Swanning Around with Chandra

Star and Planet Formation in Cygnus OB2

A Chandra Very Large Project

www.cygob2.org

J.J. Drake, **N. Wright**, **M. Guarcello**, V. Kashyap, T. Aldcroft, E. Flaccomio, Univ. Herts, Armagh Observatory Univ. Exeter, Imperial College, UCL, Palermo Observatory, Univ. Munich, Univ. Bordeaux, CEA, CES, Harvard-Smithsonian, Univ. Liege, NASA GSFC, Smith College, Southampton Univ., Univ. Toledo, Univ. Wyoming

See N. Wright poster 133.08

Swa[illegible]with

Star and [illegible]nus OB2

J.J. Drake, **N. Wright**, **M. Guarcello**, V. Kashyap, T. Aldcroft, E. Flaccomio, Univ. Herts, Armagh Observatory Univ. Exeter, Imperial College, UCL, Palermo Observatory, Univ. Munich, Univ. Bordeaux, CEA, CES, Harvard-Smithsonian, Univ. Liege, NASA GSFC, Smith College, Southampton Univ., Univ. Toledo, Univ. Wyoming

See N. Wright poster 133.08

Swa[illegible]with

Star and [illegible]nus OB2

Happy Birthday Mario!

J.J. Drake, **N. Wright**, **M. Guarcello**, V. Kashyap, T. Aldcroft, E. Flaccomio, Univ. Herts, Armagh Observatory Univ. Exeter, Imperial College, UCL, Palermo Observatory, Univ. Munich, Univ. Bordeaux, CEA, CES, Harvard-Smithsonian, Univ. Liege, NASA GSFC, Smith College, Southampton Univ., Univ. Toledo, Univ. Wyoming

See N. Wright poster 133.08

Swanning Around with Chandra

Star and Planet Formation in Cygnus OB2

A Chandra Very Large Project

www.cygob2.org

J.J. Drake, **N. Wright**, **M. Guarcello**, V. Kashyap, T. Aldcroft, E. Flaccomio, Univ. Herts, Armagh Observatory Univ. Exeter, Imperial College, UCL, Palermo Observatory, Univ. Munich, Univ. Bordeaux, CEA, CES, Harvard-Smithsonian, Univ. Liege, NASA GSFC, Smith College, Southampton Univ., Univ. Toledo, Univ. Wyoming

See N. Wright poster 133.08

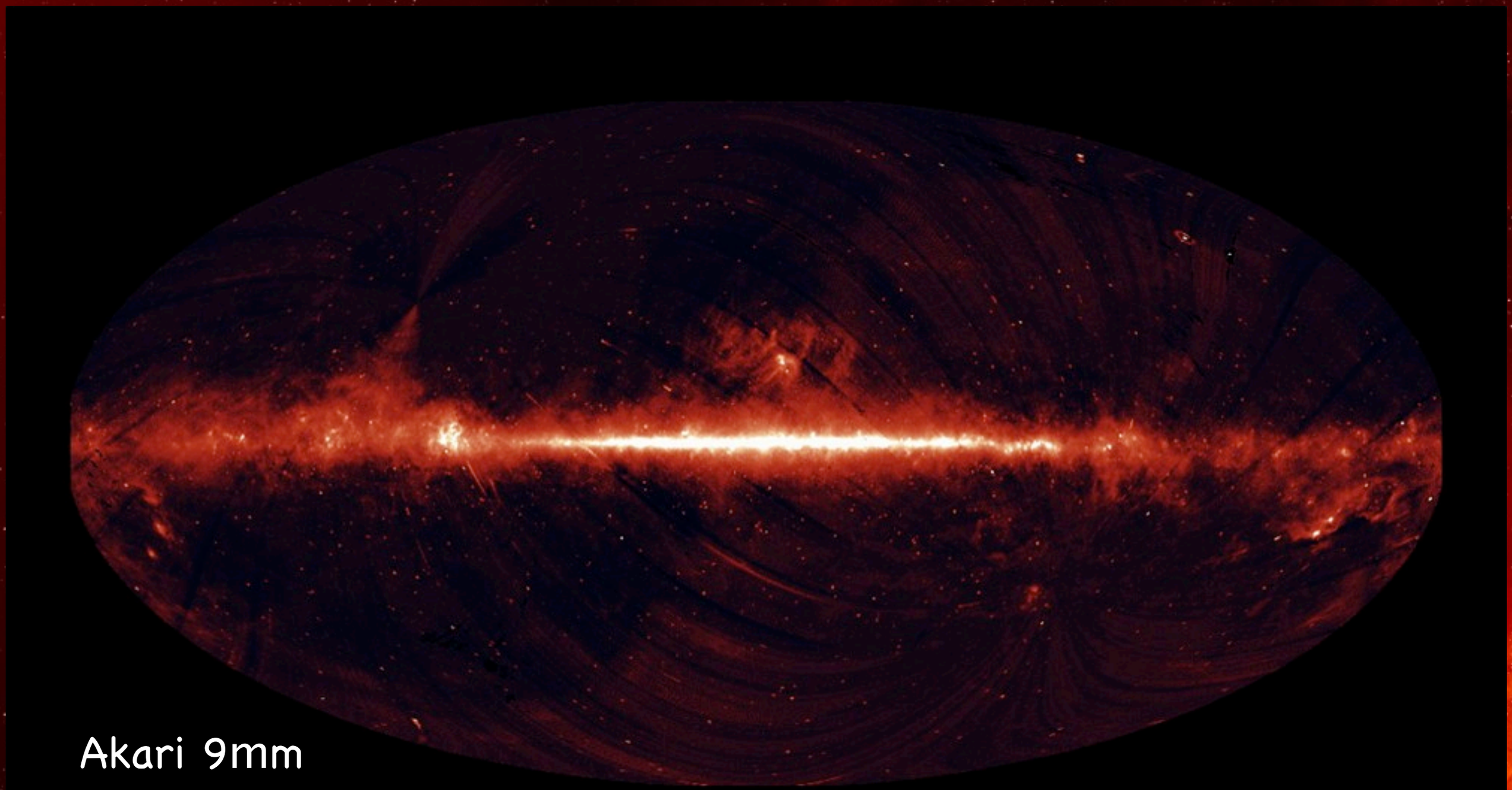
Acronym

Chandra Carina Complex Project - CCCP
Chandra Orion Ultra-deep Project - COUP
Chandra Cygnus OB2 Survey.....

~~CYCLES~~
~~COCOA~~
~~XXXXX~~
~~ECCOO~~
~~TOCCO~~
~~CHESS~~
~~CISCO~~

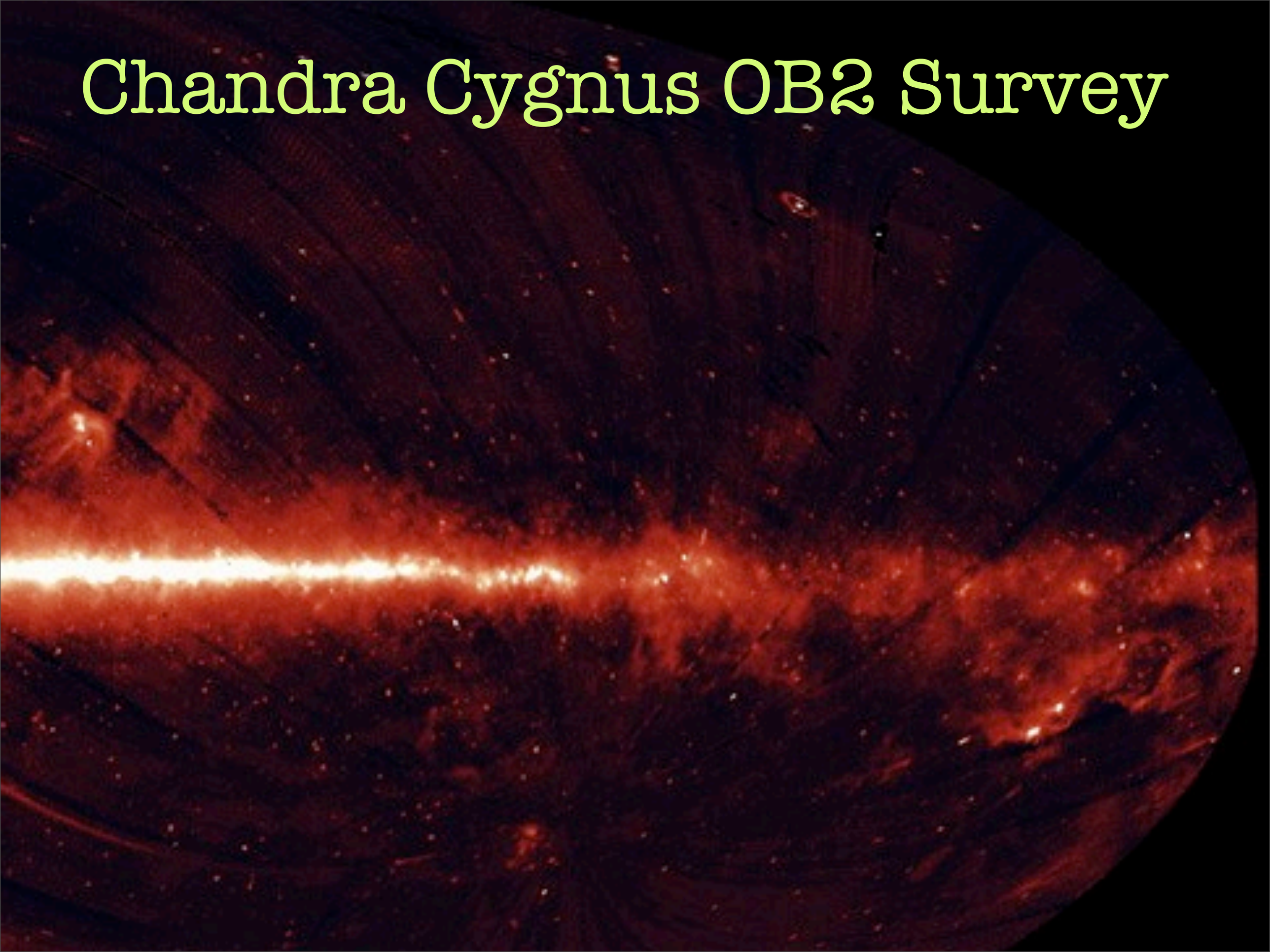
~~SUCCO~~
~~COBS~~
~~OBII Swan XanOpI~~
~~CXCI~~
~~XXXXXX~~
~~XMuSIC~~

Chandra Cygnus OB2 Survey



Akari 9mm

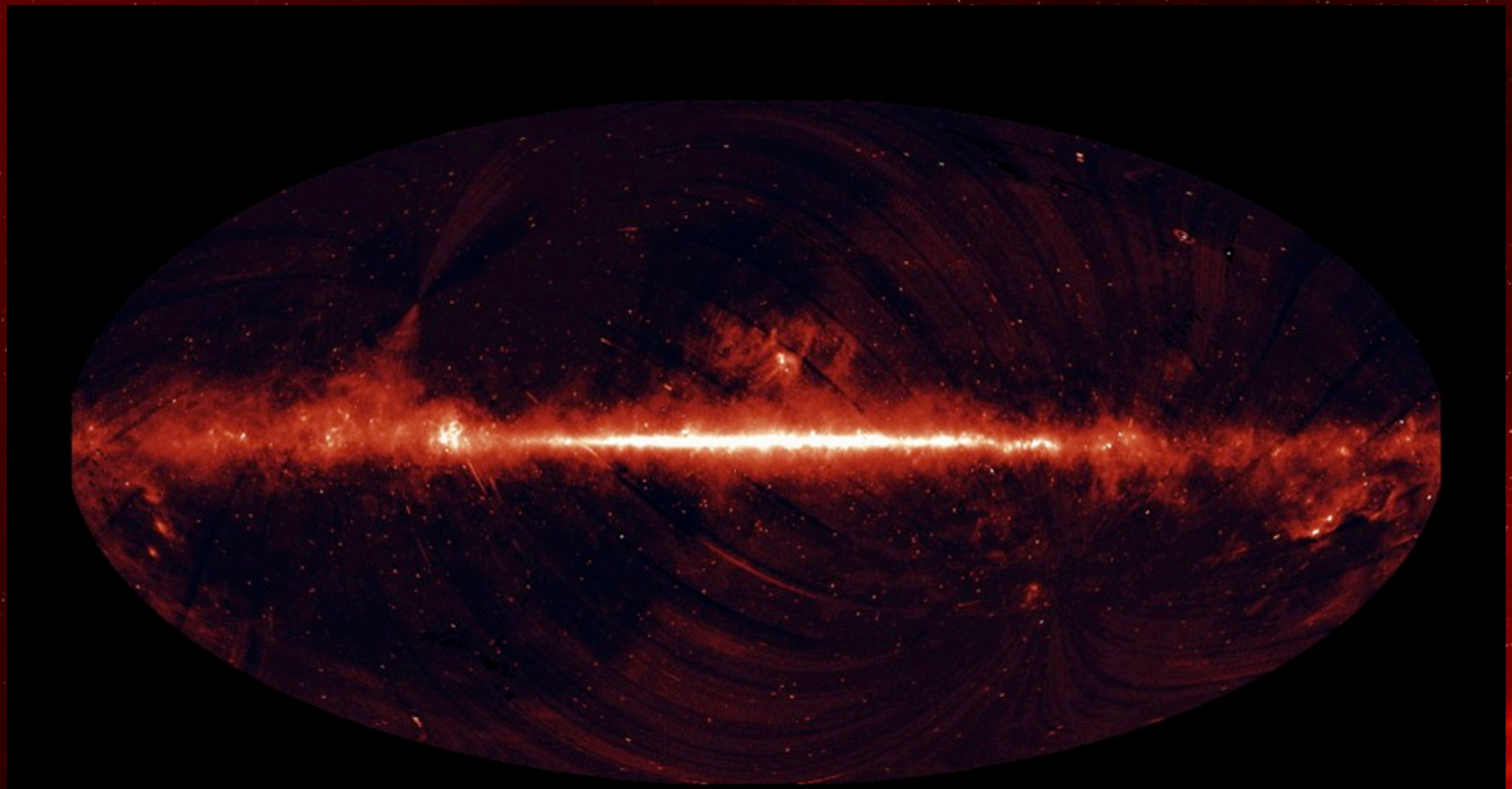
Chandra Cygnus OB2 Survey



Chandra Cygnus OB2 Survey

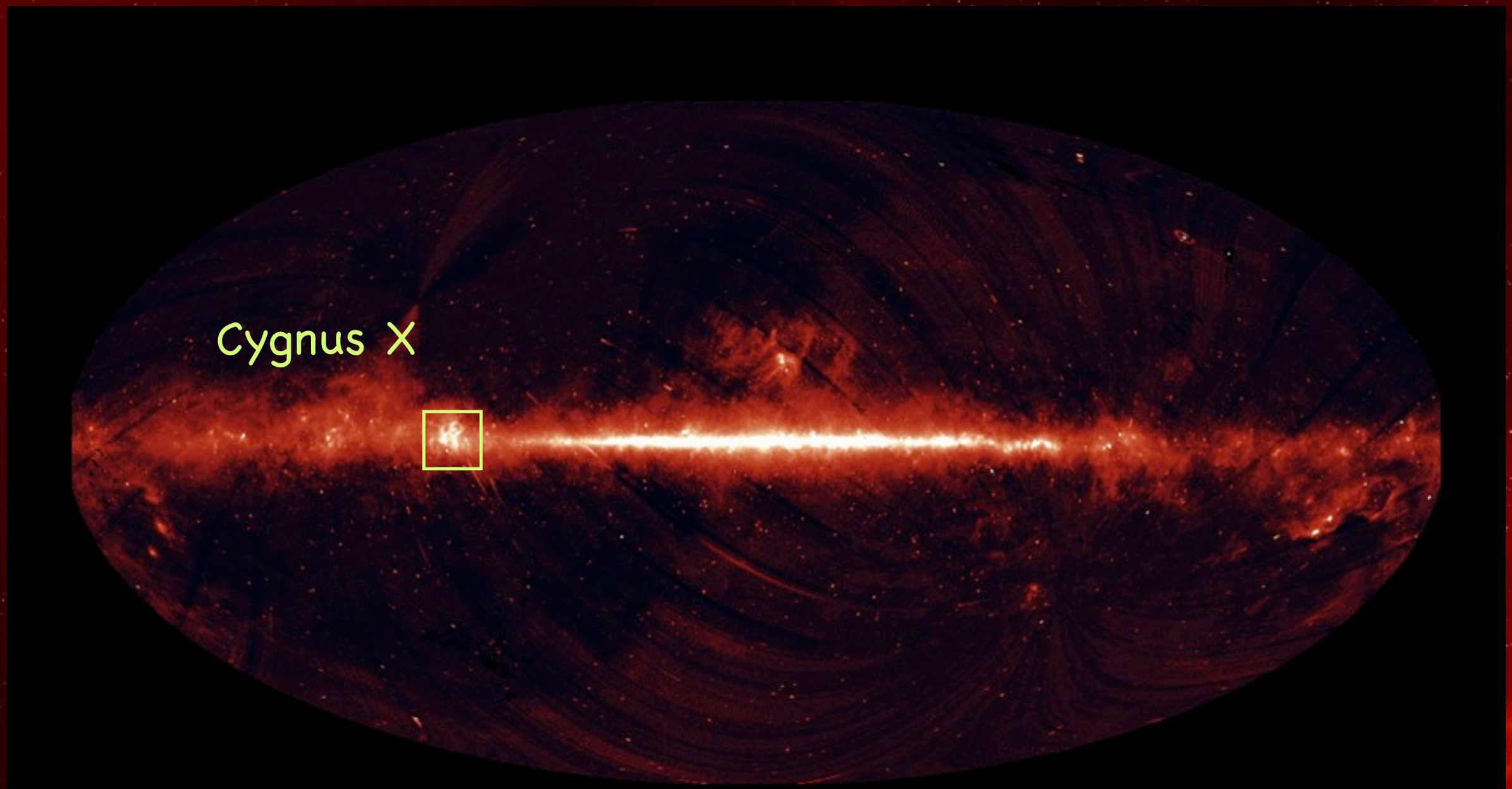
Chandra Cygnus OB2 Survey

Chandra Cygnus OB2 Survey

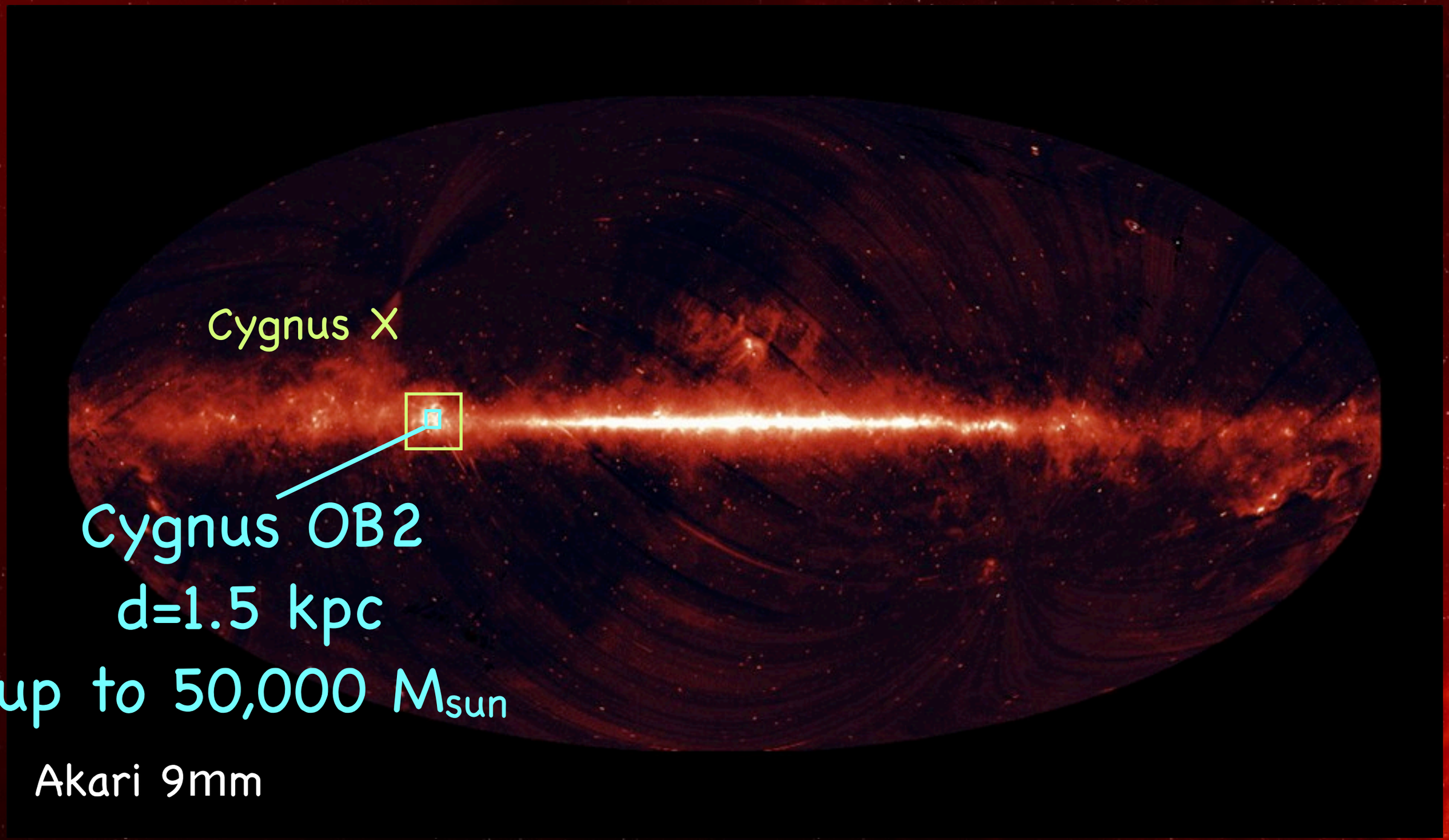


Akari 9mm

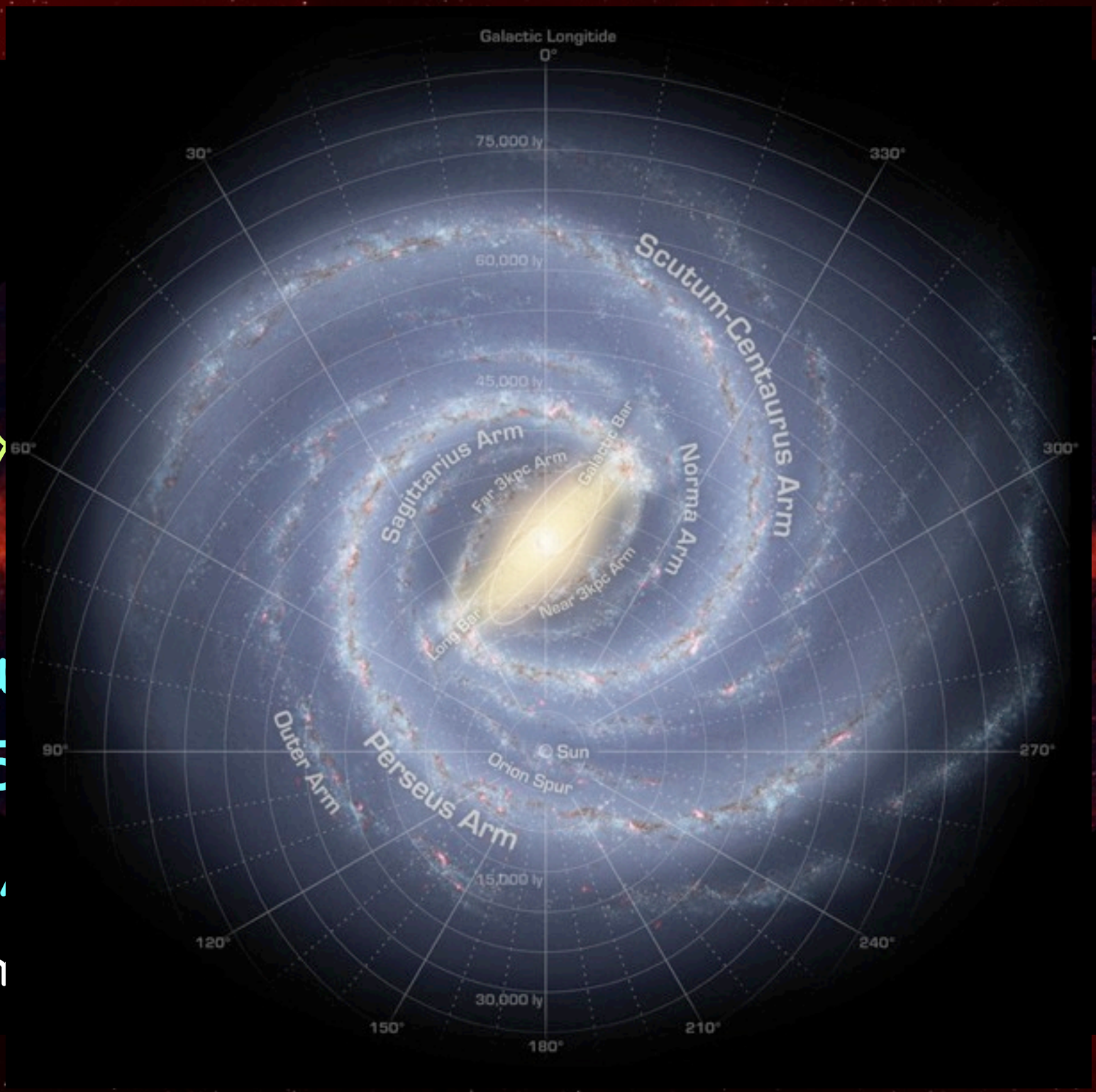
Chandra Cygnus OB2 Survey



Chandra Cygnus OB2 Survey



Chandra Cygnus OB2 Survey



Cy

Cygnu

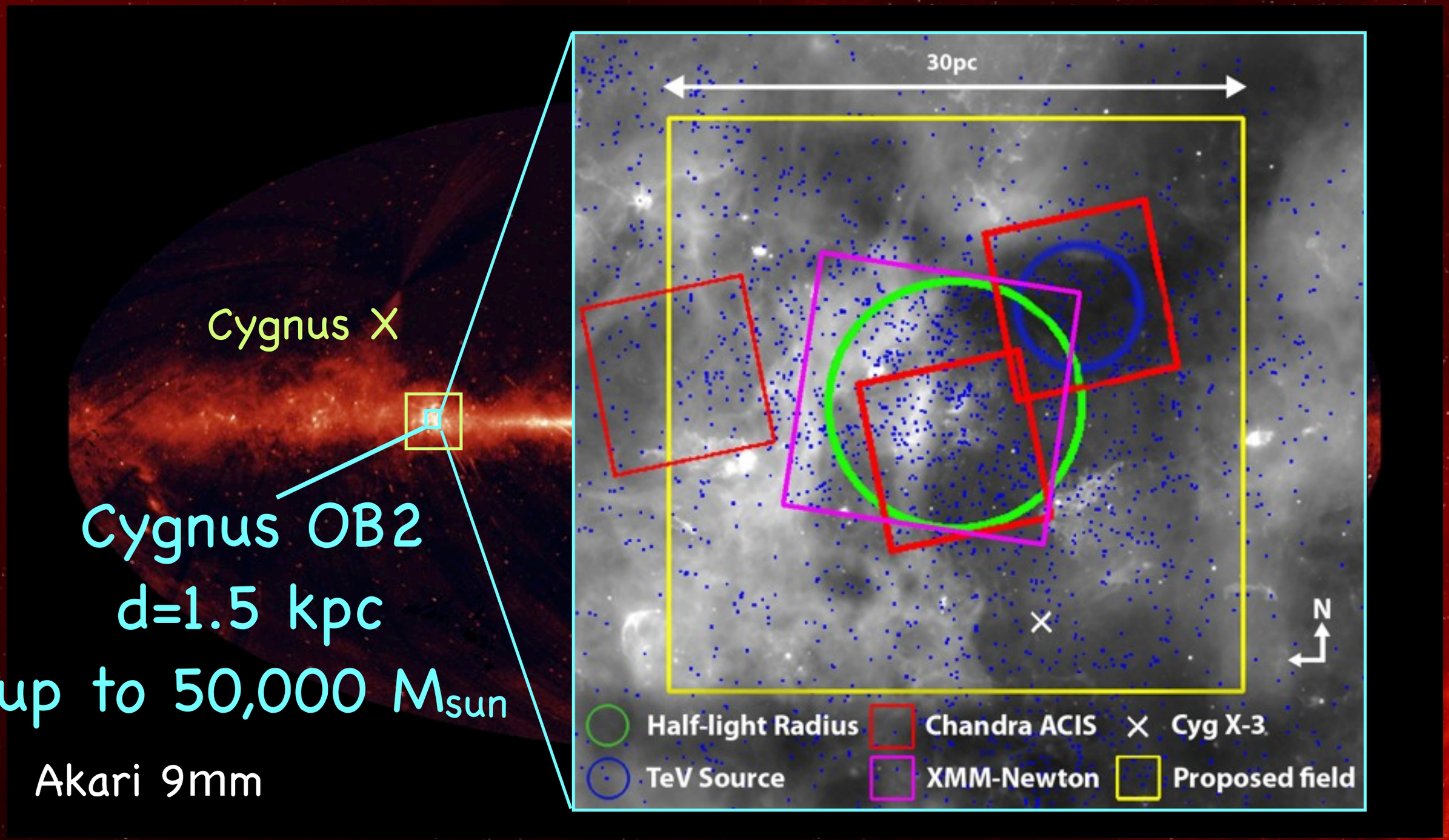
d=1.5

up to 50

Akari 9mn

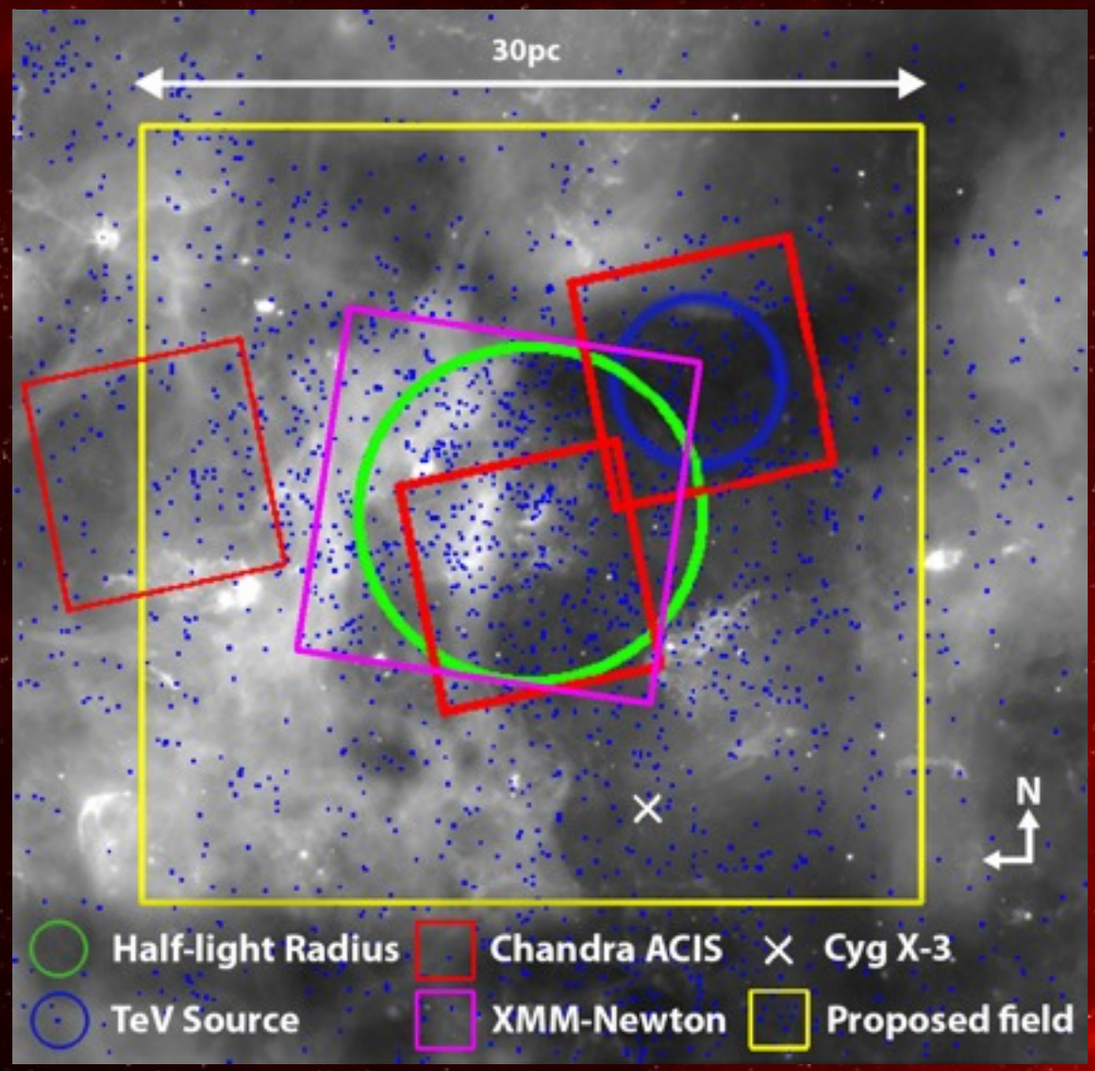

60,000 ly
45,000 ly
15,000 ly
Scutum-Centaurus Arm
Norma Arm
Sagittarius Arm
Far 3kpc Arm
Galactic Bar
Near 3kpc Arm
Long Bar
Perseus Arm
Outer Arm
Orion Spur
Sun
You are here
90°
270°
300°
330°

Chandra Cygnus OB2 Survey

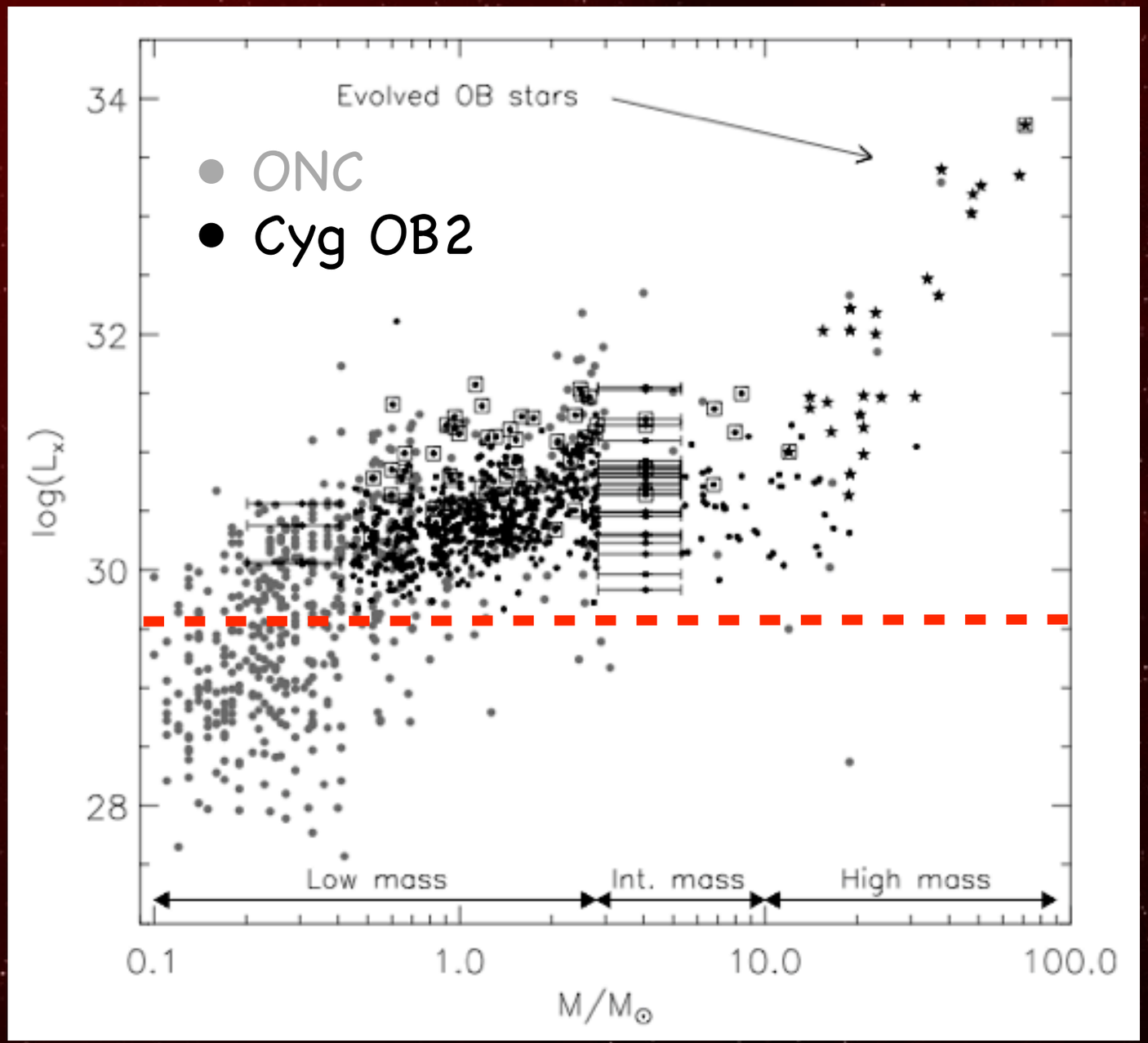


Motivation

- Nearest SF region (1.5 kpc) with pretentions to approaching "supercluster" dimensions
  - two O3 stars, up to 2000 OB stars
  - dynamically quite unevolved
- Extensive existing multi-wavelength coverage (inc. Spitzer Cygnus X legacy)
- X-rays isolate young population against back/foreground
  - Can reach < 1 Msun
- MSF, protoplanetary disks, X-ray evolution



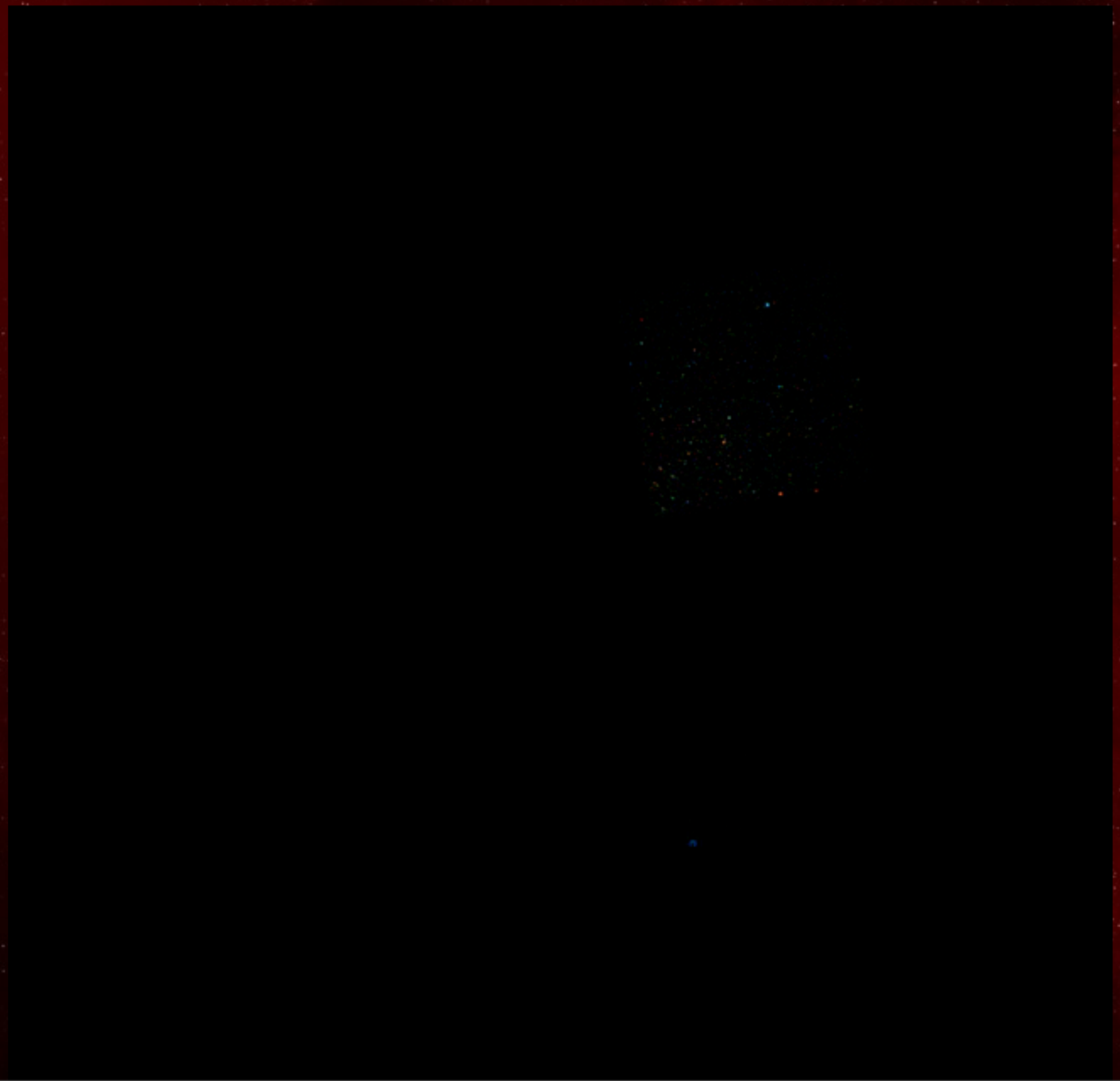
Survey Depth



- Complete to 1 Msun
- ~50% complete for 0.5 Msun
- decent fraction of 0.1-0.5 Msun
- $L_X < 10^{29.5}$ erg/s
- 5000-10000 sources predicted

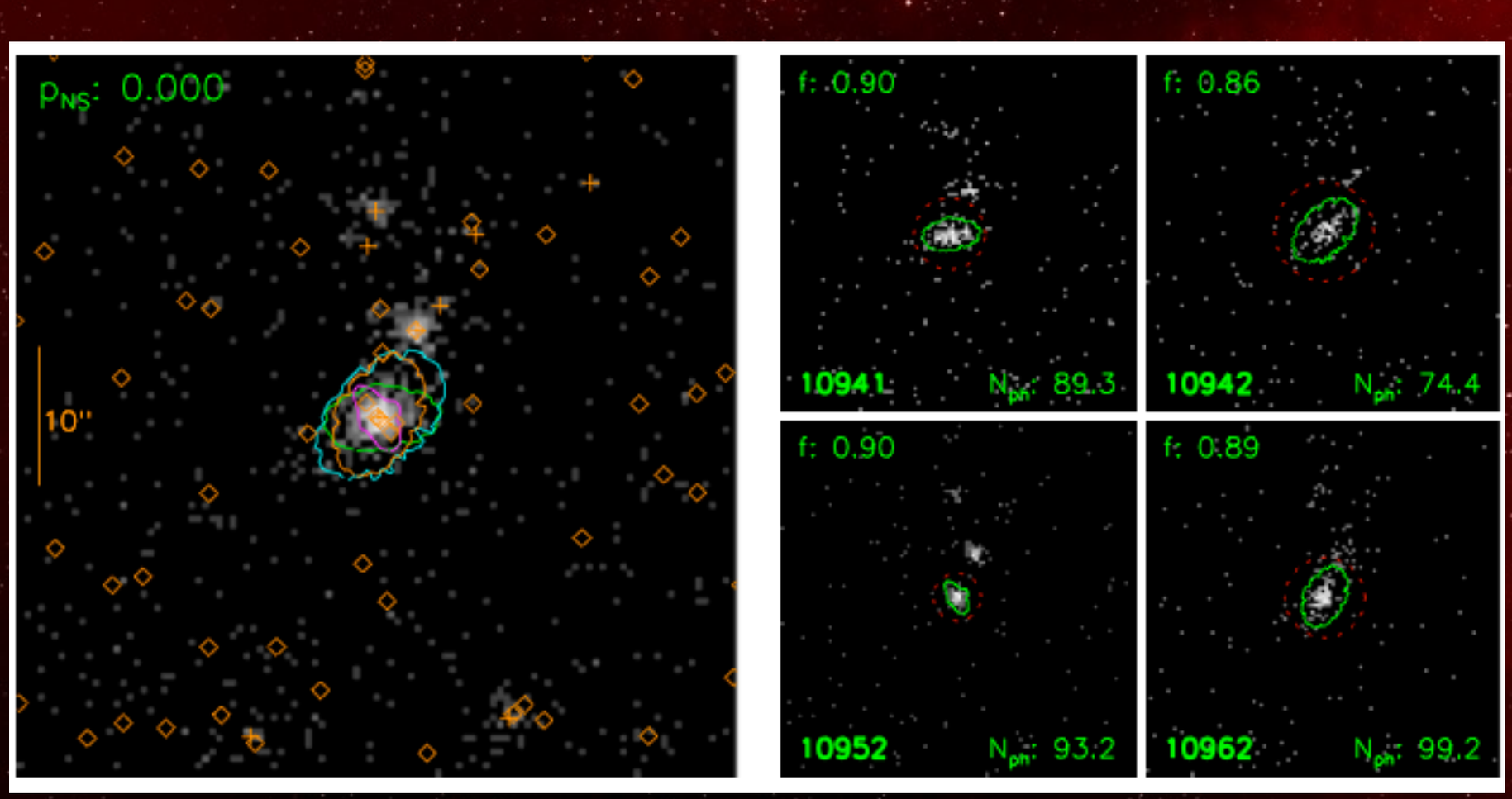
Survey Execution

Survey Execution



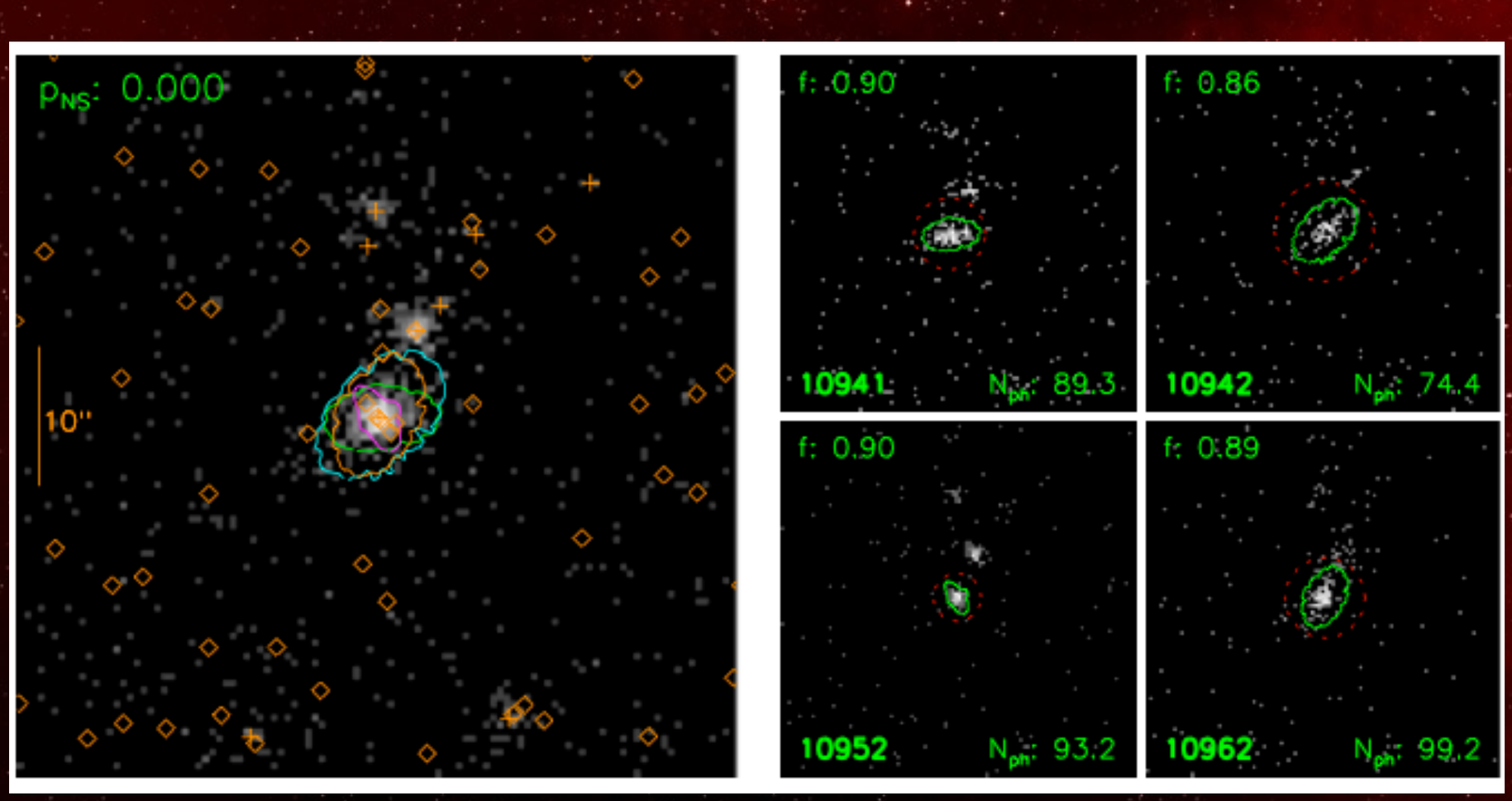
12,182 X-ray sources
90% of catalog will be Cyg OB2 members
300,000 UKIDDS NIR sources
100,000 optical sources

Methodology



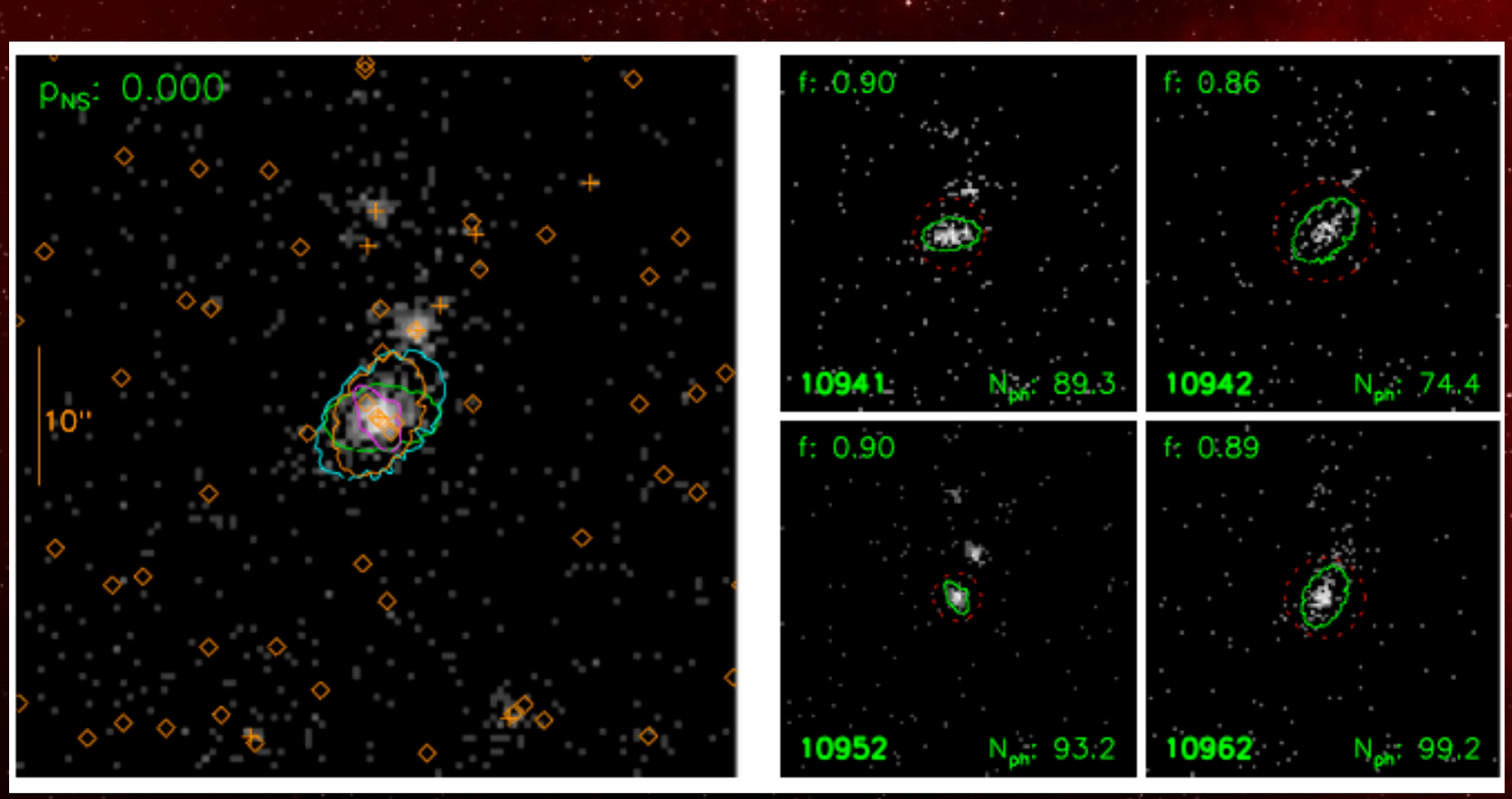
Methodology

- wavdetect, Palermo wave detect, "Vinay Detect"



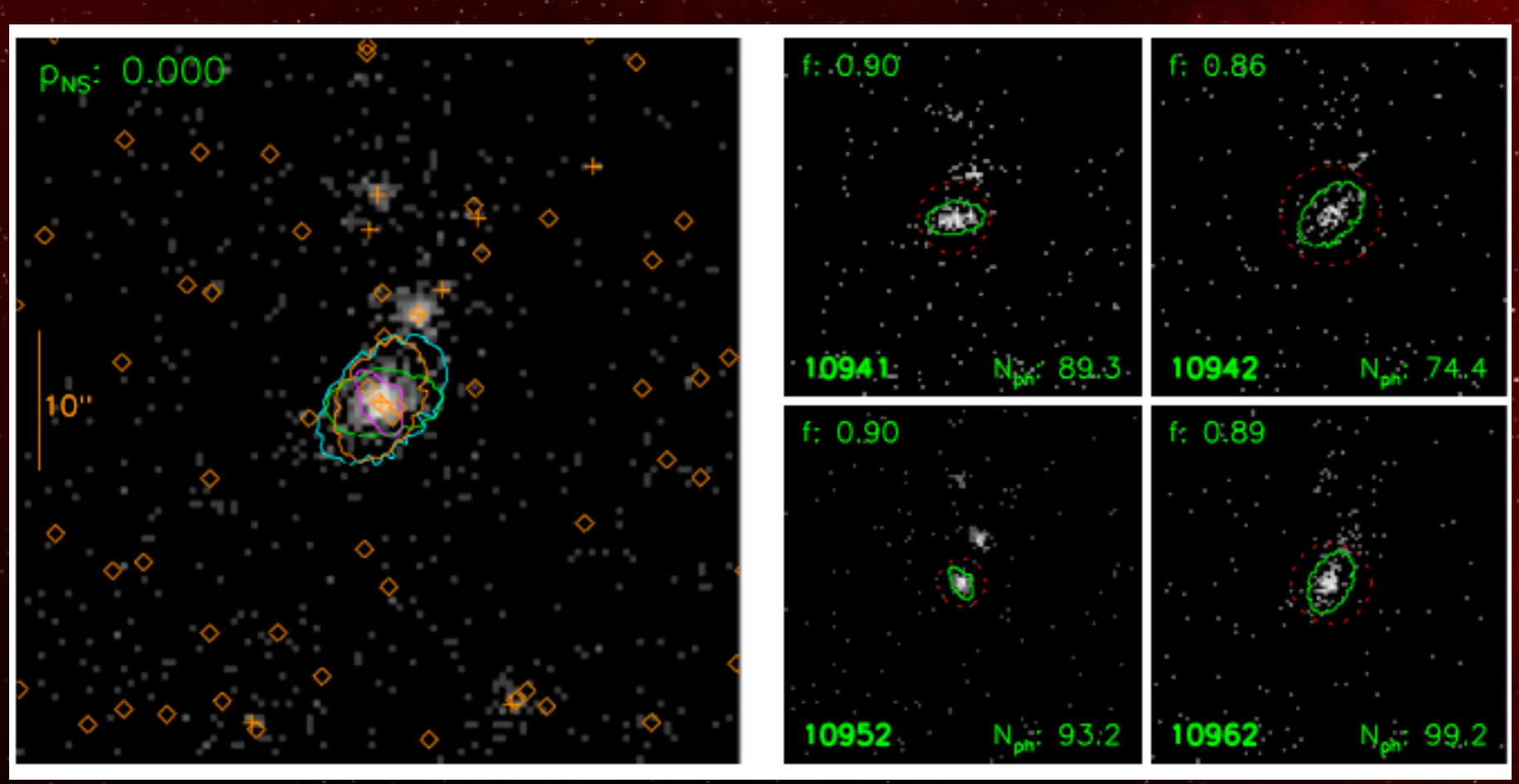
Methodology

- wavdetect, Palermo wave detect, "Vinay Detect"
- ACIS Extract (Broos et al)

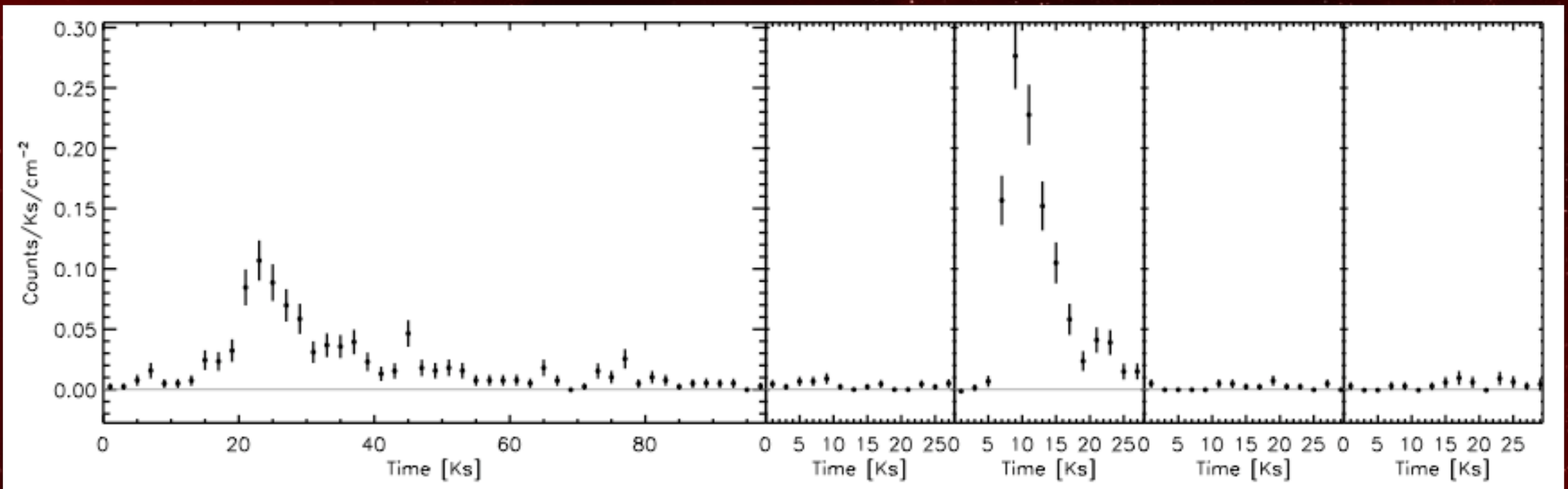


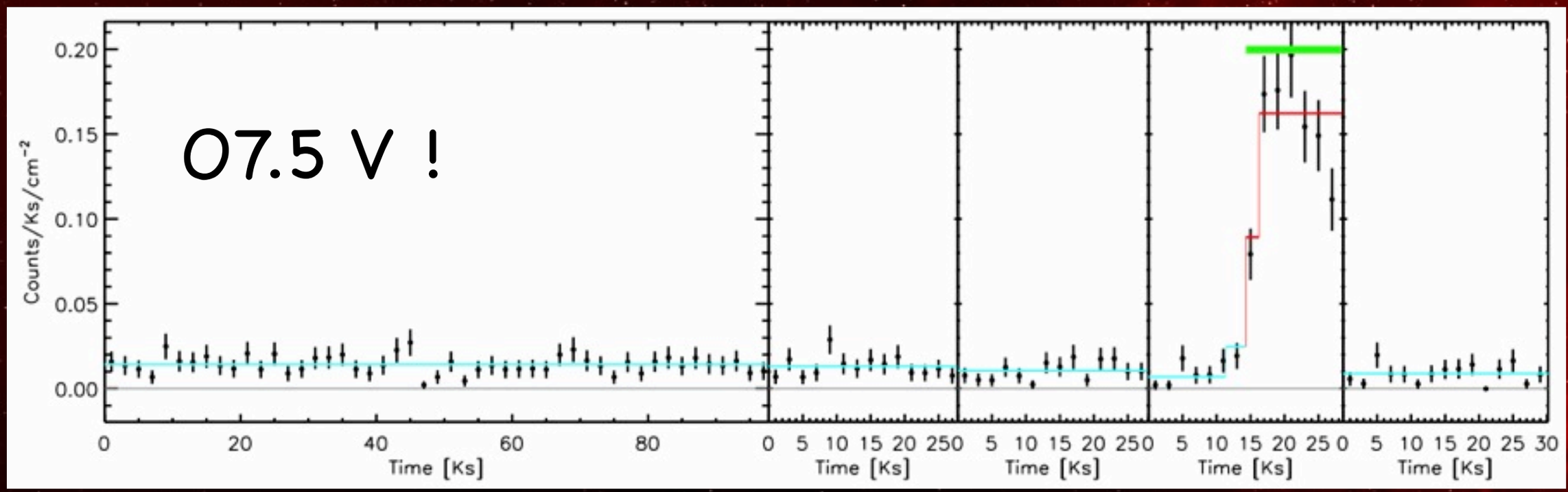
Methodology

- wavdetect, Palermo wave detect, "Vinay Detect"
- ACIS Extract (Broos et al)
- Postdocs in windowless rooms

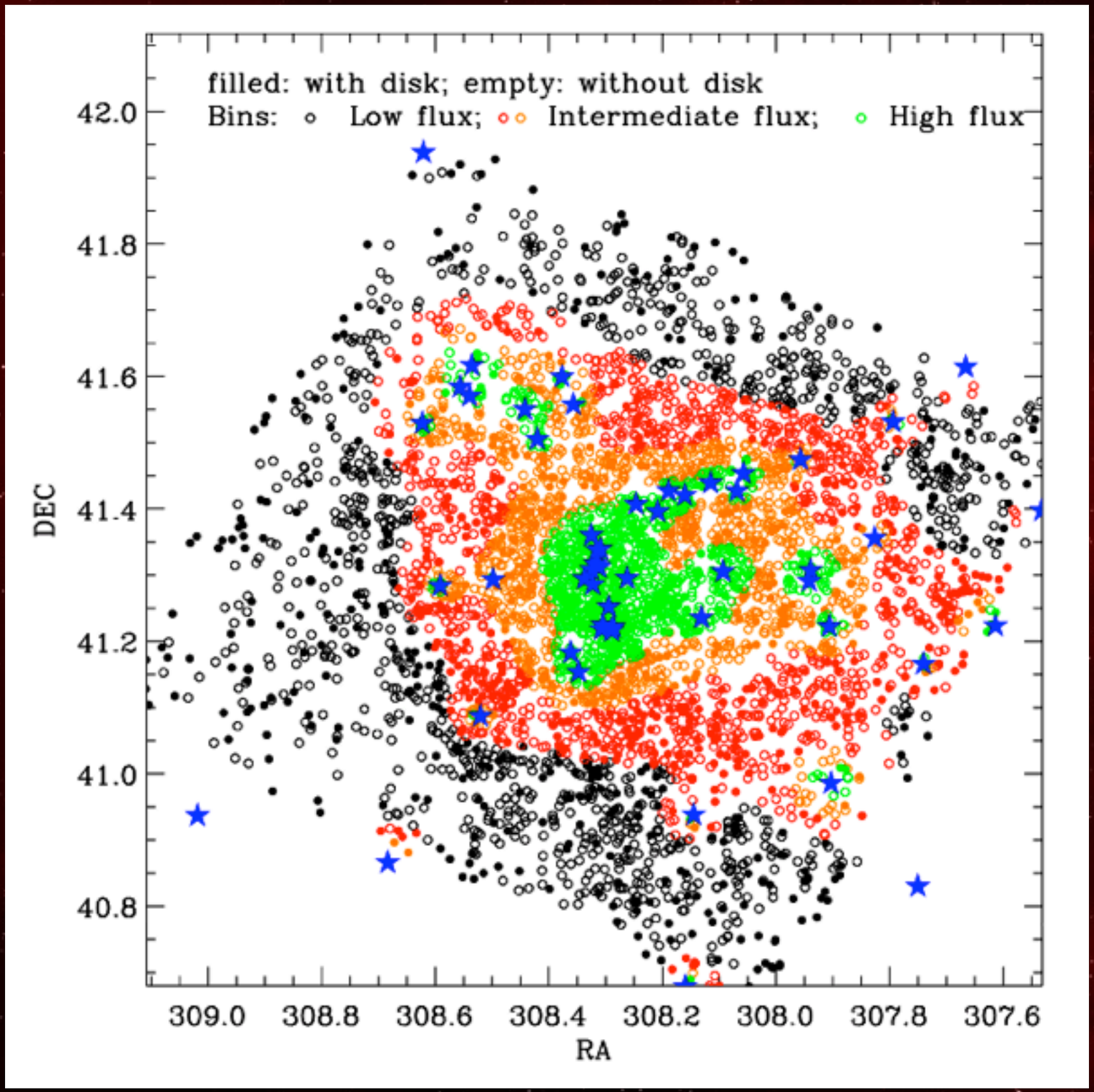


Flares, of course

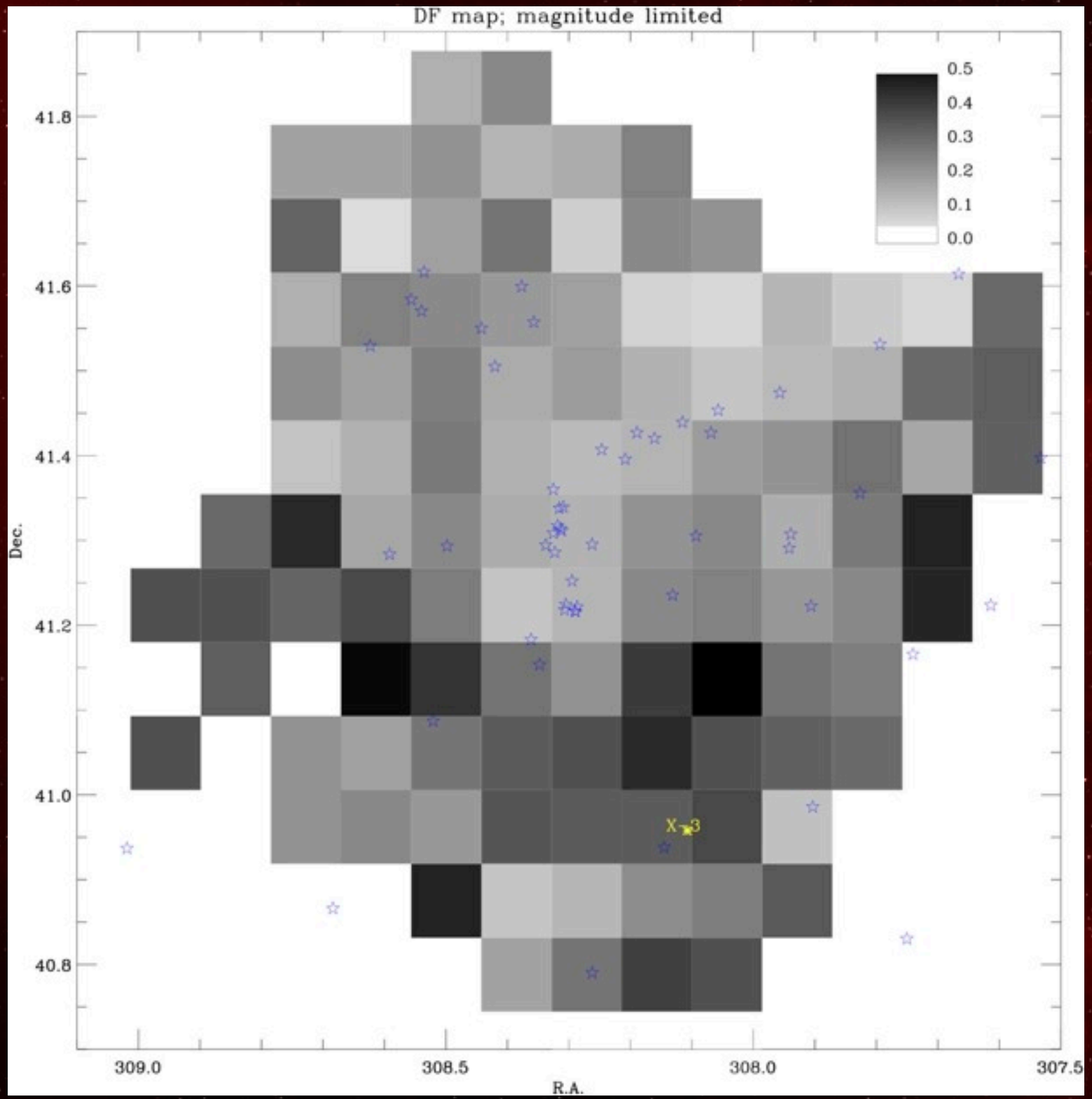




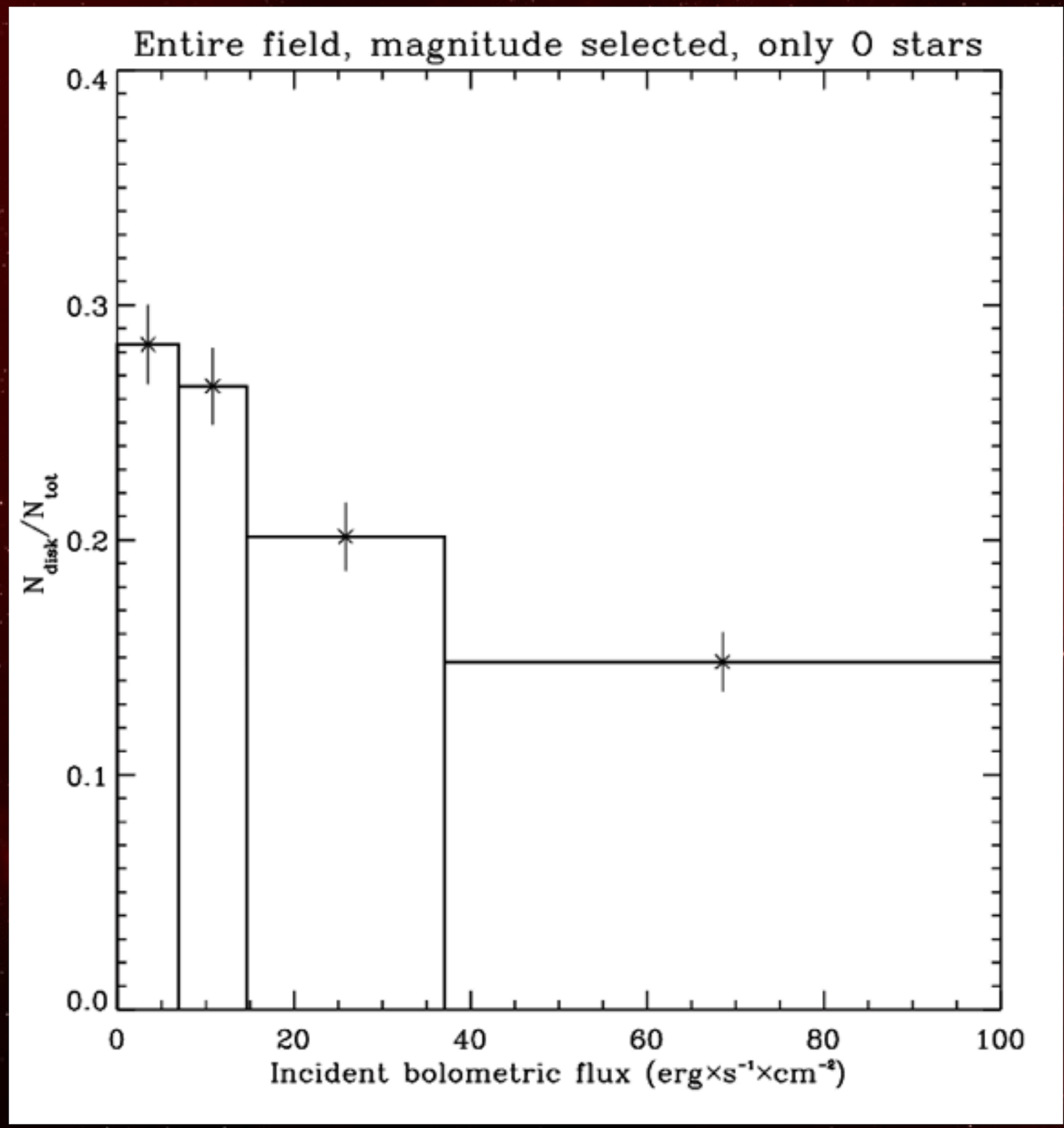
Disk UV Photoevaporation



Disk UV Photoevaporation



Disk UV Photoevaporation

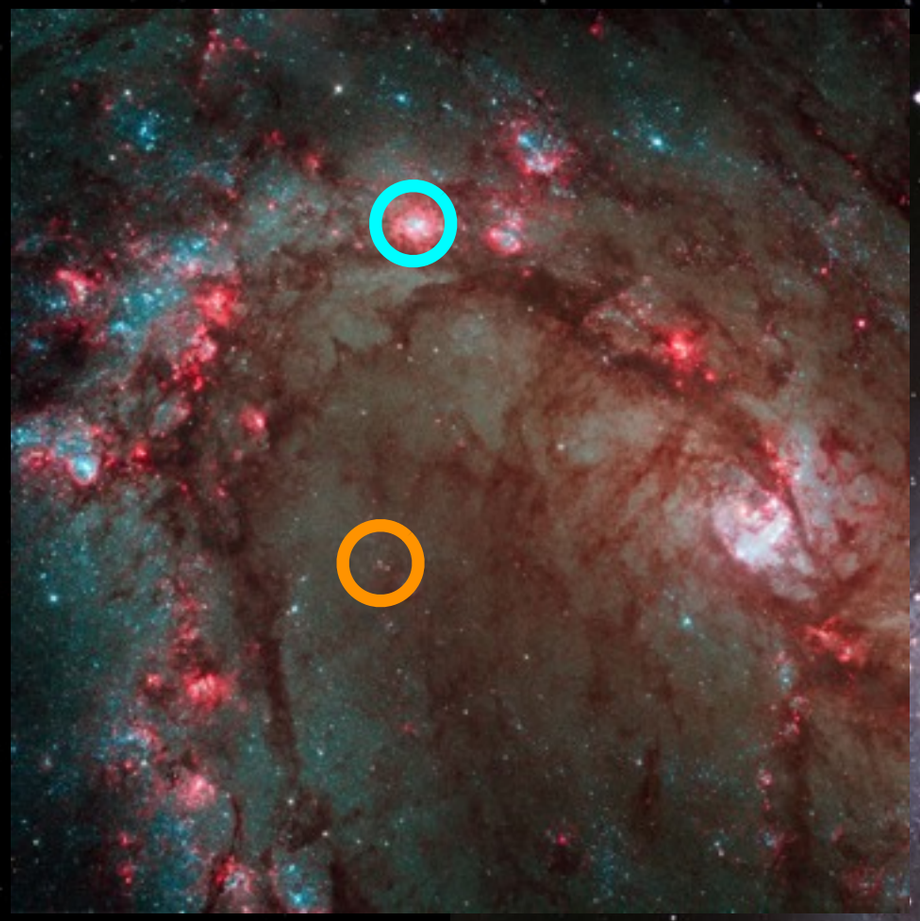


Planets: Which environments?

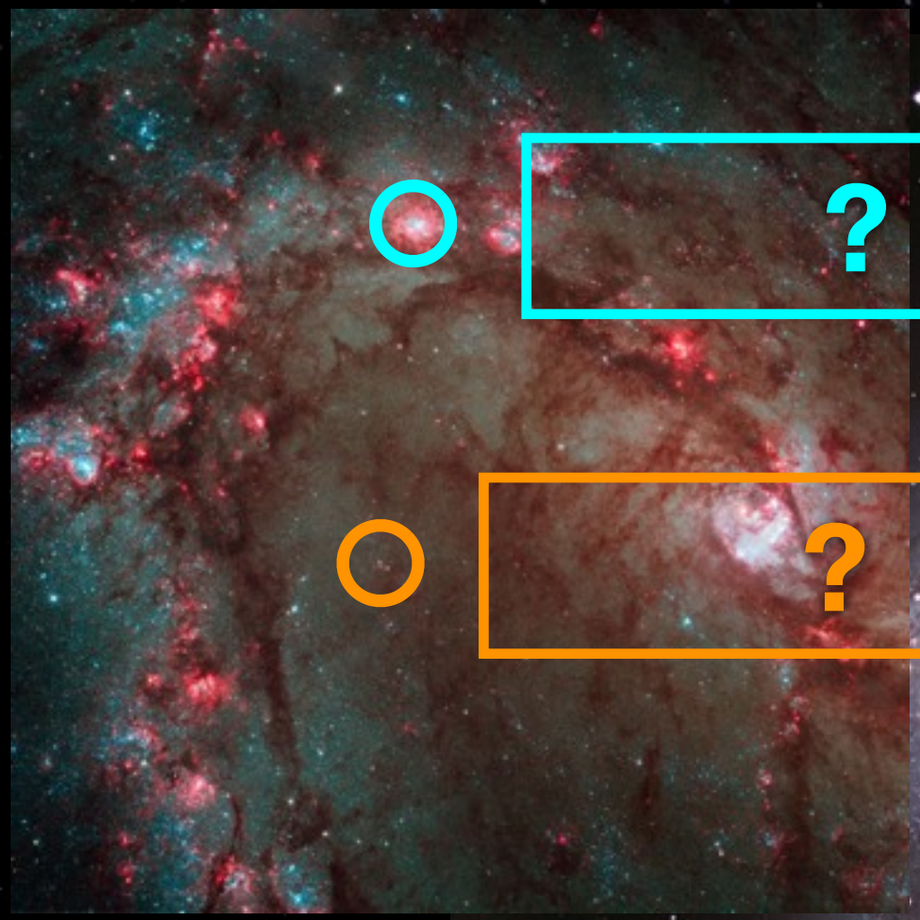
Planets: Which environments?

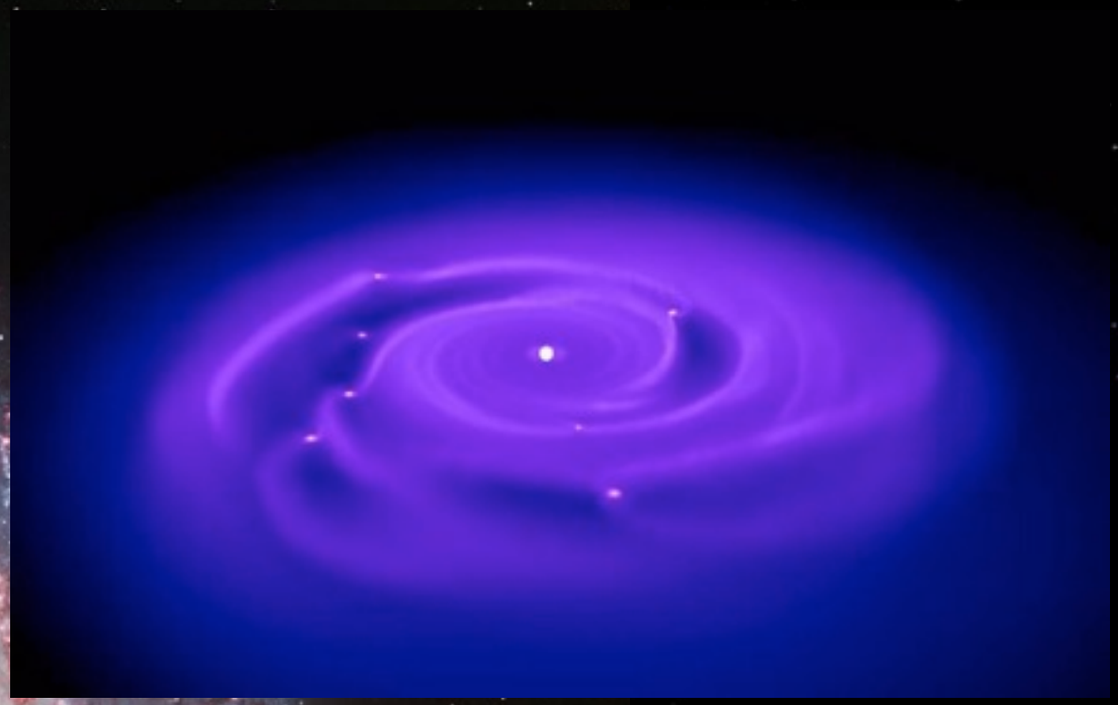
Planets: Which environments?

Planets: Which environments?

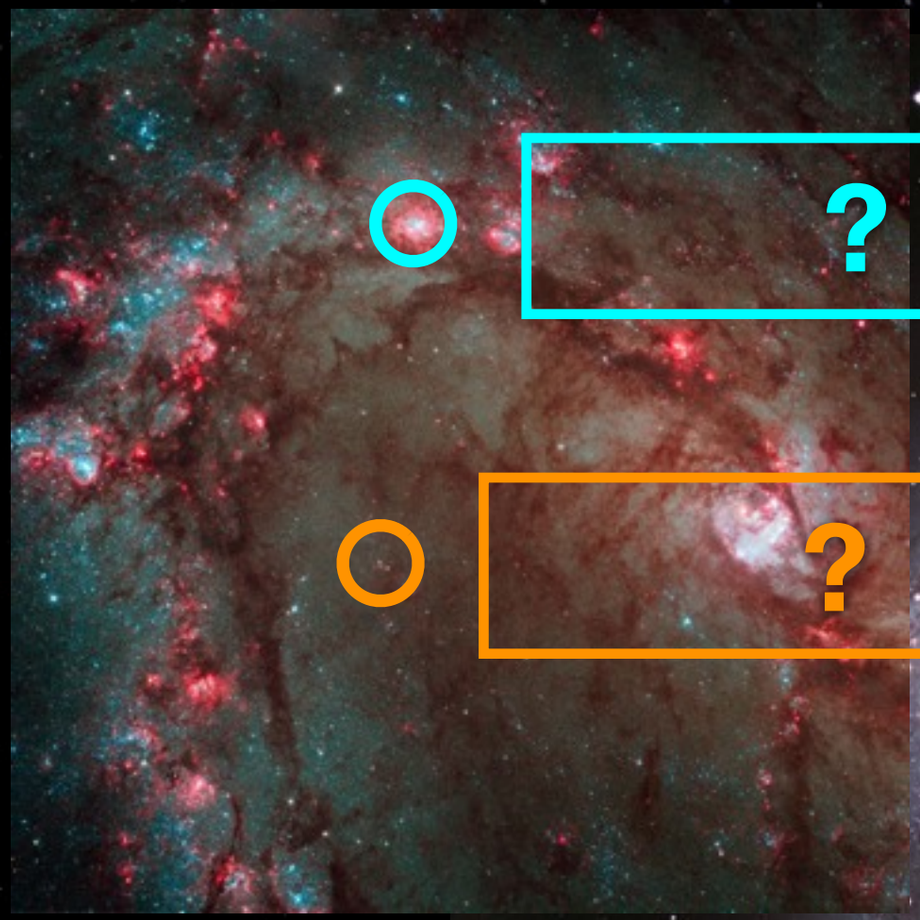


Planets: Which environments?



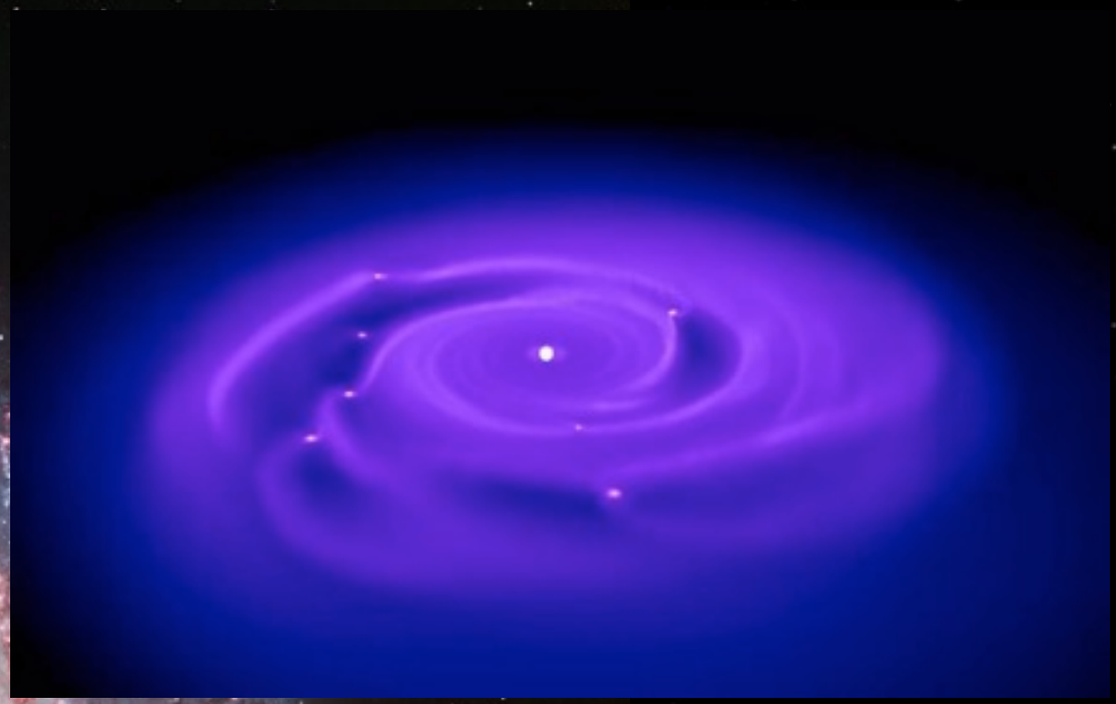


Planets: Which environments?

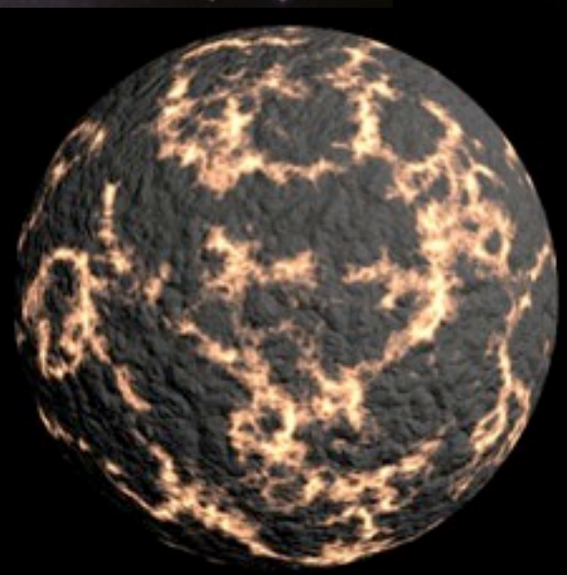


?

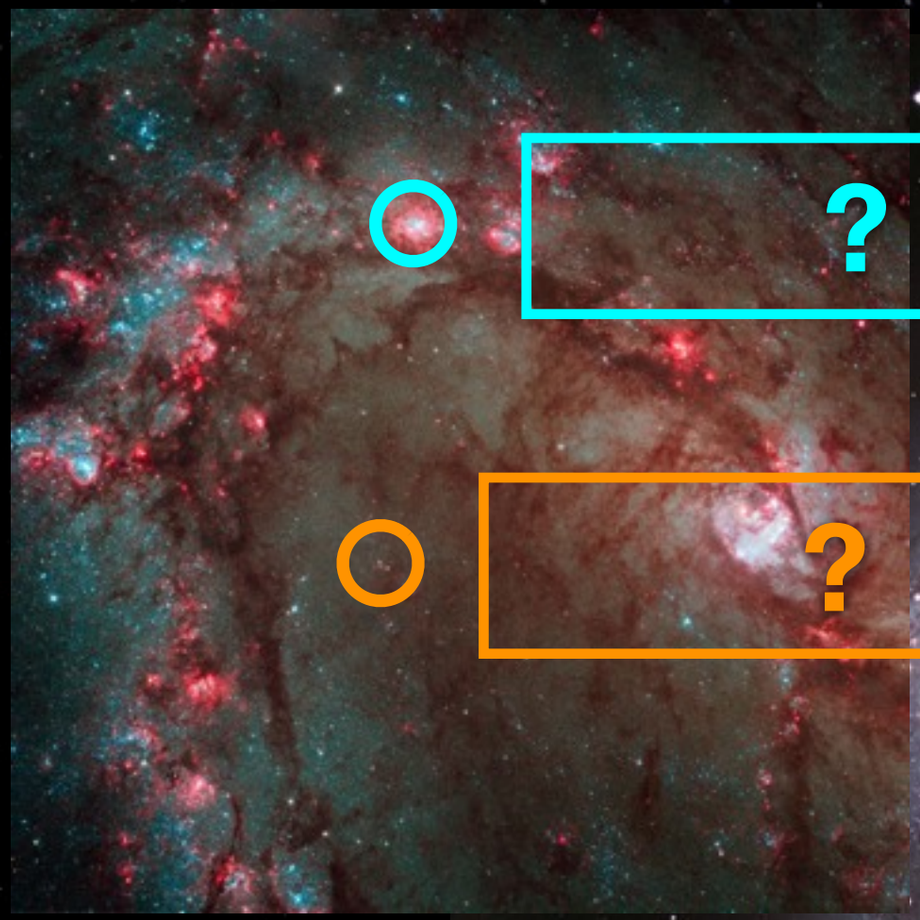
?



?

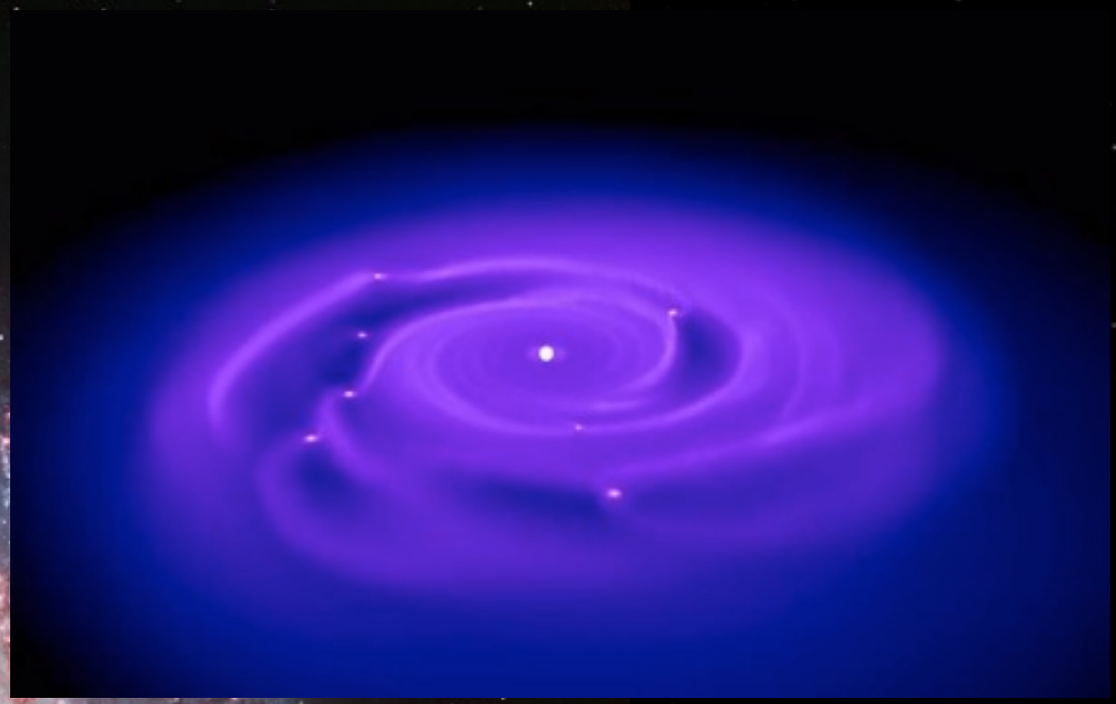


Planets: Which environments?



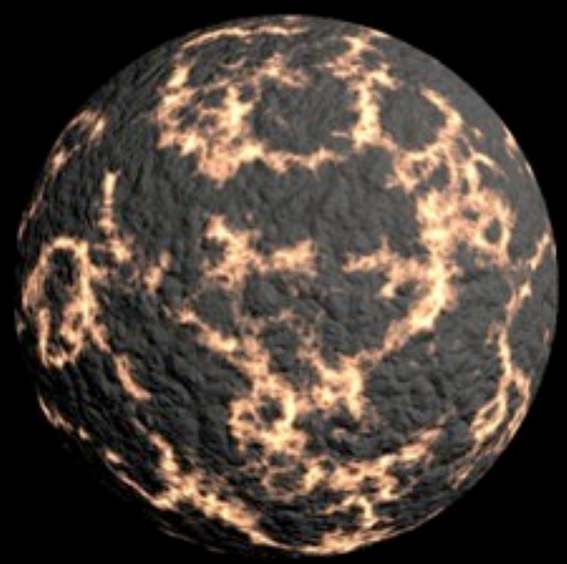
?

?



?

?



Conclusion

- The Chandra Cygnus OB2 survey provides the best evidence to date that OB stars severely affect the evolution of the birthplaces of planets

Survey Science To Come

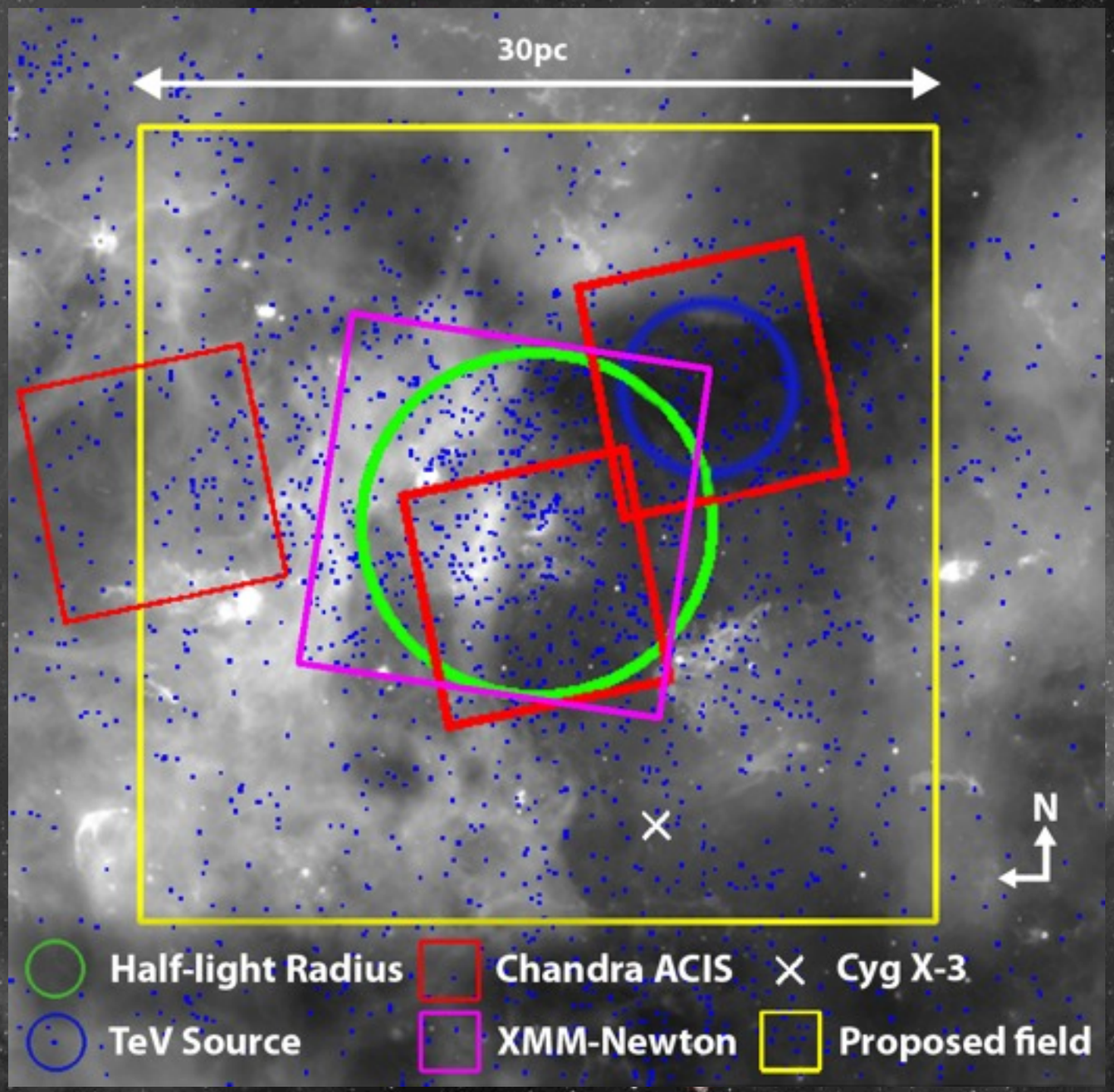
- Stellar census of Cyg OB2; high mass SF
  - IMF, variations
  - search for mass segregation
  - Dynamics, boundedness, energetics --> supercomputer simulation
  - Search for PWN
- Protoplanetary disk evolution
  - UV photoevaporation
  - comparison with younger Orion
- X-ray properties
  - large OB sample
  - v.large T Tauri sample - 1+Myr older than Orion

Organisation

- Survey core at SAO: Drake (PI), Wright (Project Scientist), Aldcroft (technical lead), Guarcello (new postdoc in April), Fruscione
- Science consortium: IPHAS-like organisation
- Main participating groups: SAO, Palermo, various IPHAS
- Collaboration open and welcome
- jdrake@cfa.harvard.edu

Timeline/Logistics

- Observations Jan 29-April (with luck)
- Data processing at SAO: standard reproc, source detection, re-alignment, catalogue;
- central part of field fully processed by mid-March + preliminary source list
- web-based access; www.cygob2.org (see also Nick's wikipedia page)


30pc
N
Half-light Radius
Chandra ACIS
Cyg X-3
TeV Source
XMM-Newton
Proposed field