# An X-ray Imaging Study of RCW49

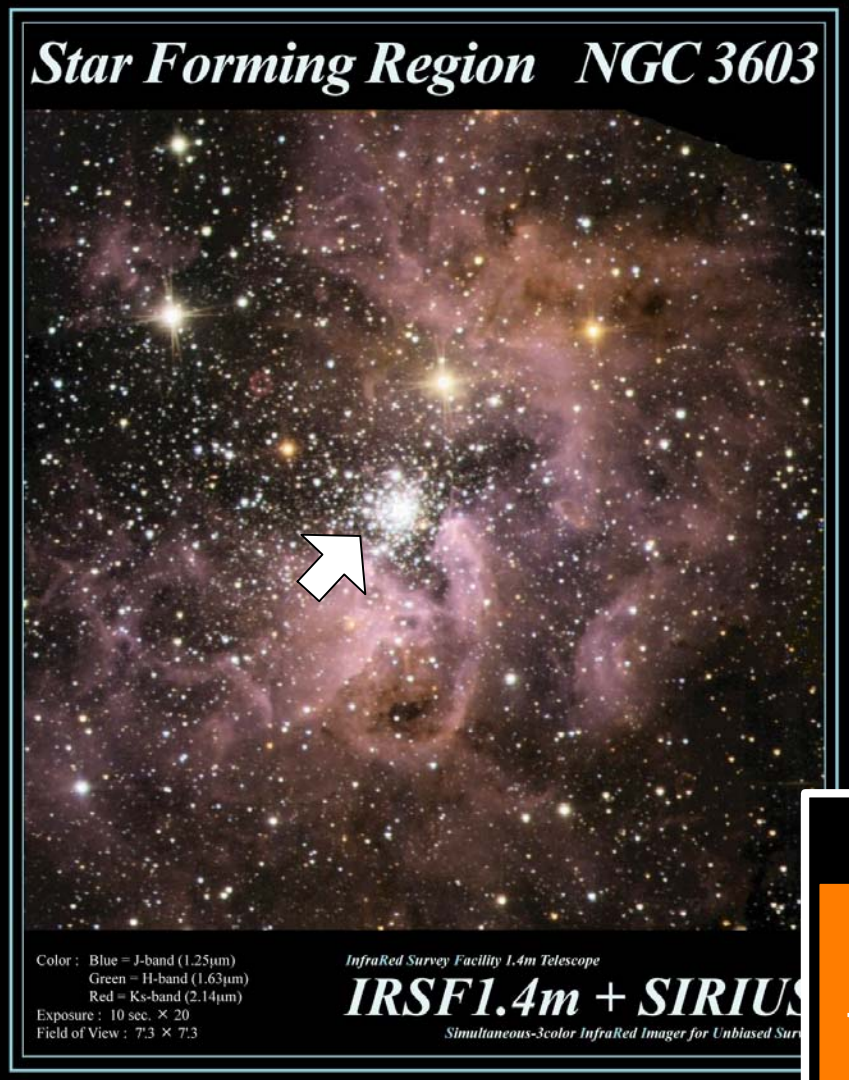
HII region / massive young star cluster / massive star-forming region

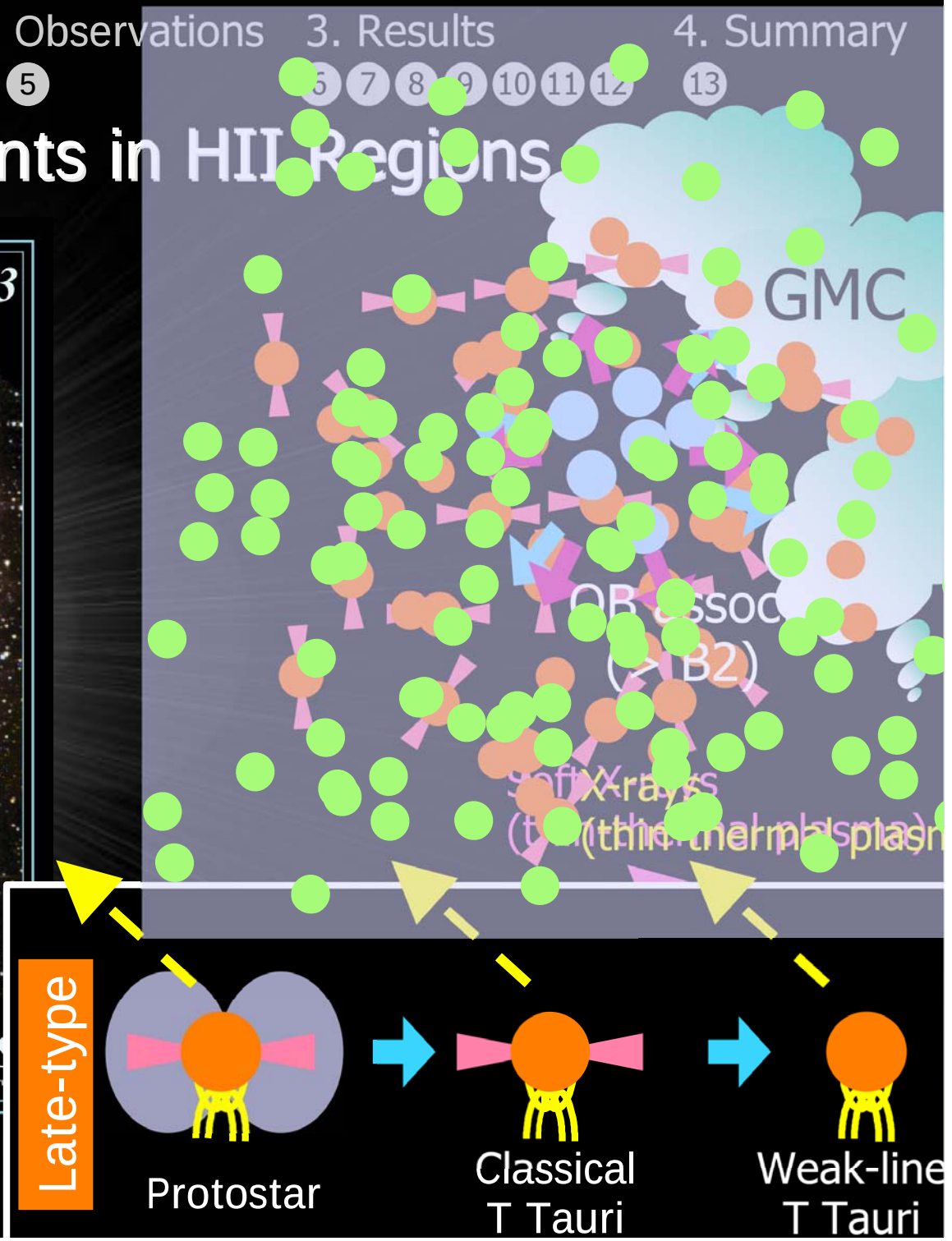
(Tsujimoto et al. 2007, ApJ, 665, 719)

Masahiro Tsujimoto
Pennsylvania State University

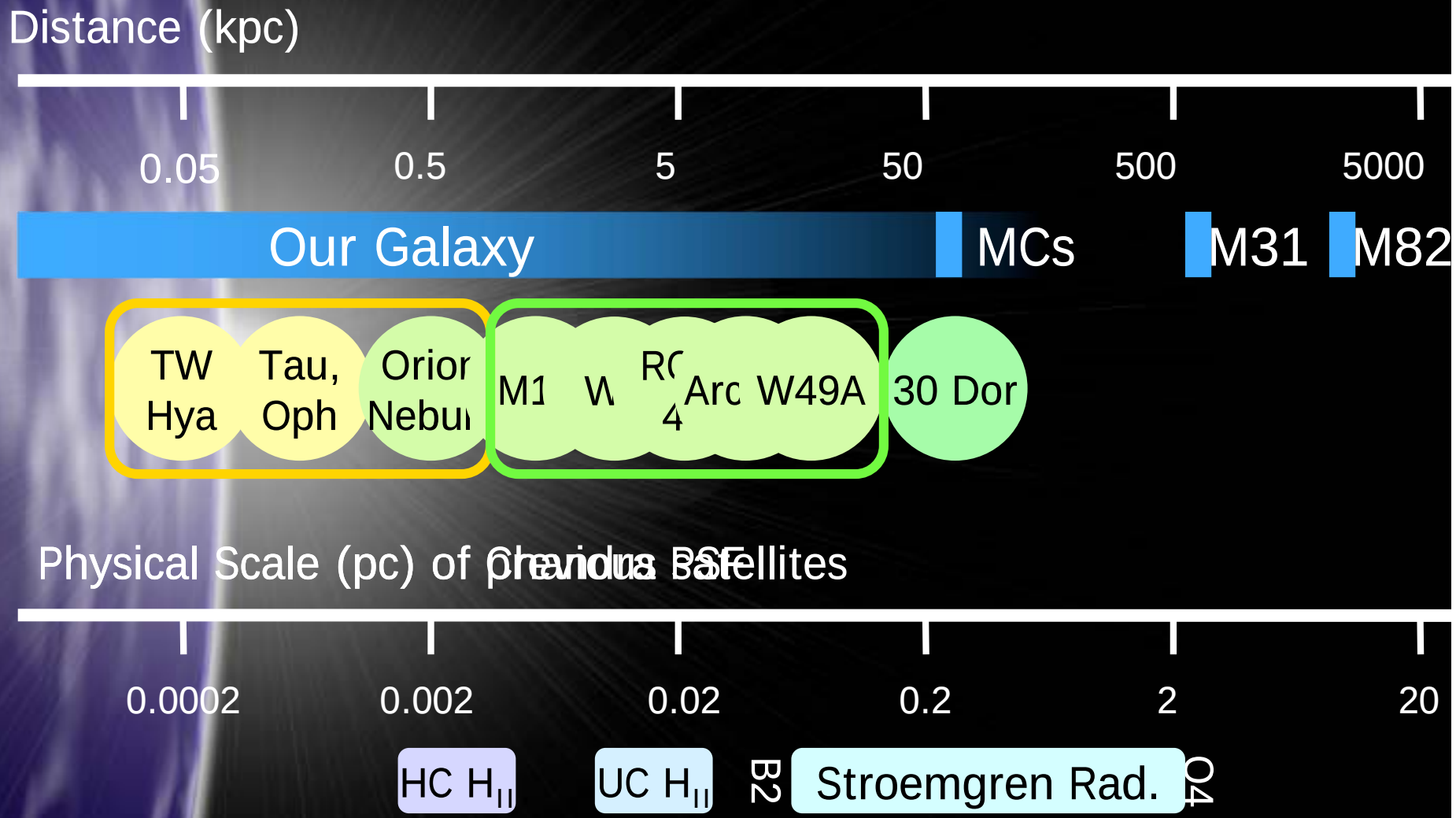
## Contents

# 1. Constituents in HII Regions



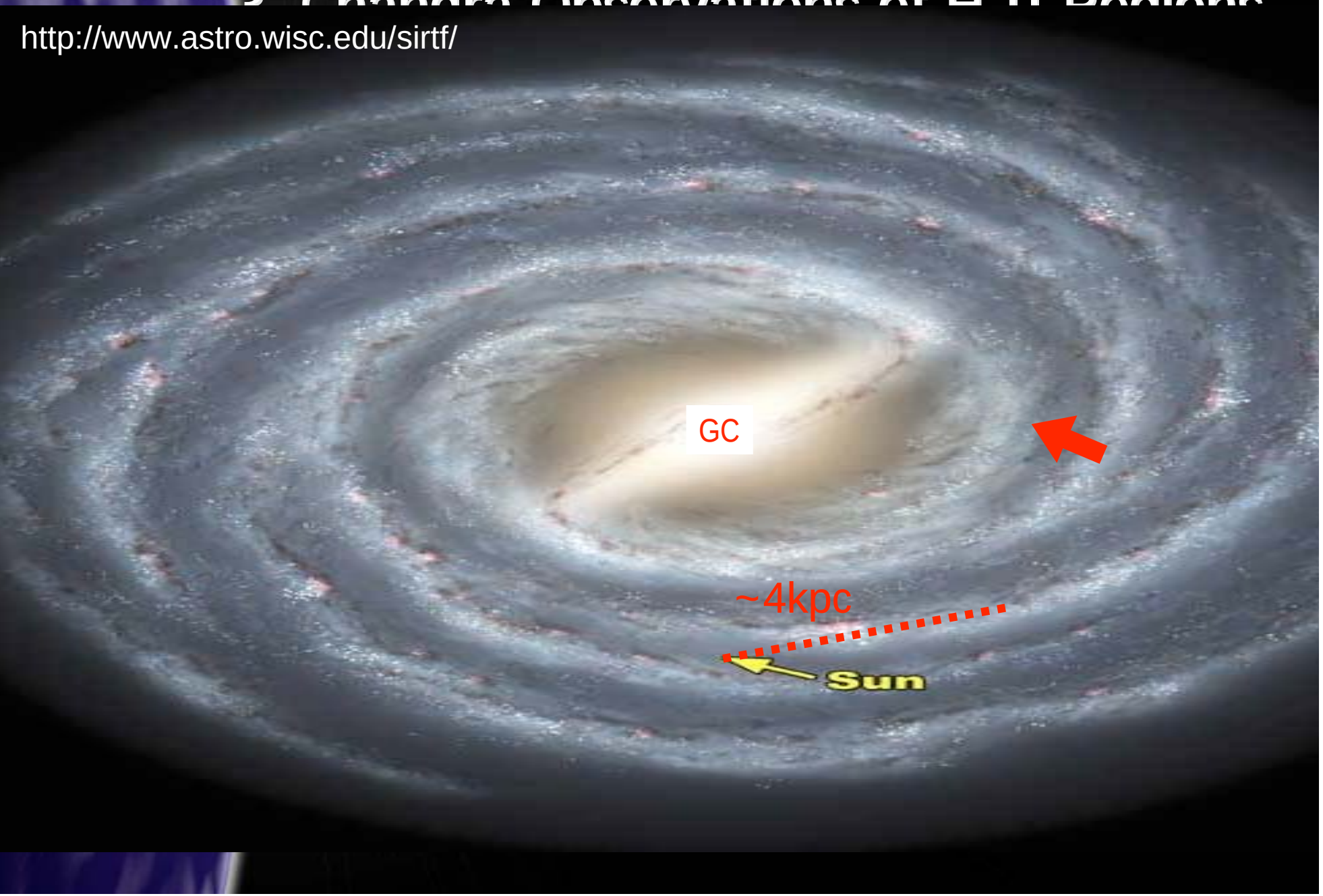



# 2. Scale and Chandra Resolution

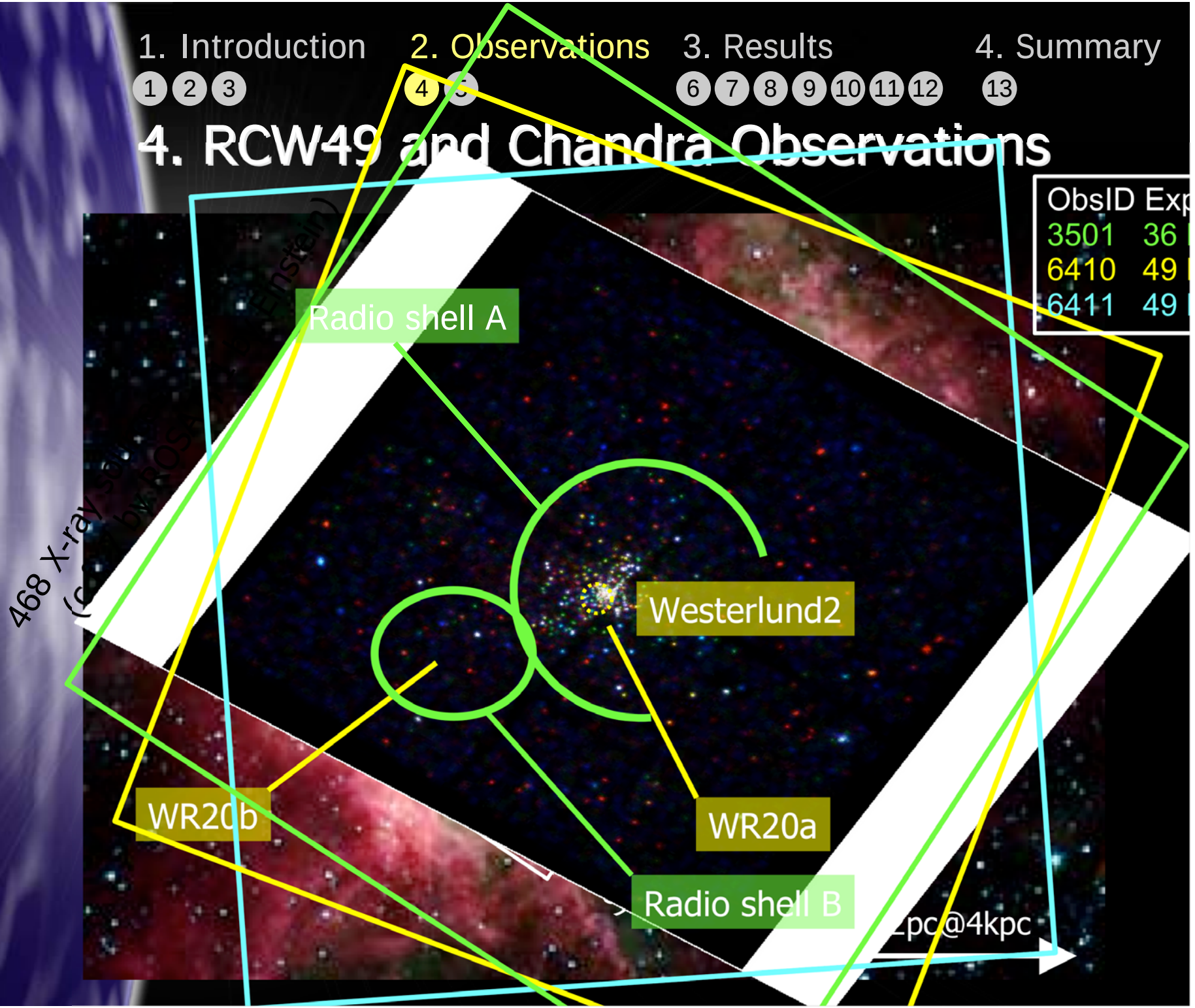


# 3. Chandra Observations of H II Regions

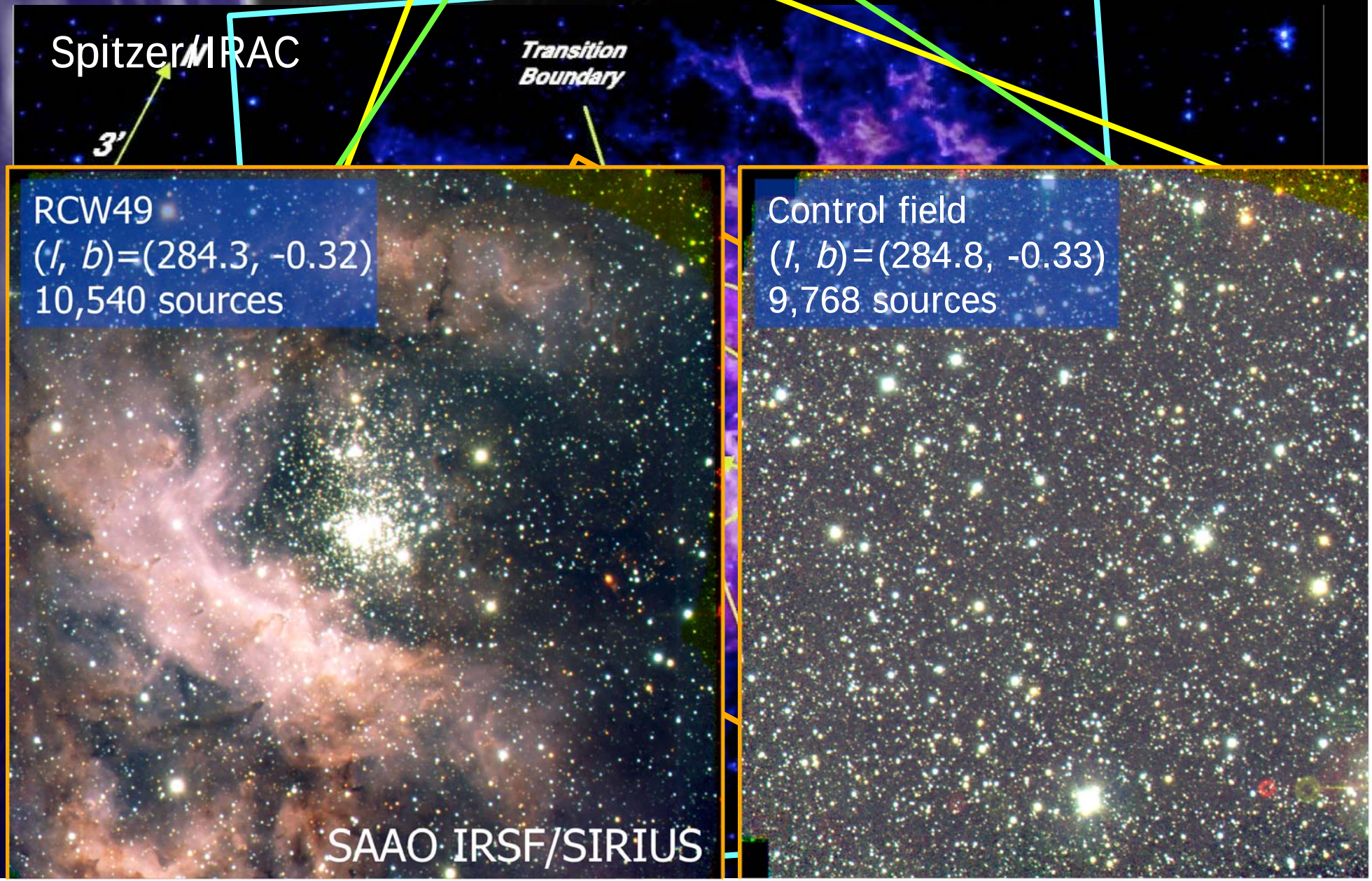
http://www.astro.wisc.edu/sirtf/



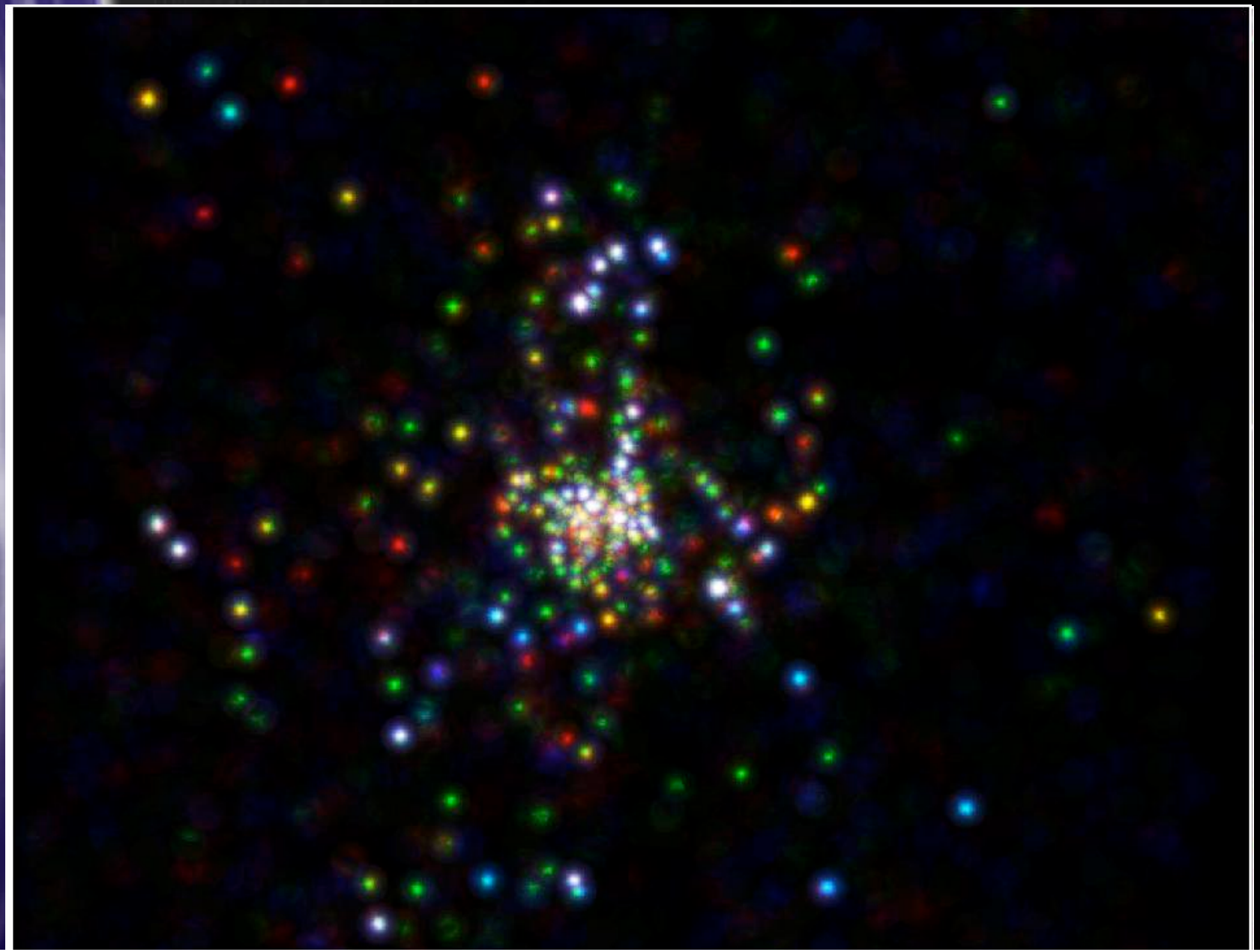
# 4. RCW49 and Chandra Observations



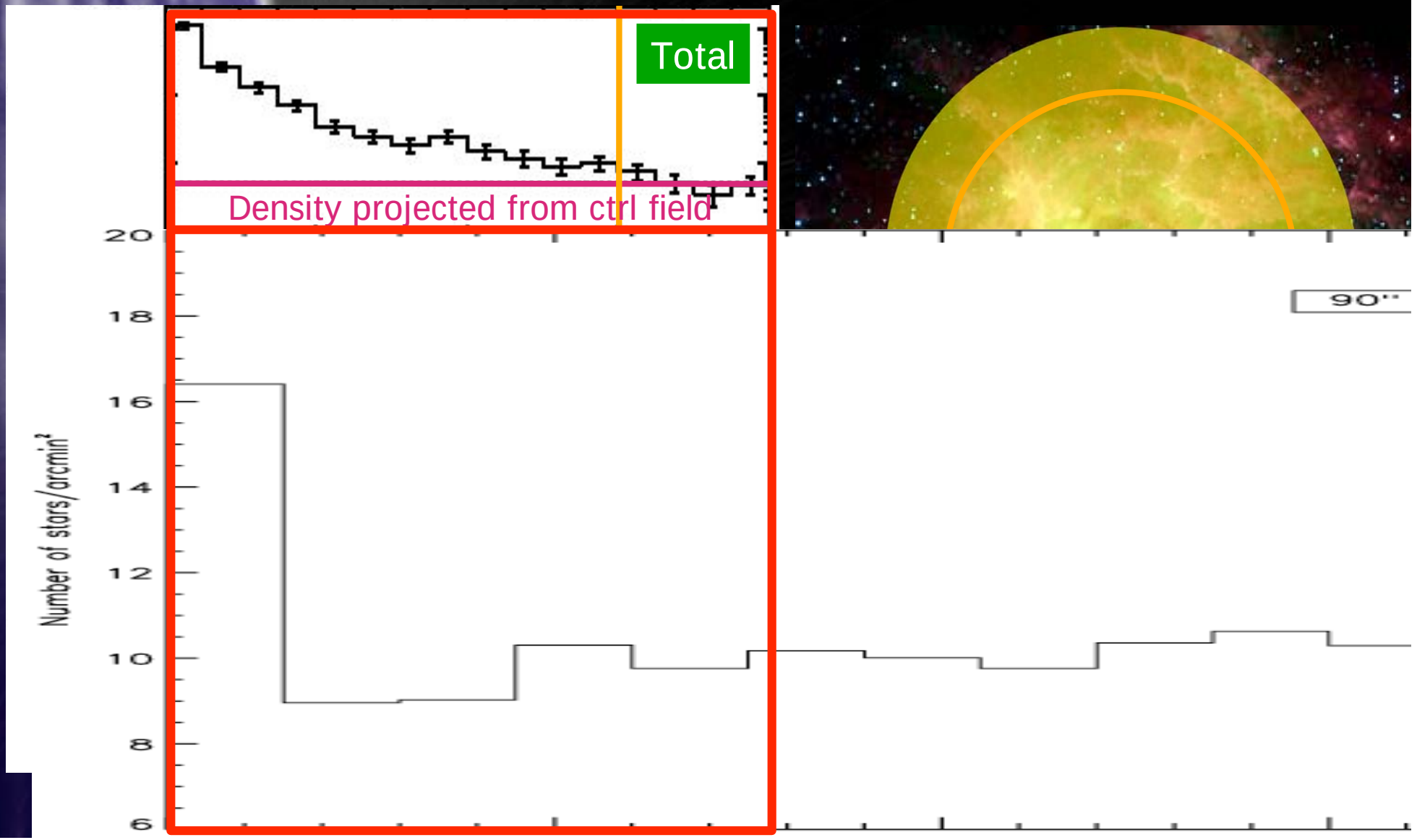
# 5. Infrared Observations



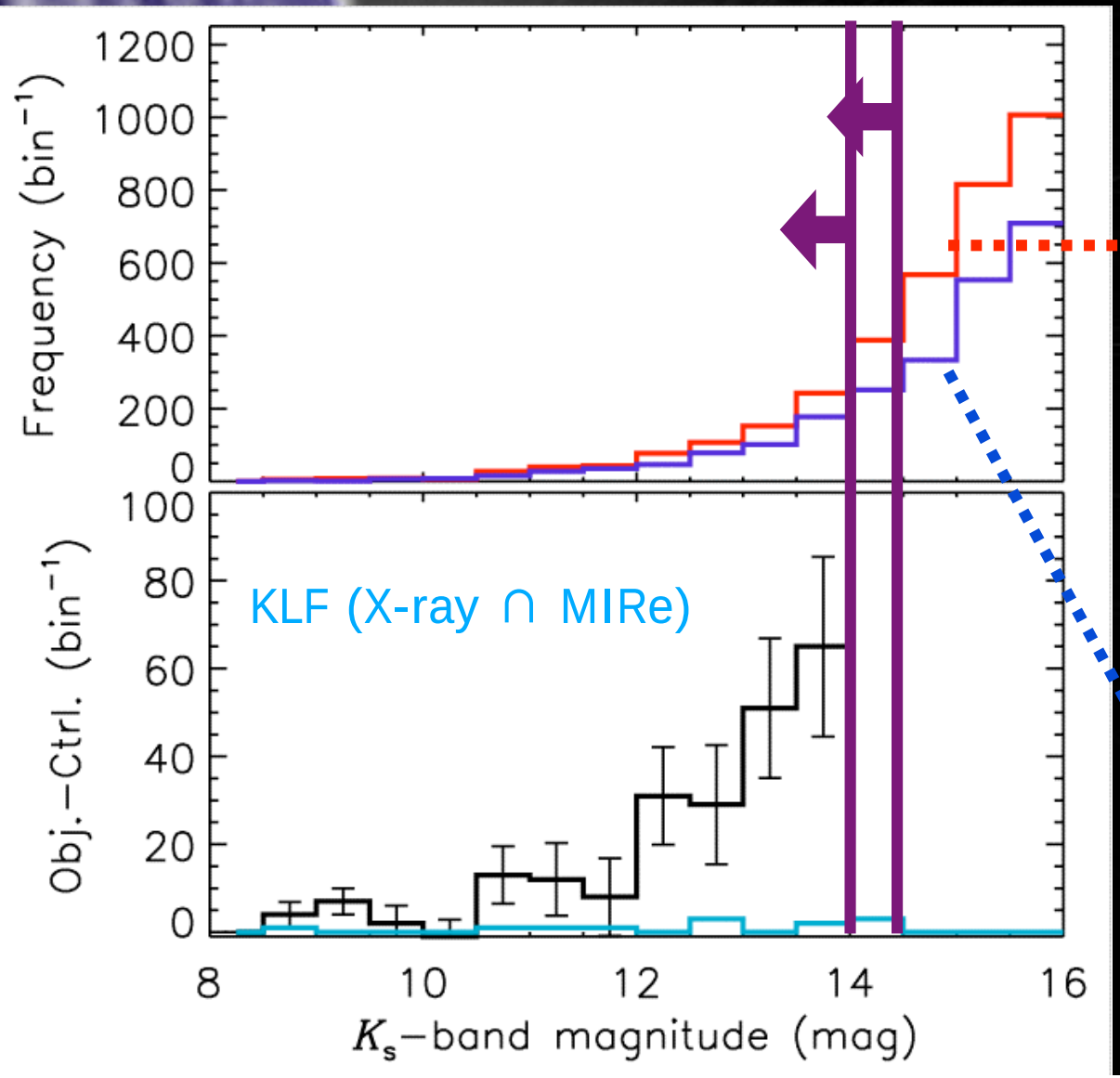
# 6. Resolving the central OB association



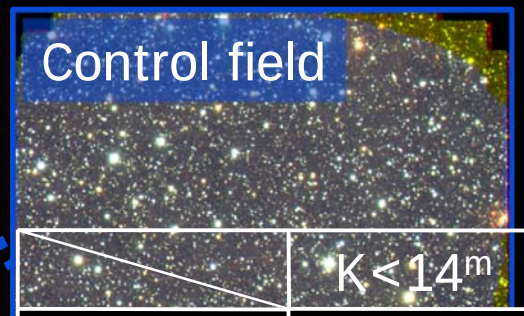
# 7. Cluster membership – few conamination



# 8. Complementarity of Chandra & Spitzer

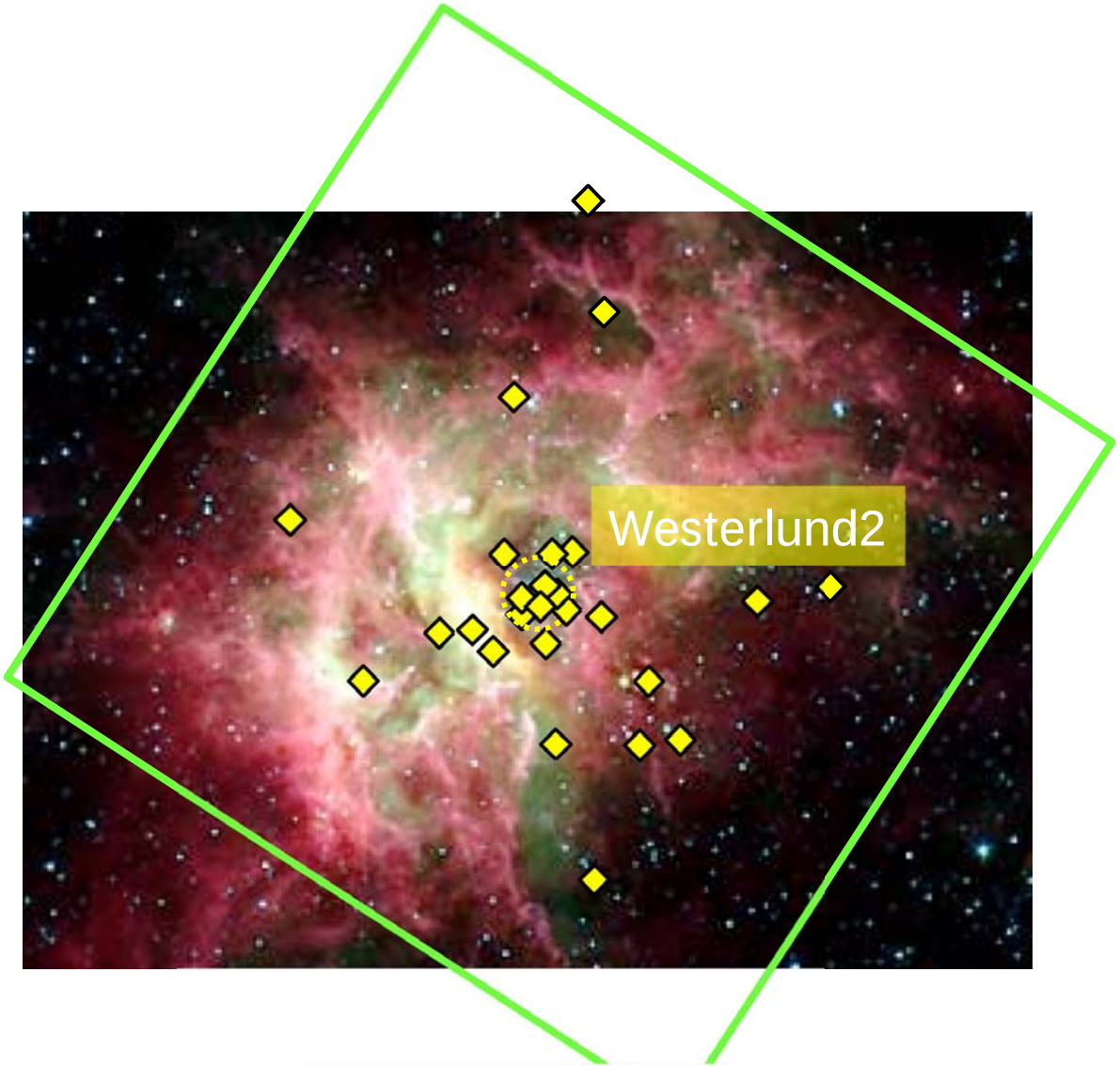







| | K<14$^m$ | K<14.5 |
|---|---|---|
| Total | 221 | 358 |

# 9. New early-type star candiates




Color-Magnitude diagran
X-ray sources w/ JHK.

~30 new OB candidat
+13 prev-known, spec

batial distr. of new OB

~1/2 are out of OB as

Many OBs may remain
unIDed in other mSFR

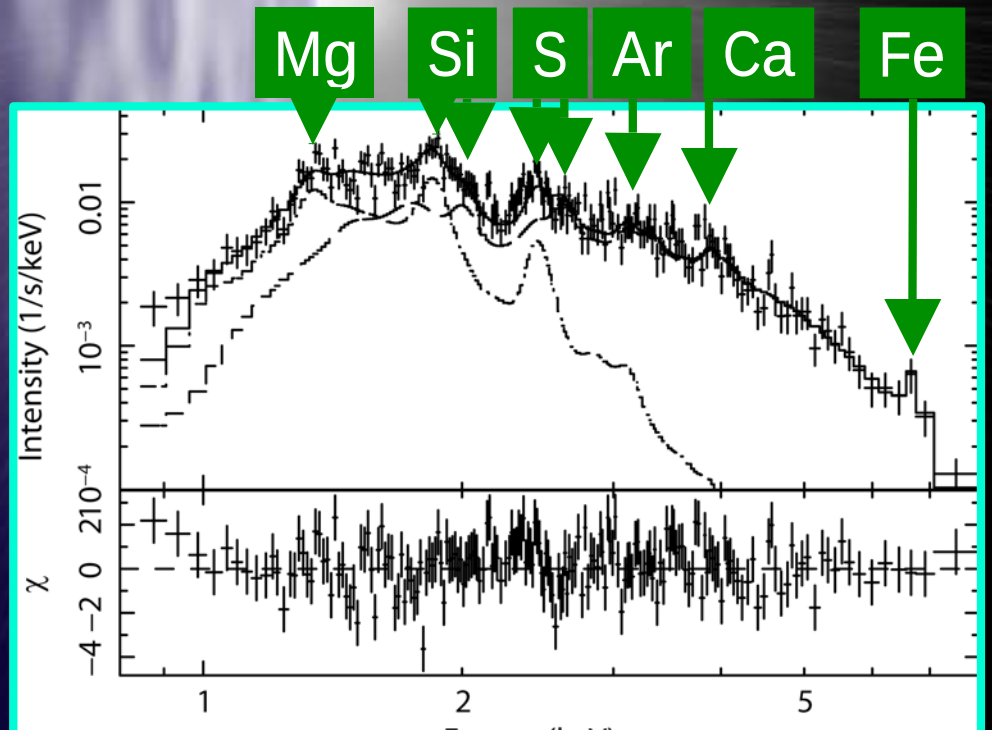
Spectroscopic follow-u
(AAT, CTIO) this winte

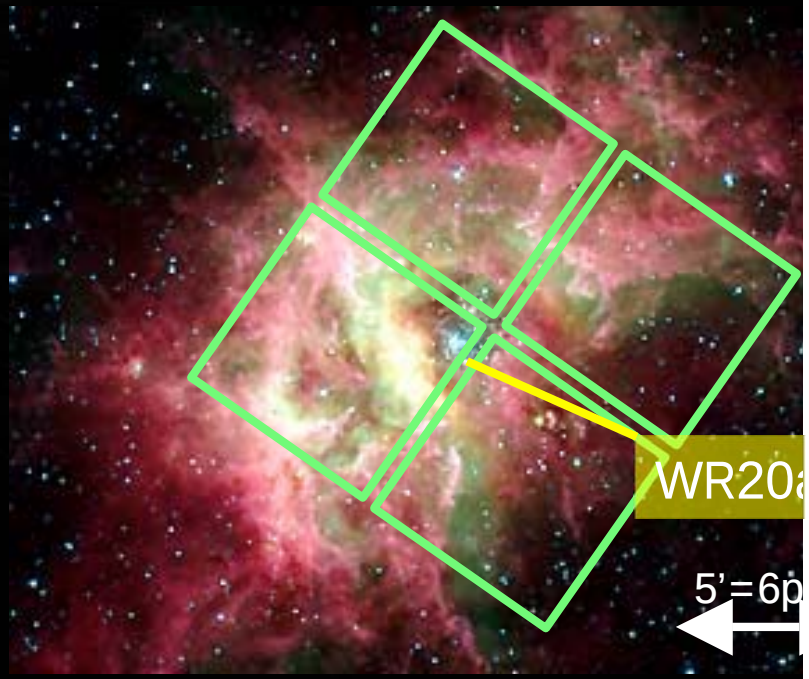
# 10. Wolf-Rayet binary WR20a

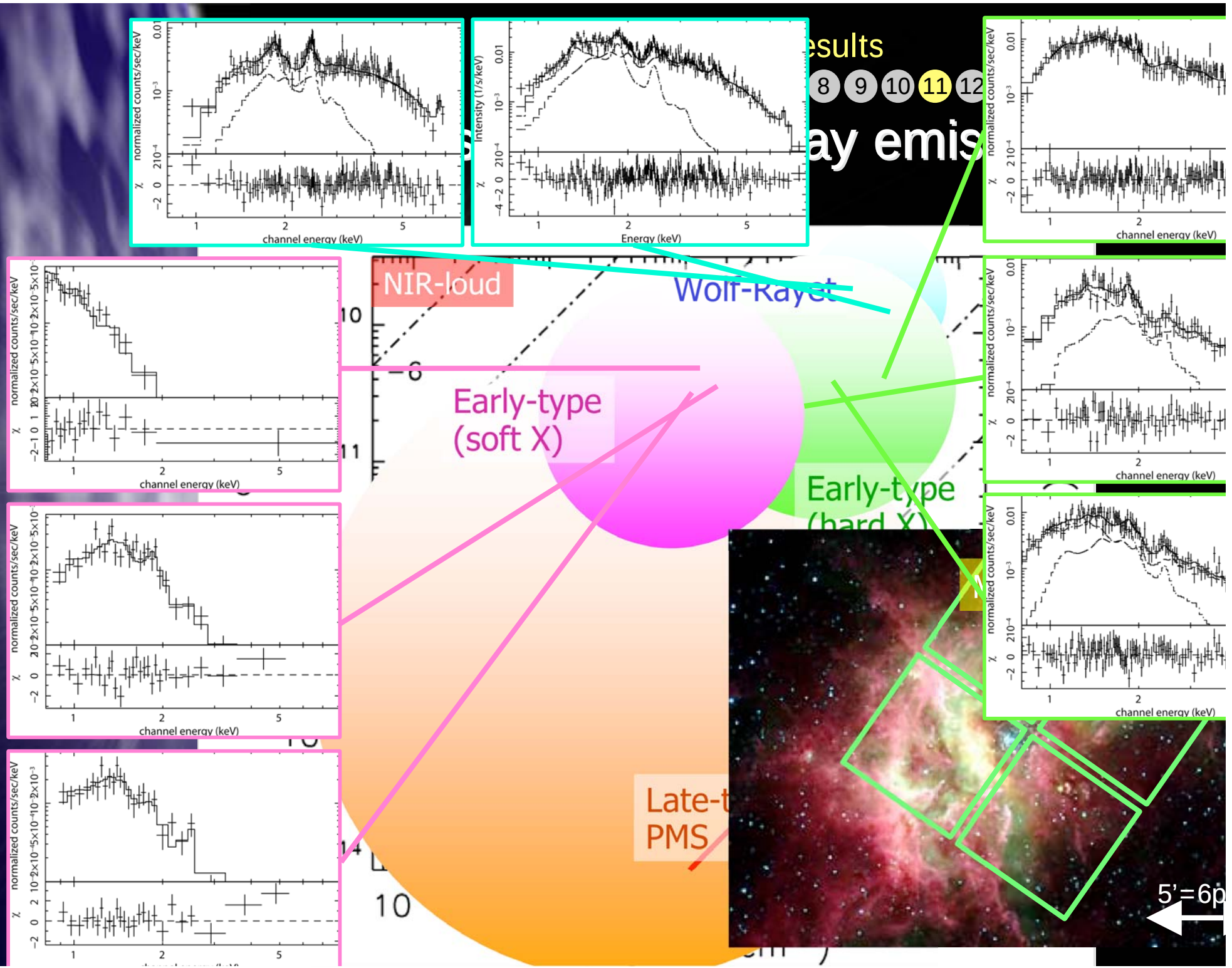
WR20a : “Binary Wolf-Rayet” star: WN6+WN6

1. An eclipsing binary (Bonanos+ 2004).
2. Doppler tomography (Rauw+ 2004).

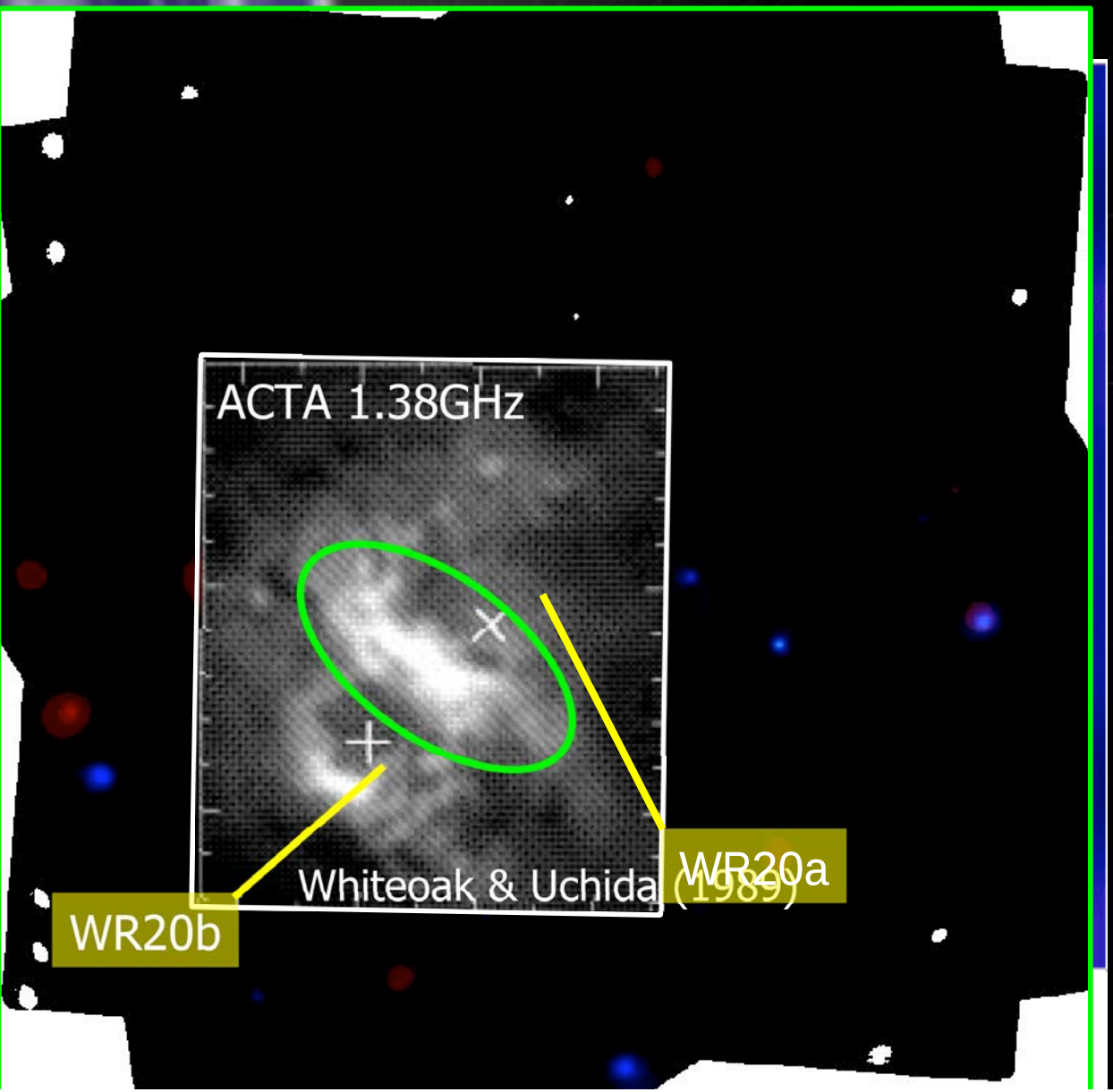
- $M_1$=83.5 Mo $M_2$=82.0 Mo; the most massive pairs.
- $P_{orb}$ = 3.686 days. $\theta_{inc}$ = 74.5 degrees.




esults
8 9 10 11 12
ay emis
NIR-loud
Wolf-Rayet
Early-type
(soft X)
Early-type
(hard X)
Late-t
PMS
5'=6p
normalized counts/sec/keV
channel energy (keV)
Energy (keV)
Intensity (1/s/keV)

# 12. Diffuse X-ray and TeV γ-ray emission



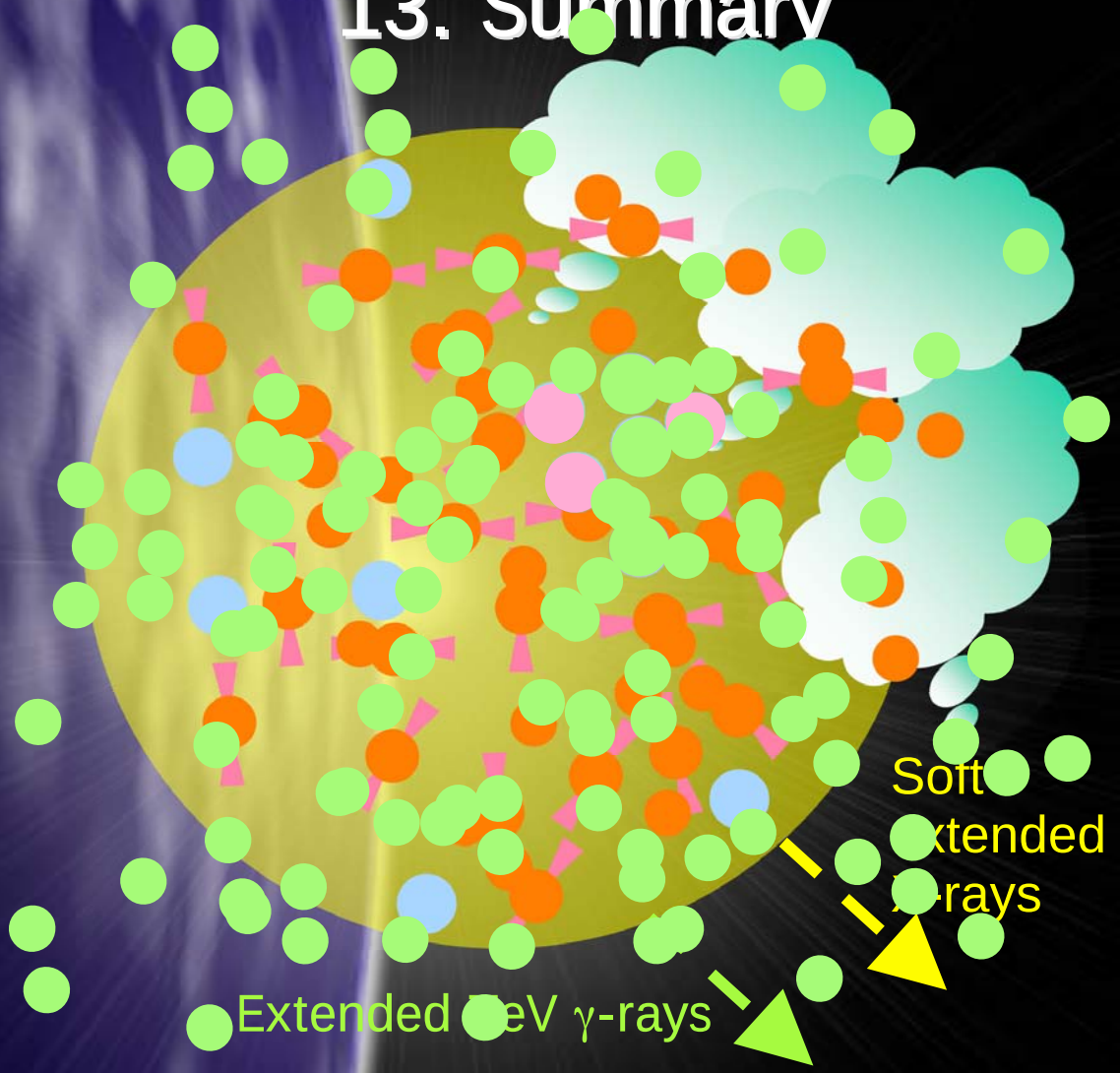

## TeV γ-ray emission

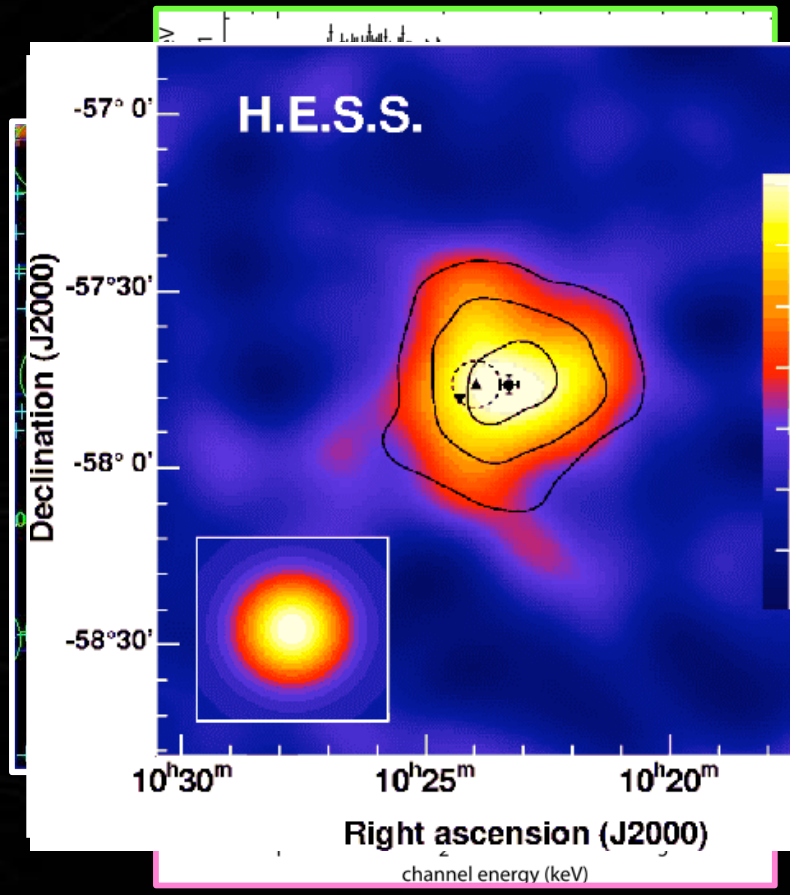
- 1st from star clusters
- Extended (~10').
- IC, $\pi^0$ decay, or else.

## Diffuse hard X-rays

- Soft extended emissi
- 1.38GHz enhanceme

# 13. Summary




- Many new phenomena found (in other regions, too).
- Important for cluster evolution, effects on ISM, particle accel.
- None of them are identified in low-mass star-forming regions.