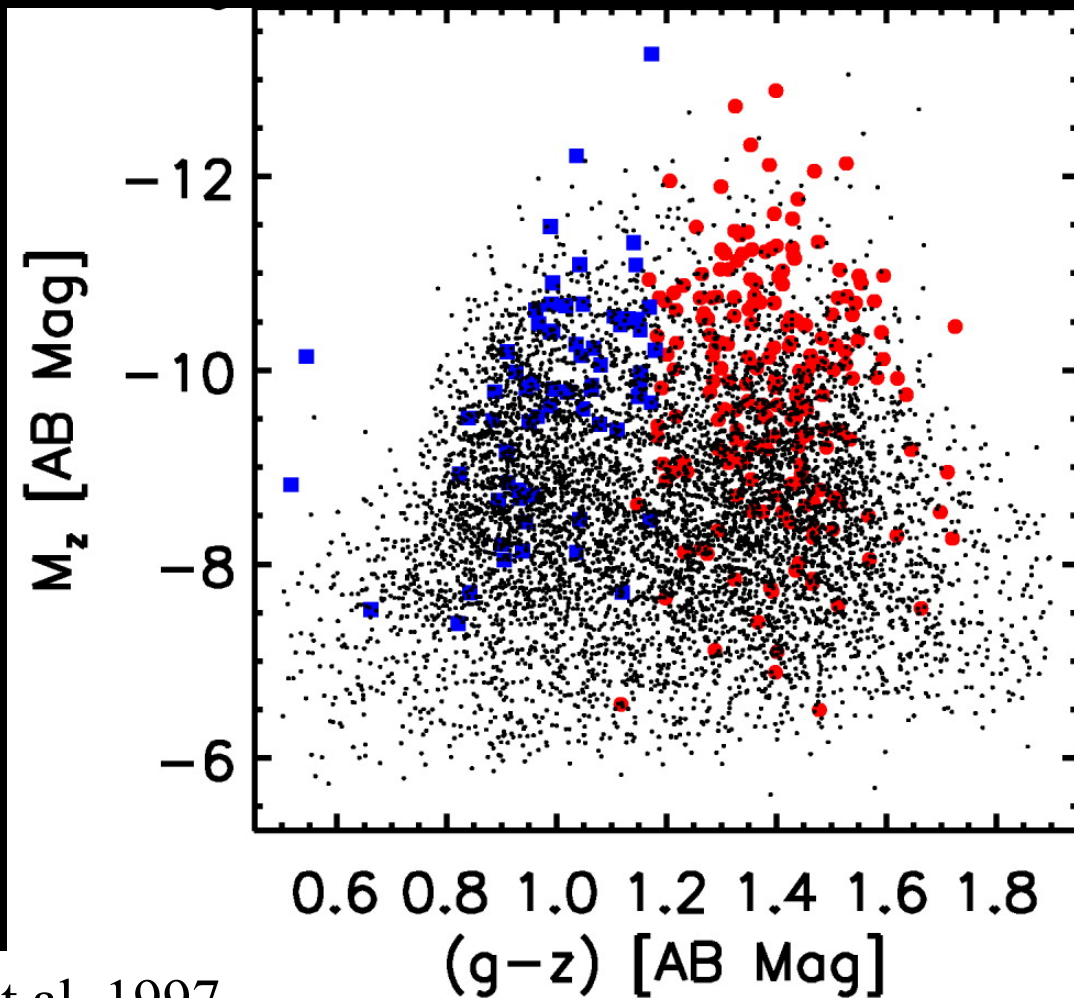
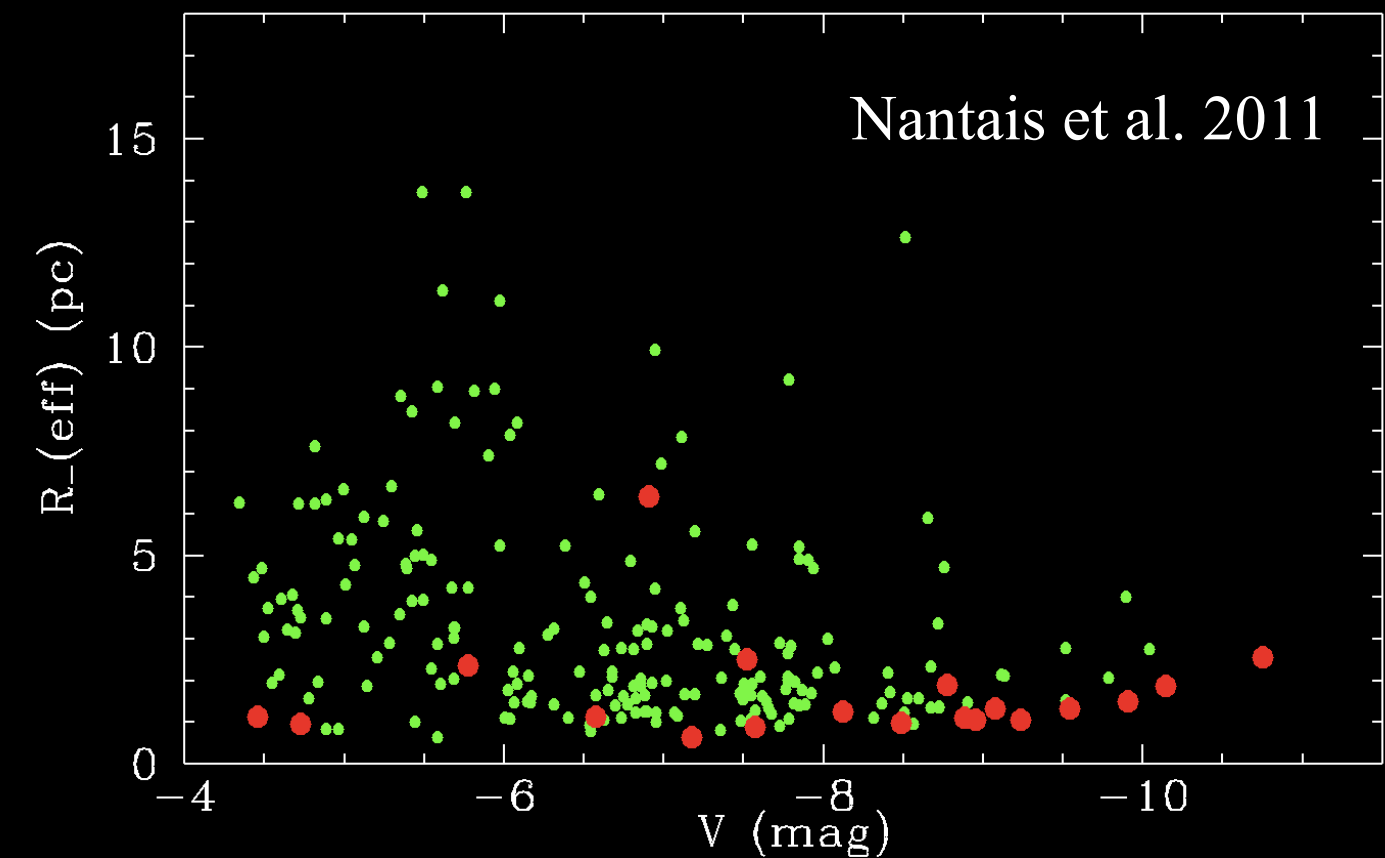
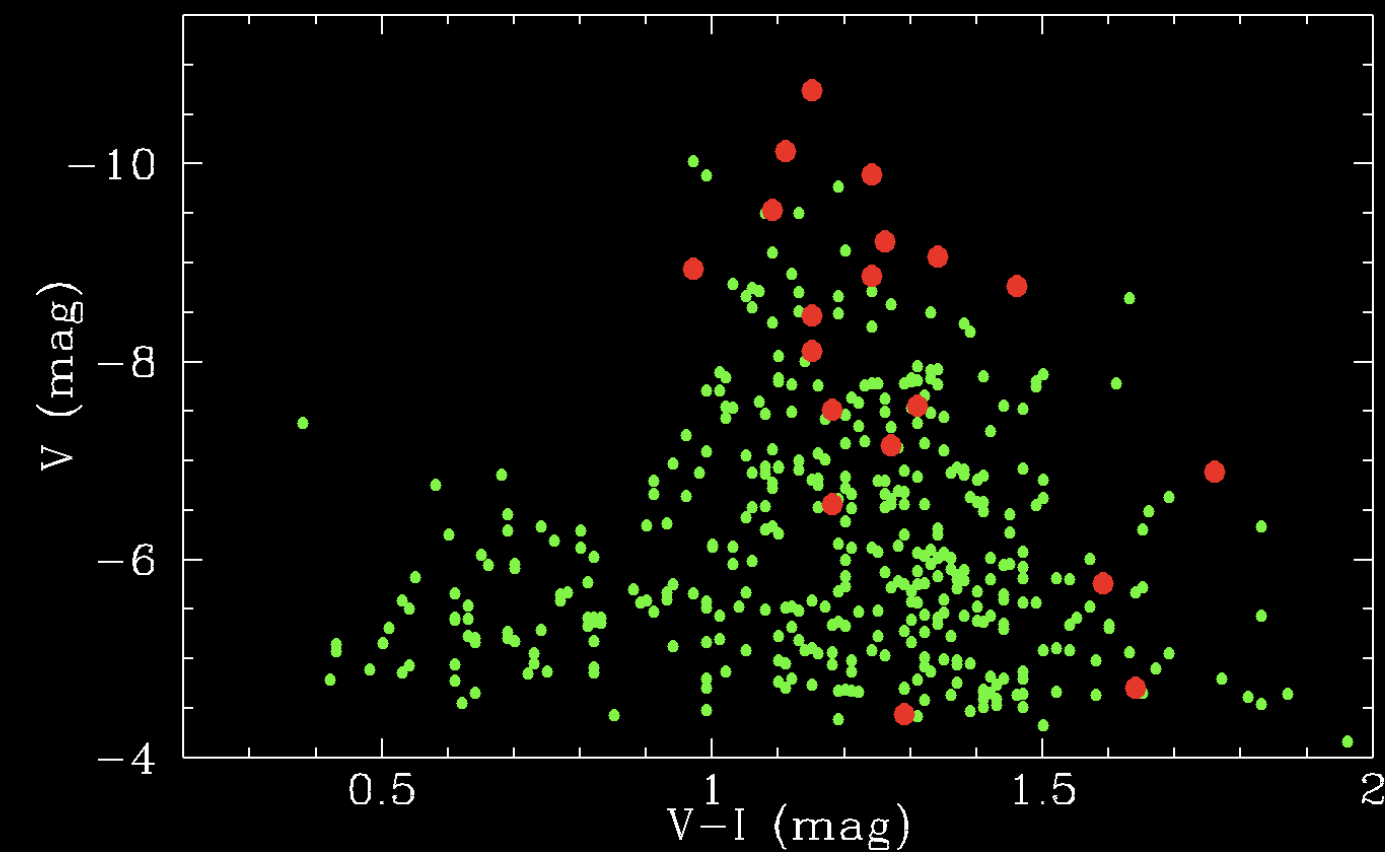
Preliminary Luminosity Functions



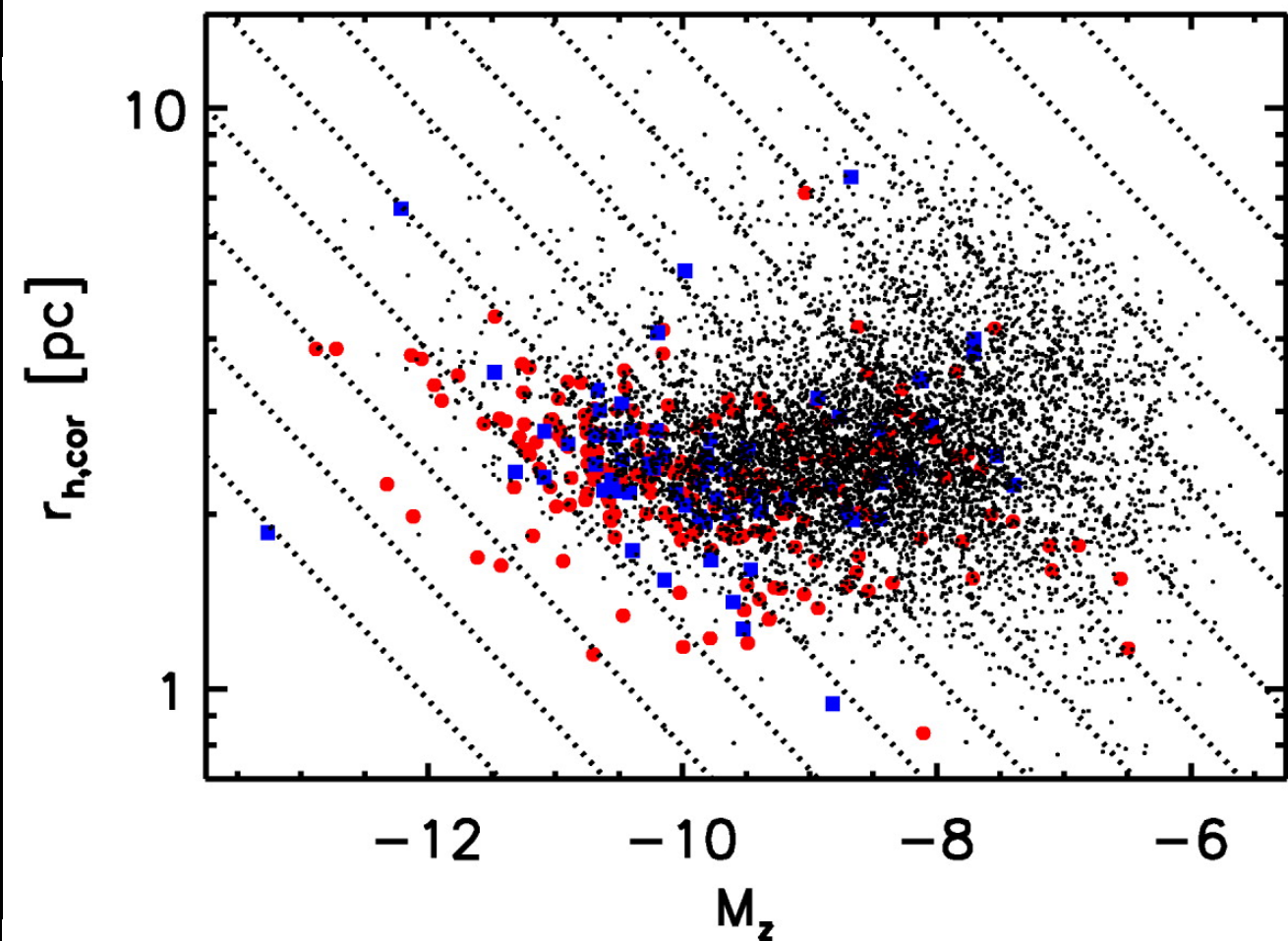
Not corrected for incompleteness or fit yet!

- Contamination
 - Bulge with HMXBs: $<\sim 10\%$
 - Fraction of HMXBs in the disk: $\sim 1/3$ – $1/2$ of the sources!

Globular Cluster LMXBs



Sivakoff et al. 1997



Summary

- We classify individual X-ray sources
- X-ray colors should not be used to differentiate the nature of the companion
- A “pure” HMXB XLF may be steeper?
- Globular cluster LMXBs associated with redder, more massive, and denser clusters
- Explore other interesting source types: Be XRBs...