

An X-ray Imaging Study of RCW49

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

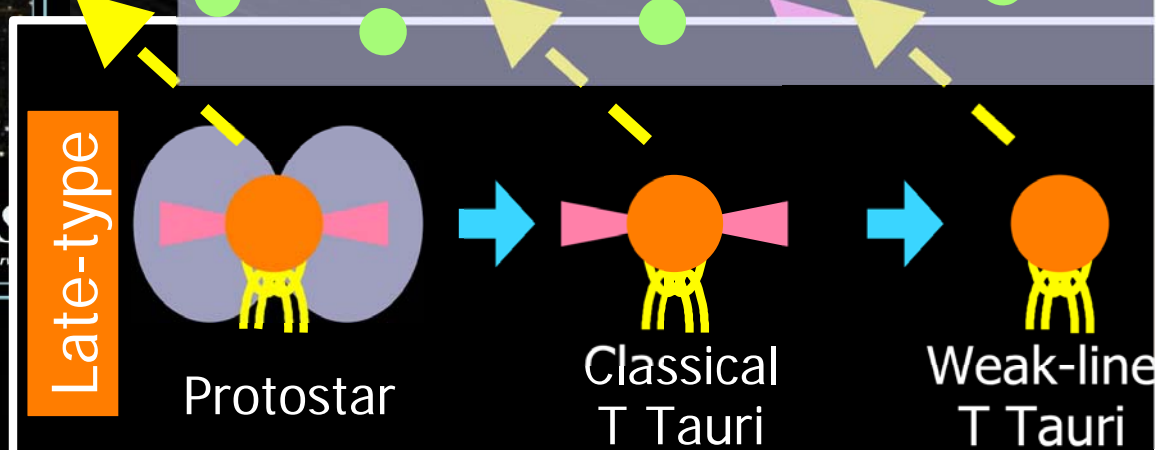
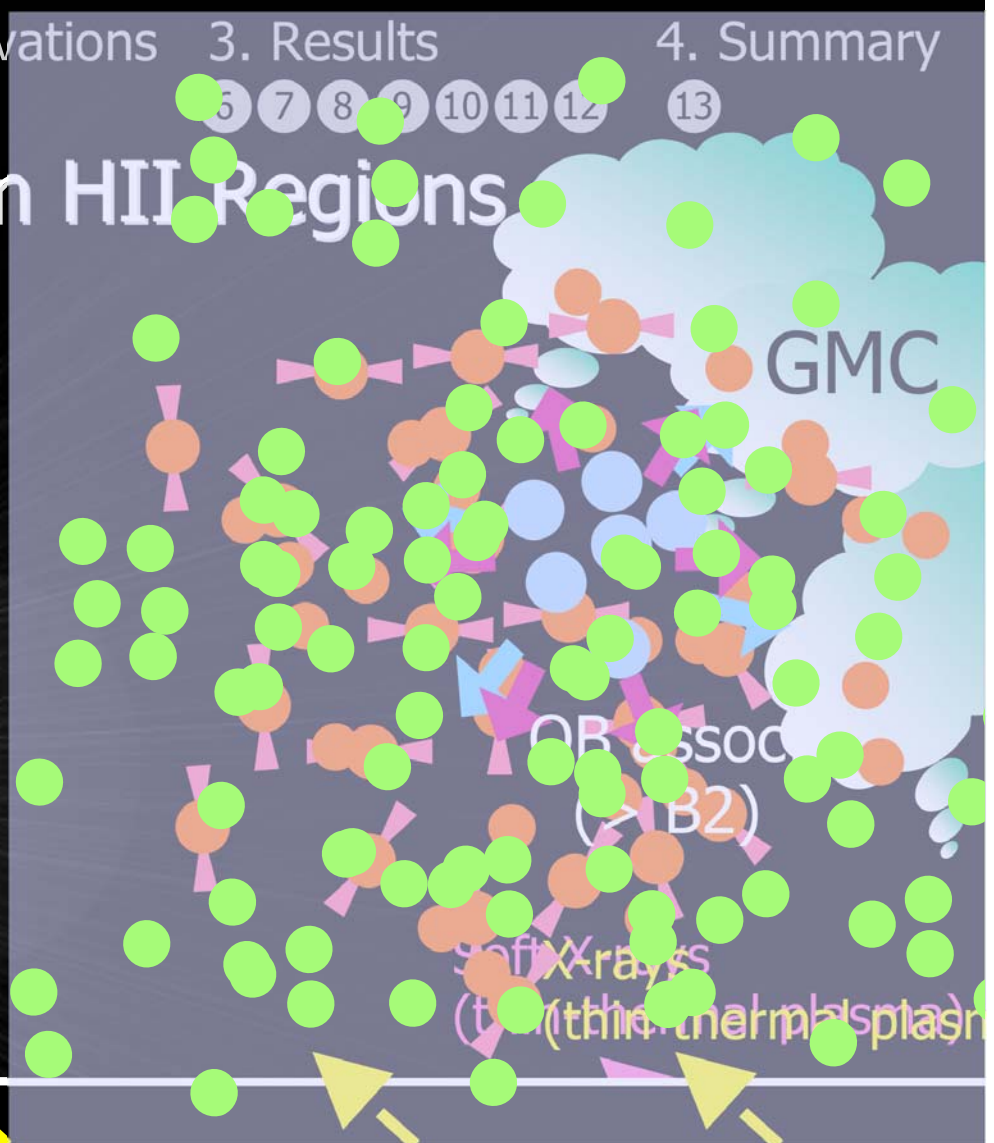
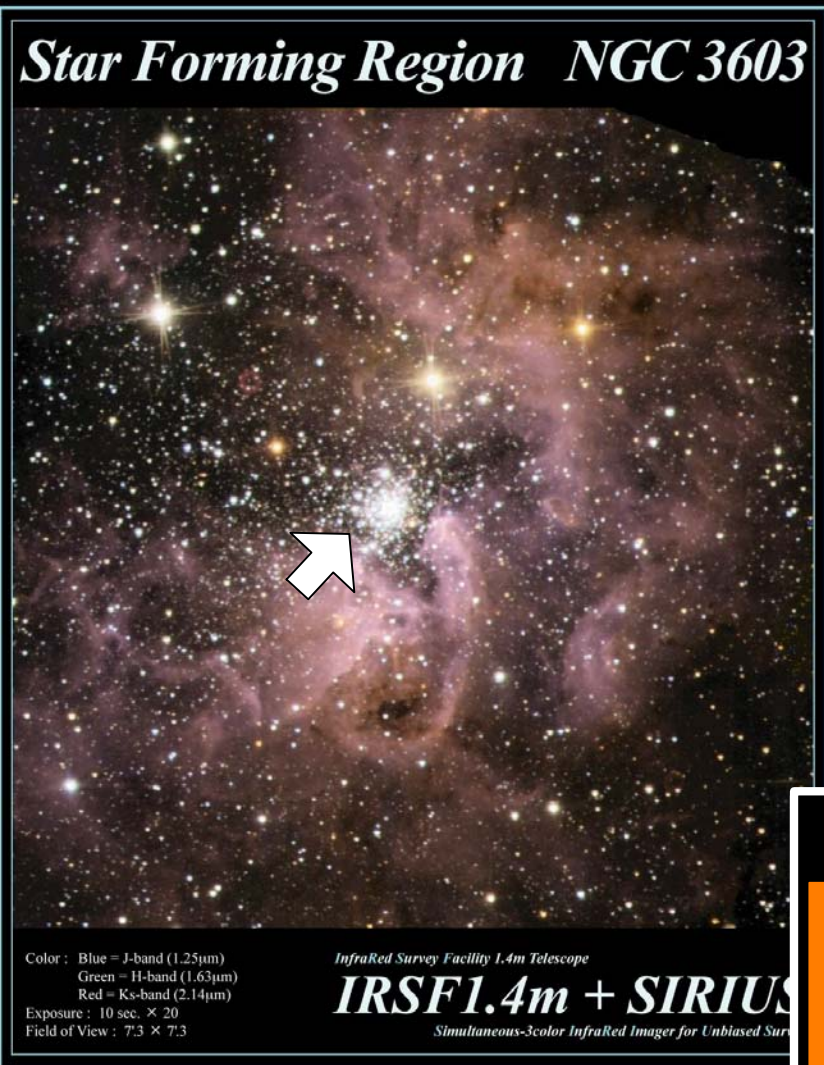
(Tsujiimoto et al. 2007, ApJ, 665, 719)

Masahiro Tsujiimoto
Pennsylvania State University

Contents

1. Introduction ... ① ② ③
 - Chandra Imaging of Galactic HII Regions
2. Observations .. ④ ⑤
 - Chandra (X-ray), IRSF (NIR), Spitzer (MIR)
3. Results ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫
 - (1) Resolving OB assoc., (2) Cluster membership
 - (3) New O stars, (4) Hard O stars, (5) WR, etc.
4. Summary ⑬

1. Constituents in HII Regions



1. Introduction

2. Observations

3. Results

4. Summary

1

2

3

4

5

6

7

8

9

10

11

12

13

2. Scale and Chandra Resolution

Distance (kpc)

0.05

0.5

5

50

500

5000

Our Galaxy

MCs

M31

M82

TW
Hya

Tau,
Oph

Orior
Nebu

M1

W

R_C
4

Arc W49A

30 Dor

Physical Scale (pc) of phenomena & satellites

0.0002

0.002

0.02

0.2

2

20

HC H_{II}

UC H_{II}

B2

Stroemgren Rad.

O4

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1 2 3

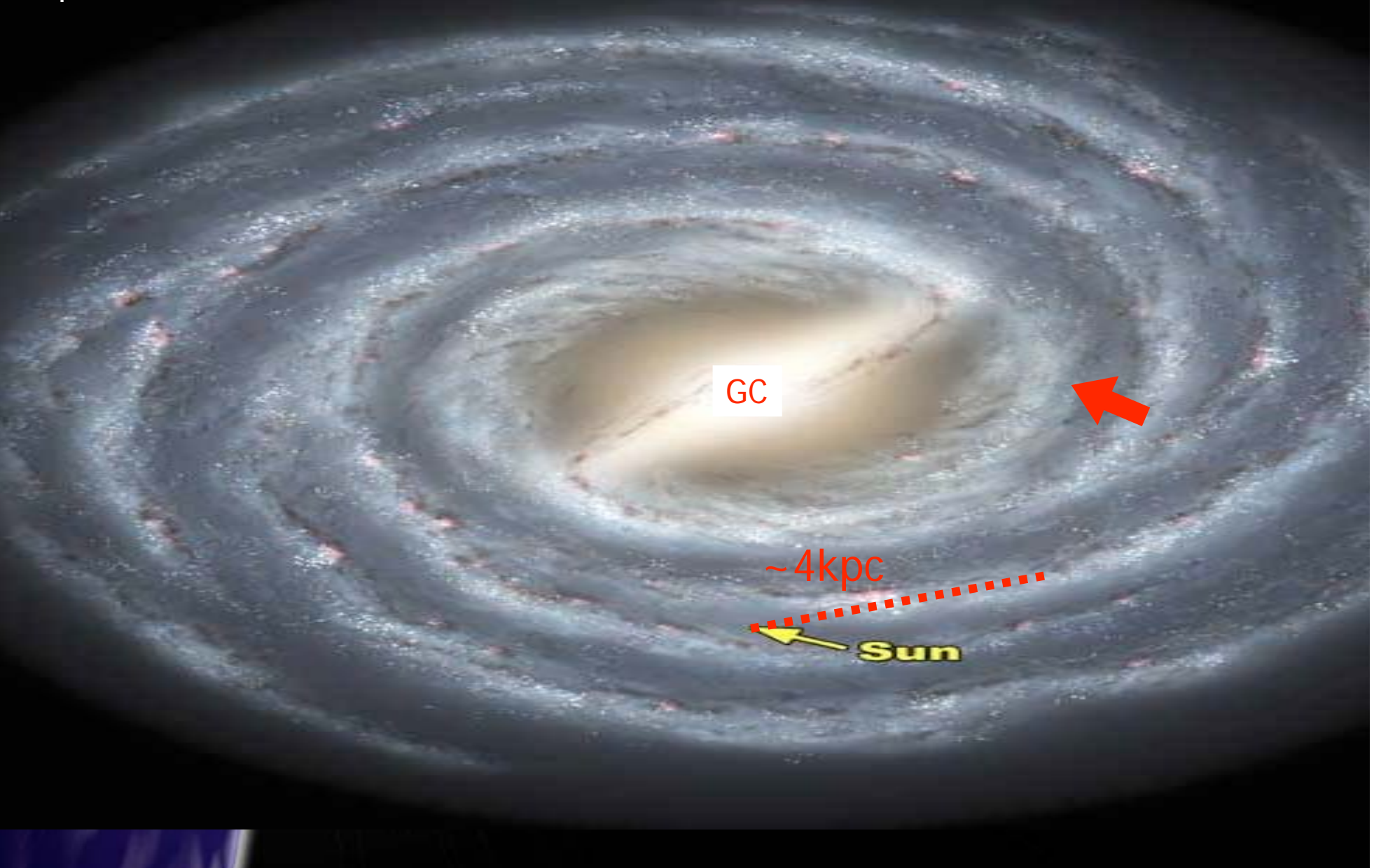
4 5

6 7 8 9 10 11 12

13

2. Chandra Observations of H II Regions

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



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① ② ③

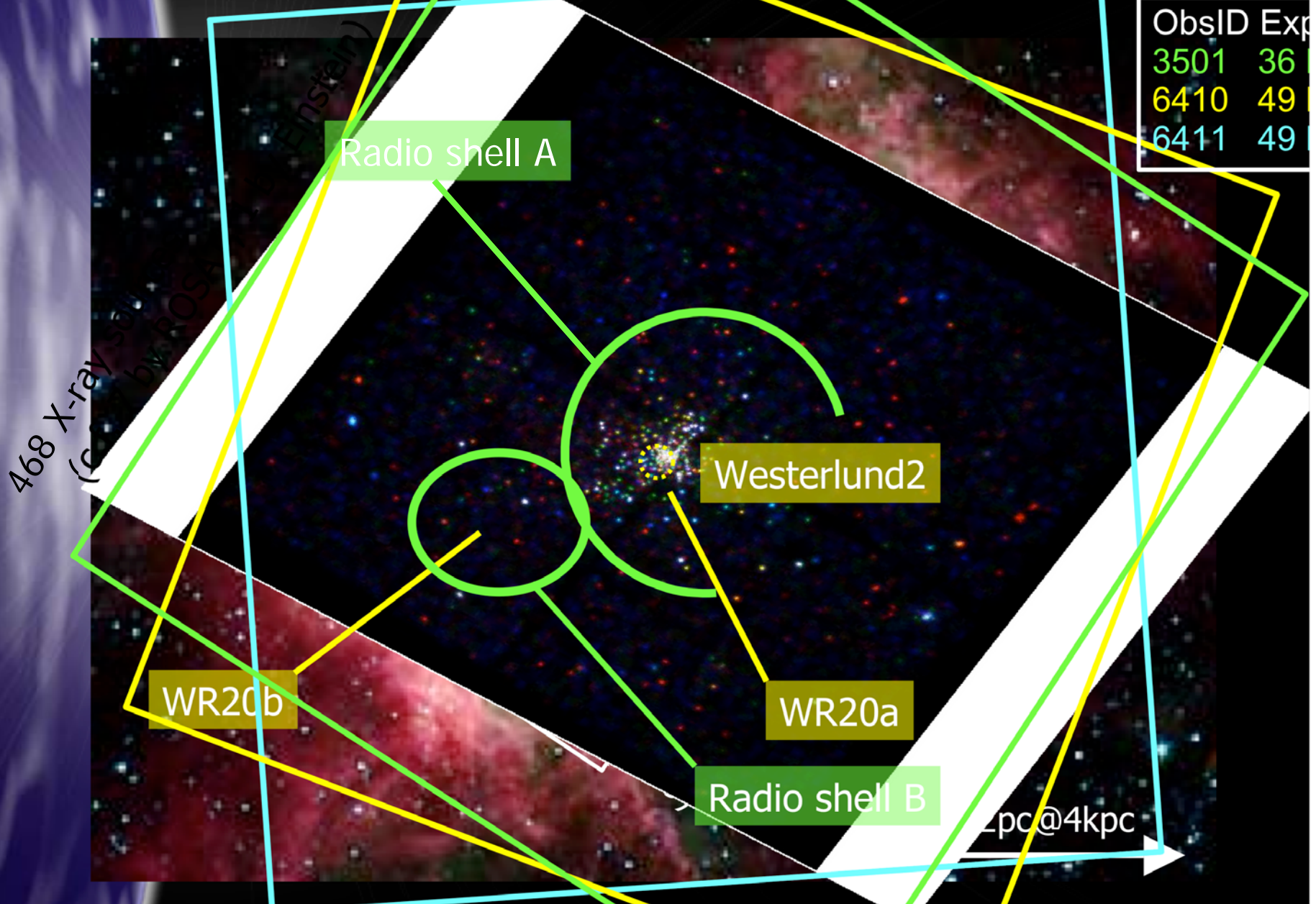
④ ⑤

⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫

⑬

4. RCW49 and Chandra Observations

ObsID	Exp
3501	36
6410	49
6411	49



1. Introduction

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1 2 3

4 5

6 7 8 9 10 11 12

13

5. Infrared Observations

Spitzer/MRAC

3'

*Transition
Boundary*

RCW49

$(l, b) = (284.3, -0.32)$

10,540 sources

Control field

$(l, b) = (284.8, -0.33)$

9,768 sources

SAAO IRSF/SIRIUS

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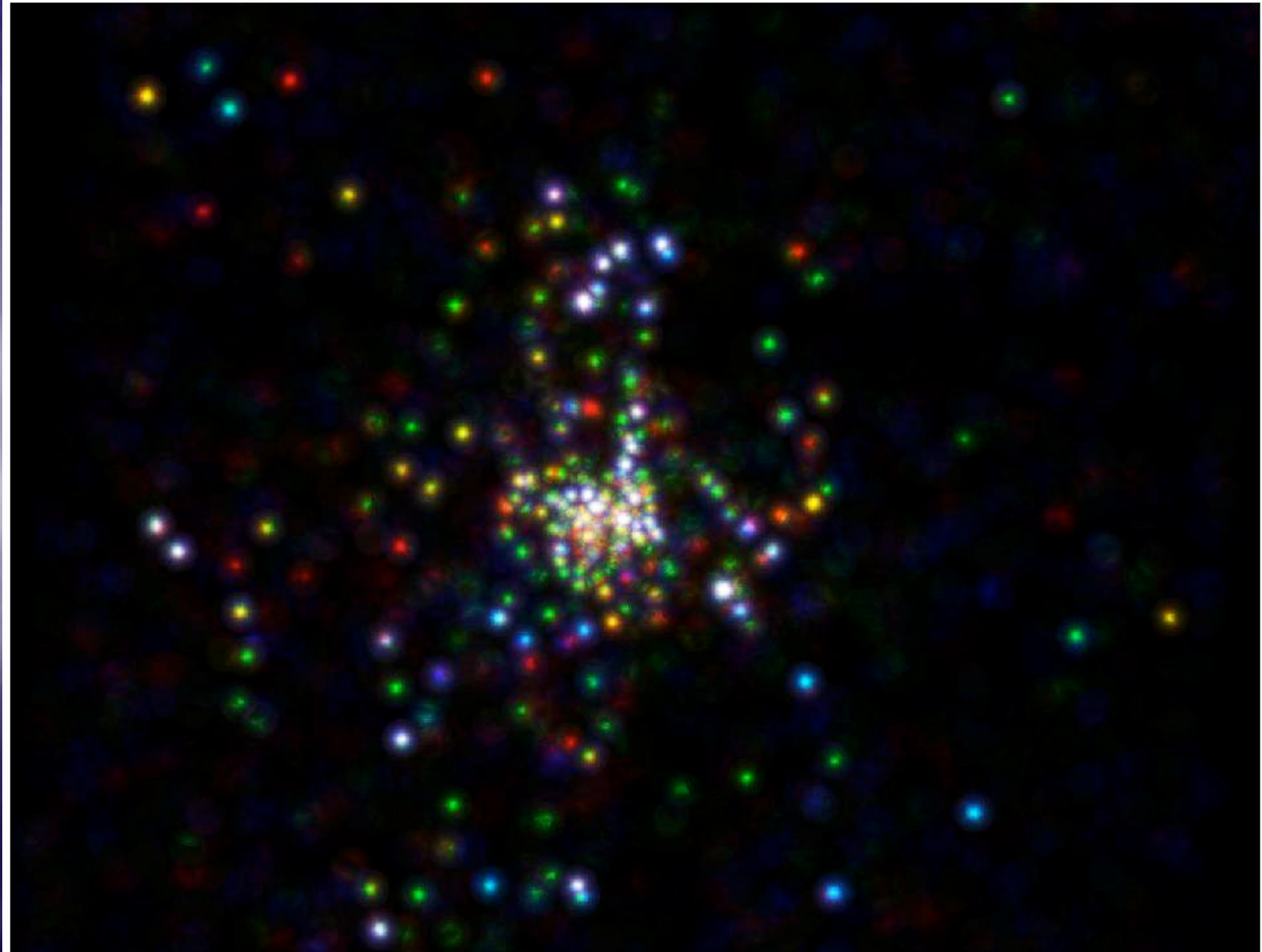
1 2 3

4 5

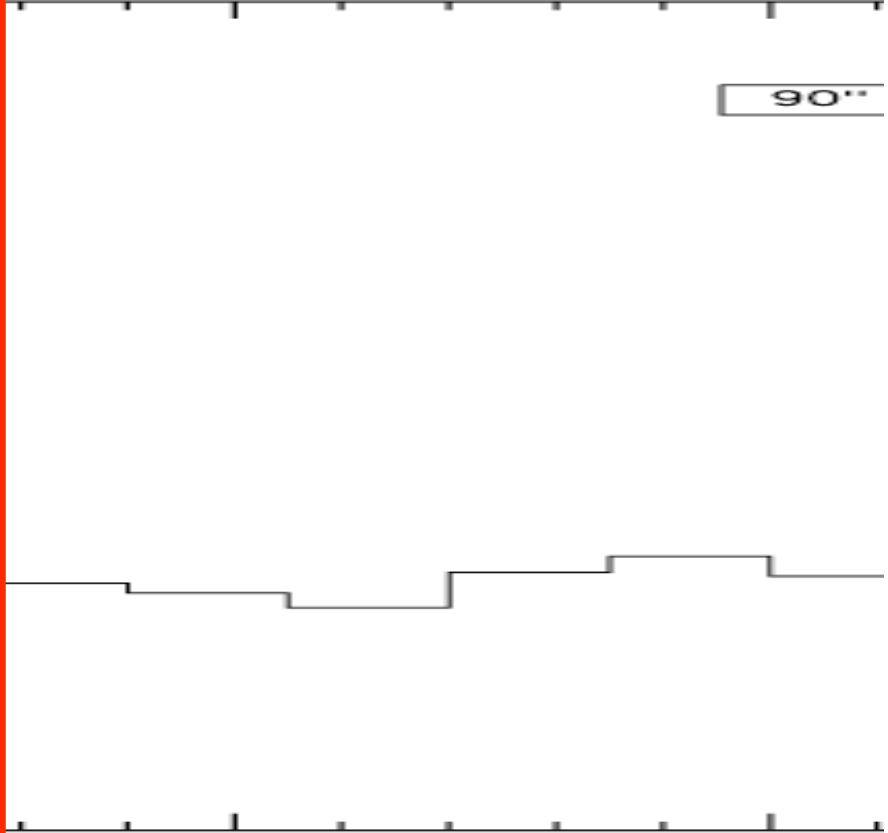
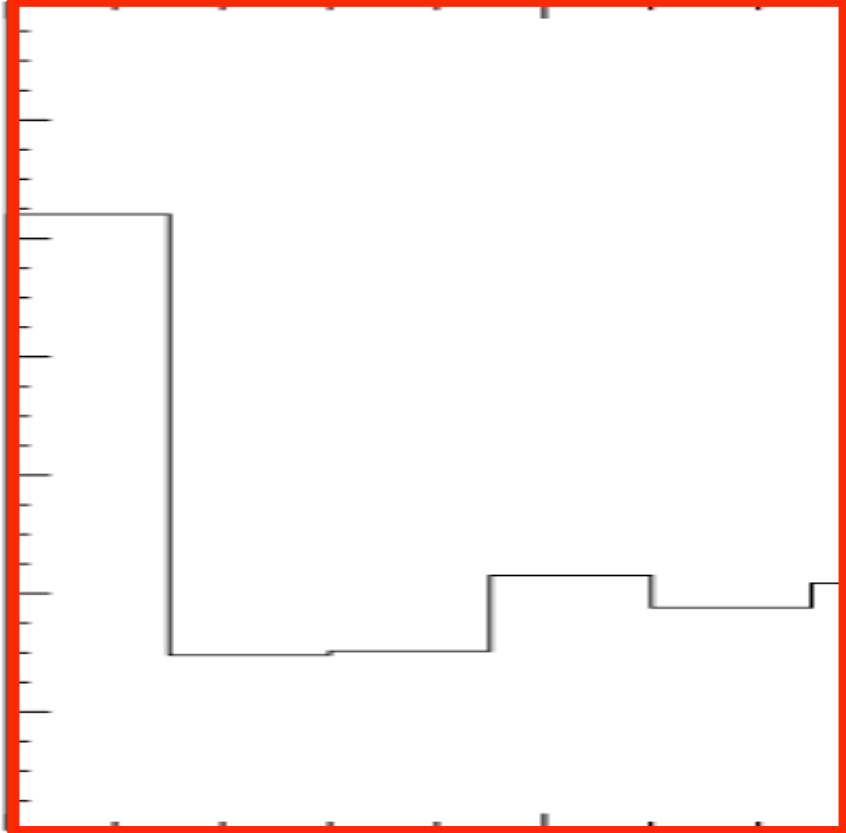
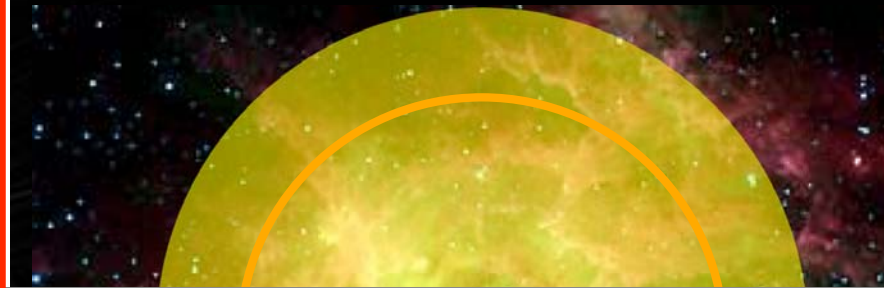
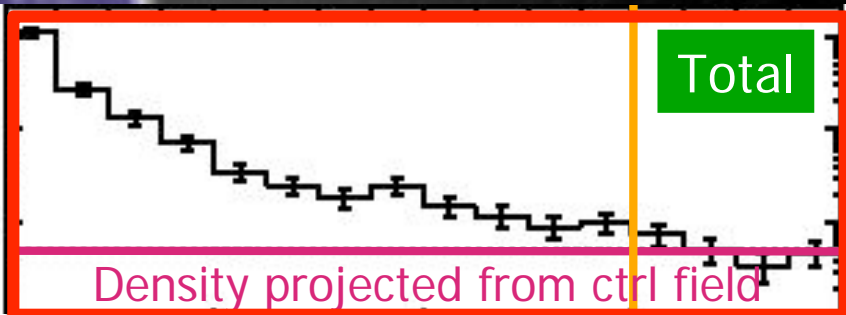
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13

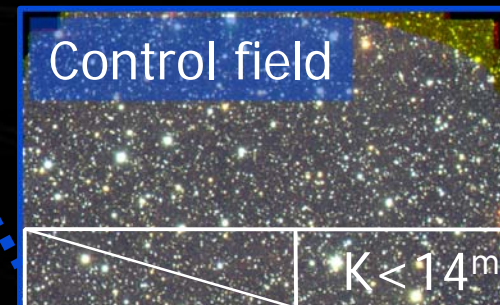
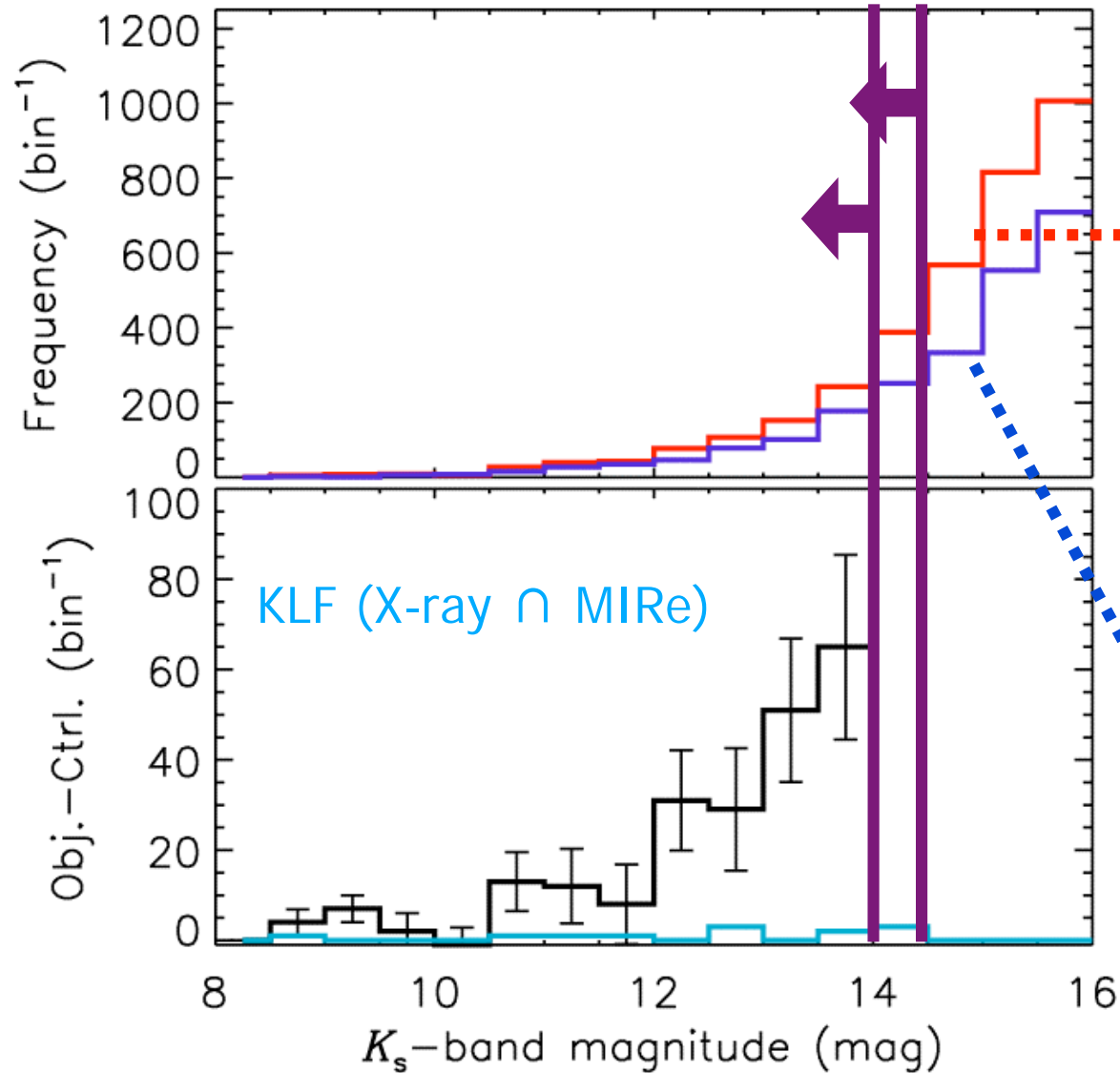
6. Resolving the central OB association



7. Cluster membership – few contamination



8. Complementarity of Chandra & Spitzer



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

9. New early-type star candidates

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

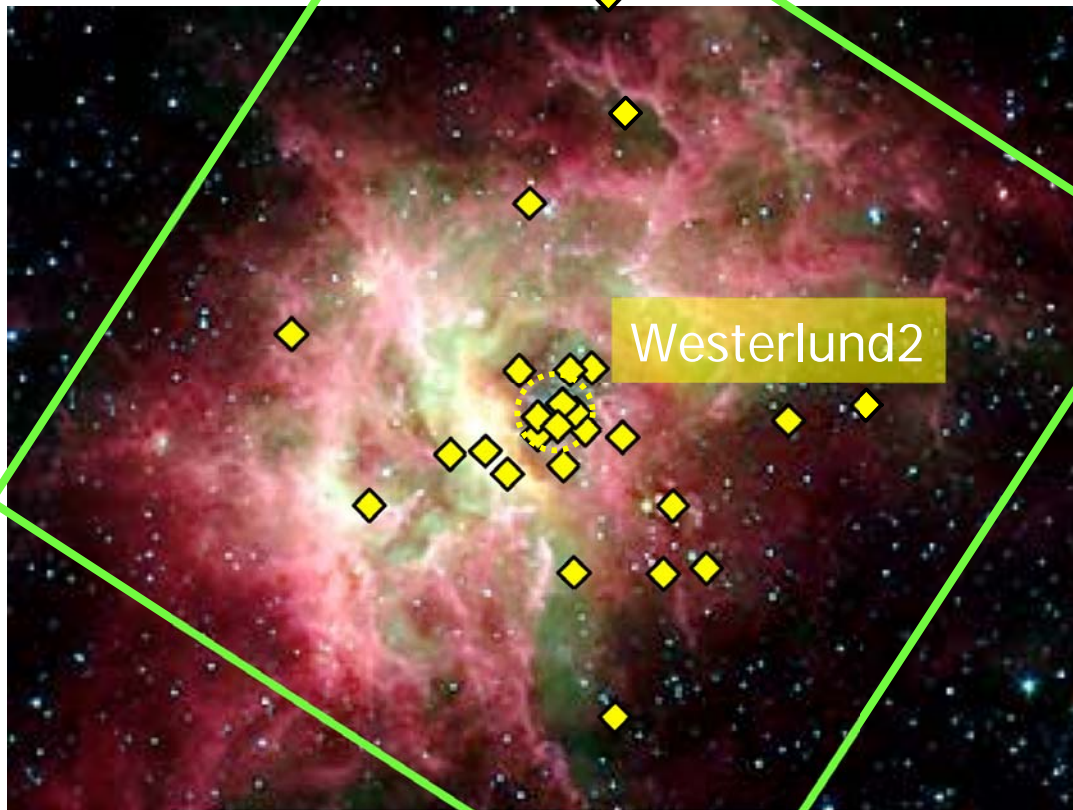
~30 new OB candidates
+13 prev-known, spec

Spatial distr. of new OB

~1/2 are out of OB as

Many OBs may remain
unIDed in other mSFR

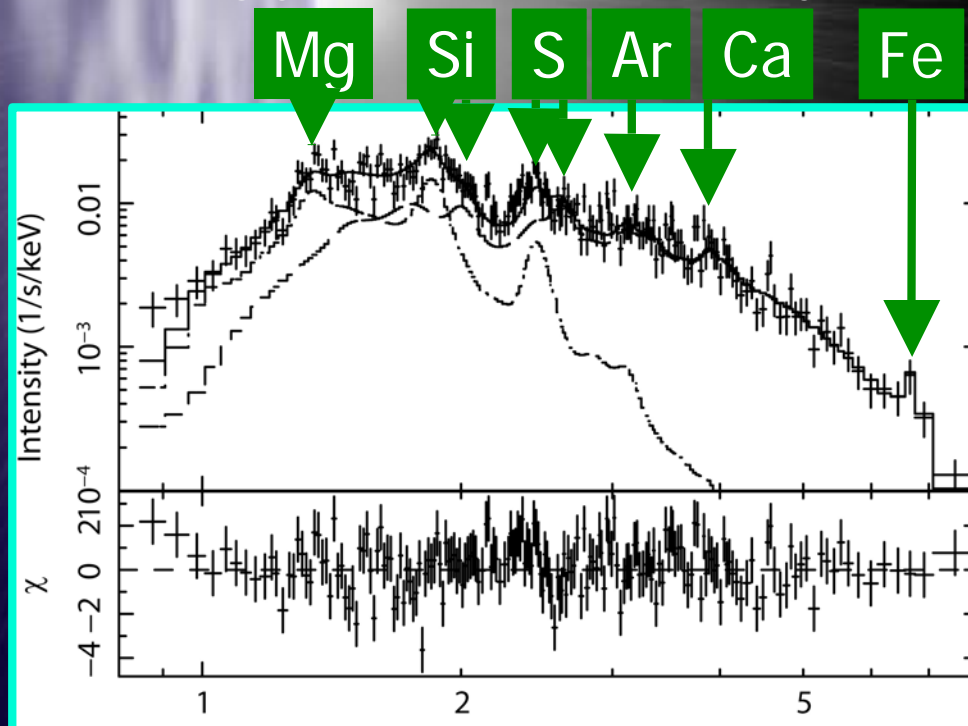
Spectroscopic follow-up
(AAT, CTIO) this winter



10. Wolf-Rayet binary WR20a

WR20a : "Binary Wolf-Rayet" star: WN6+WN6

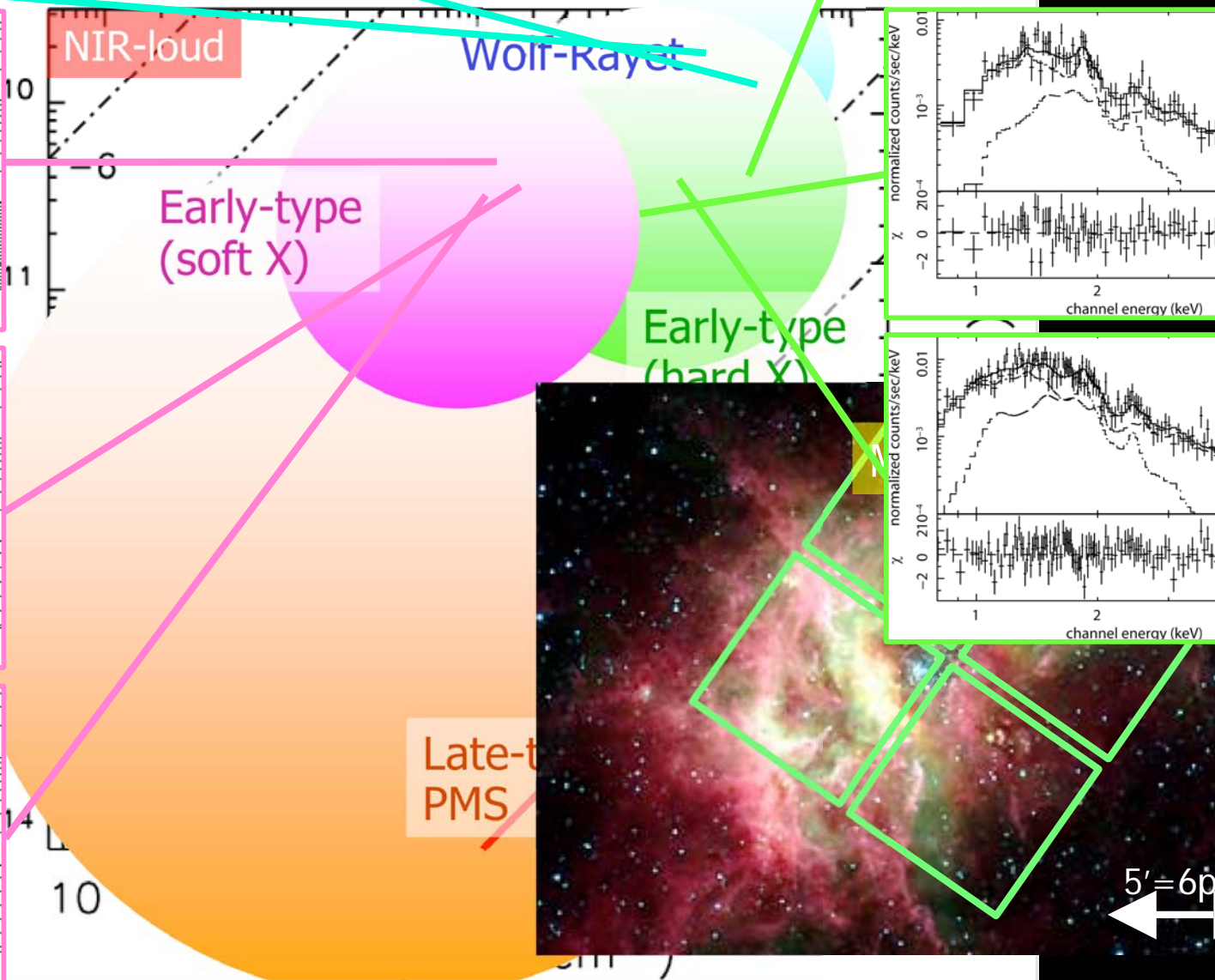
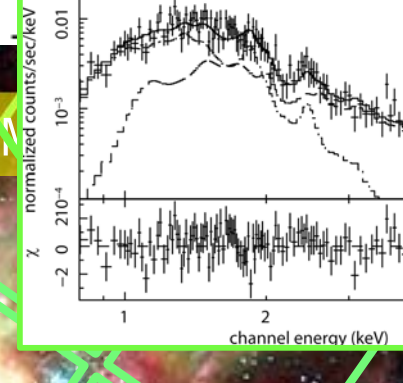
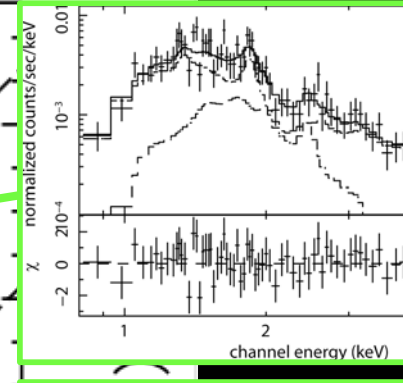
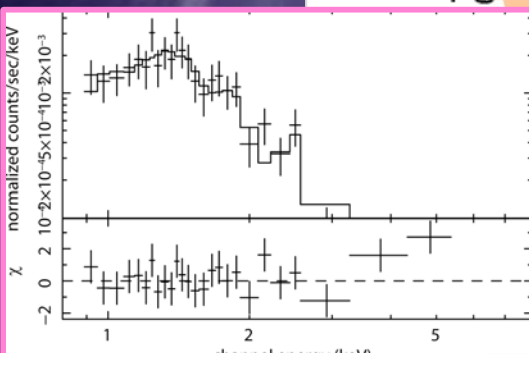
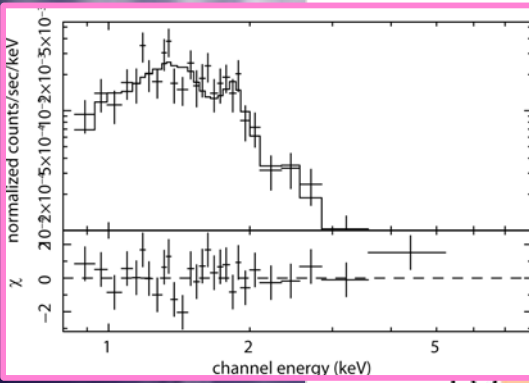
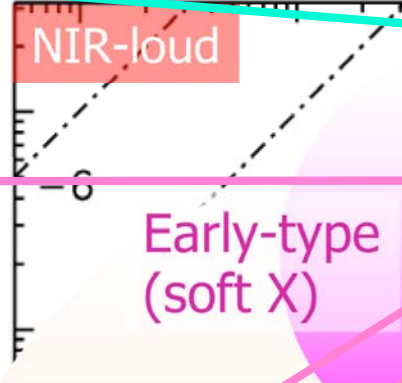
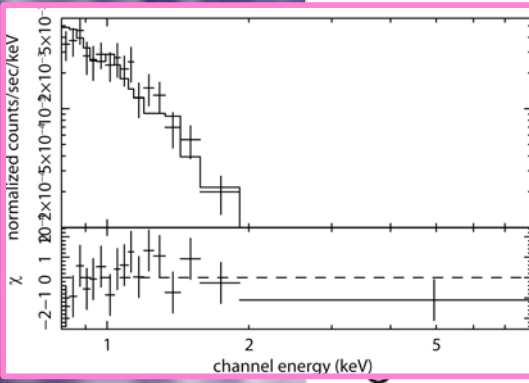
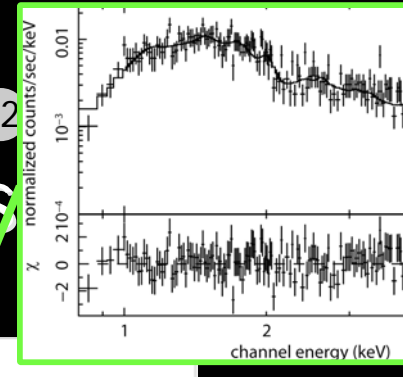
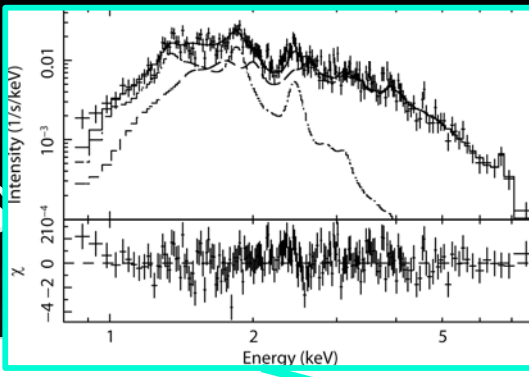
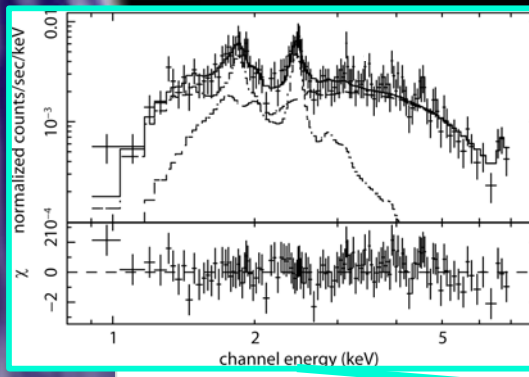
1. An eclipsing binary (Bonanos+ 2004).
 2. Doppler tomography (Rauw+ 2004).
- $M_1=83.5$ Mo $M_2=82.0$ Mo; the most massive pairs.
 - $P_{\text{orb}} = 3.686$ days. $\theta_{\text{inc}} = 74.5$ degrees.



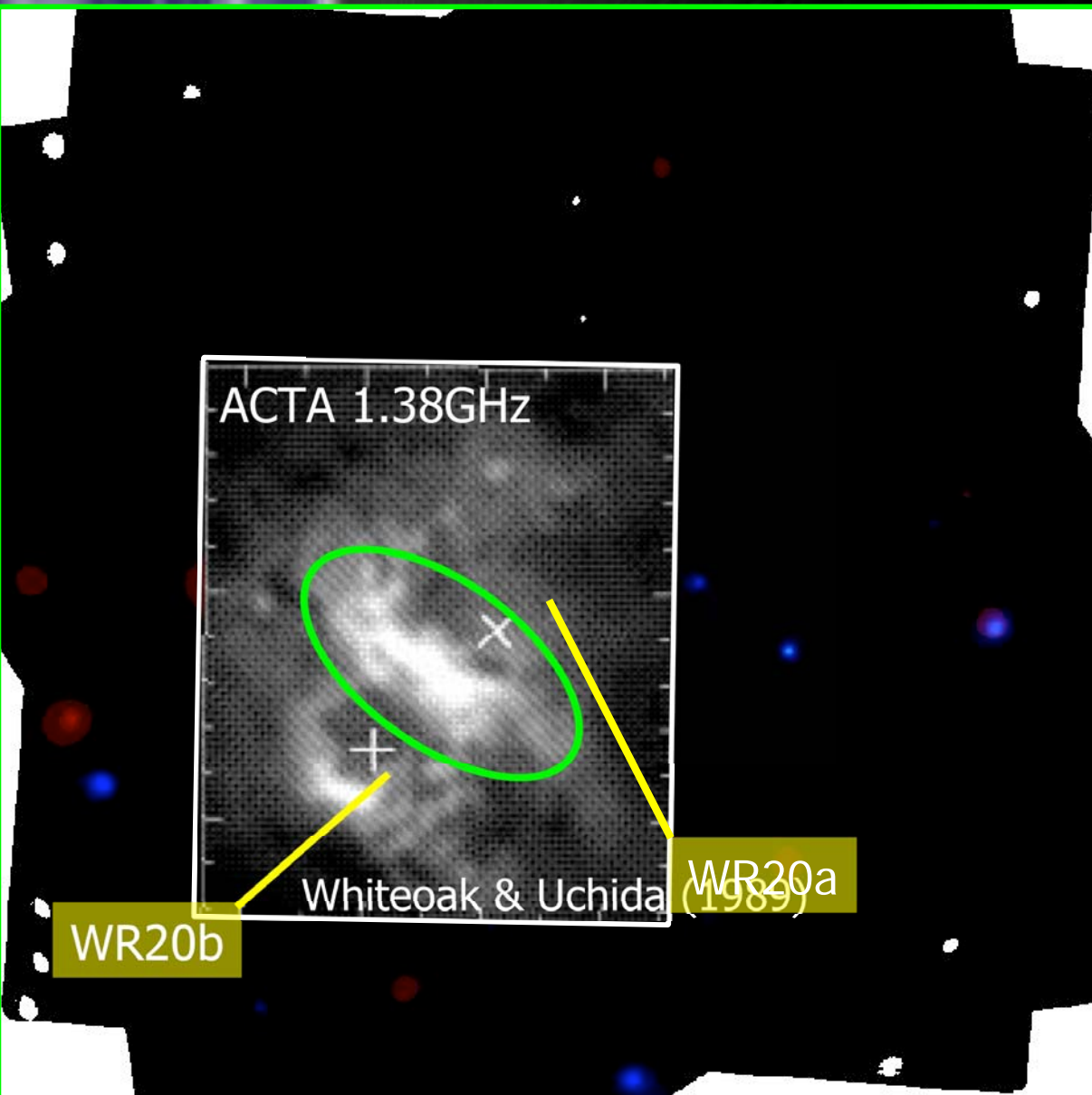
Results

8 9 10 11 12

Ray emis



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



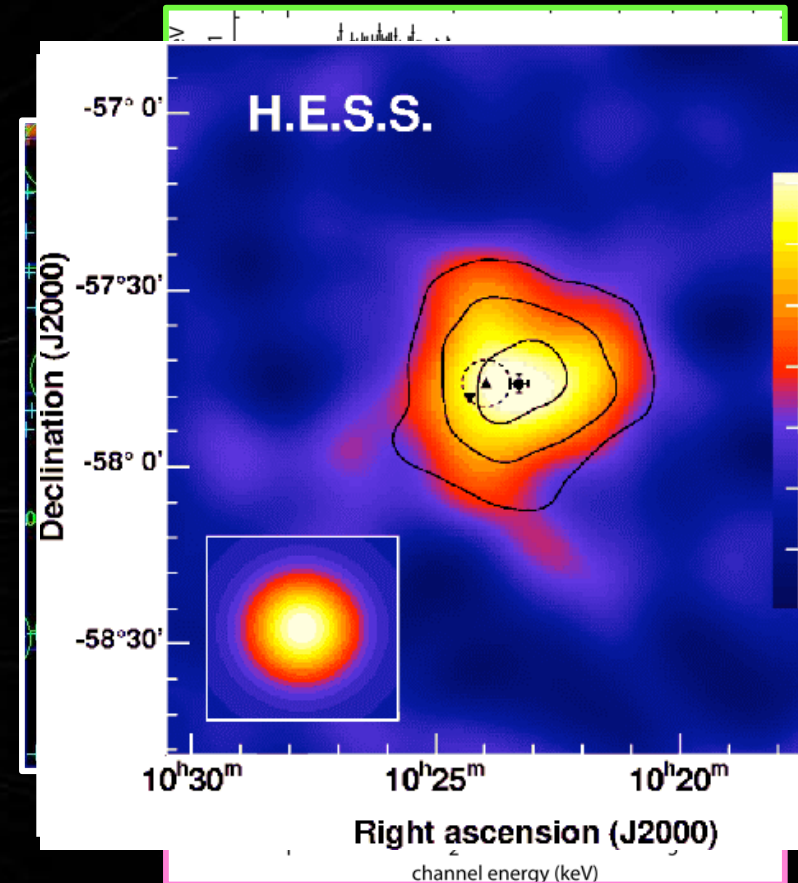
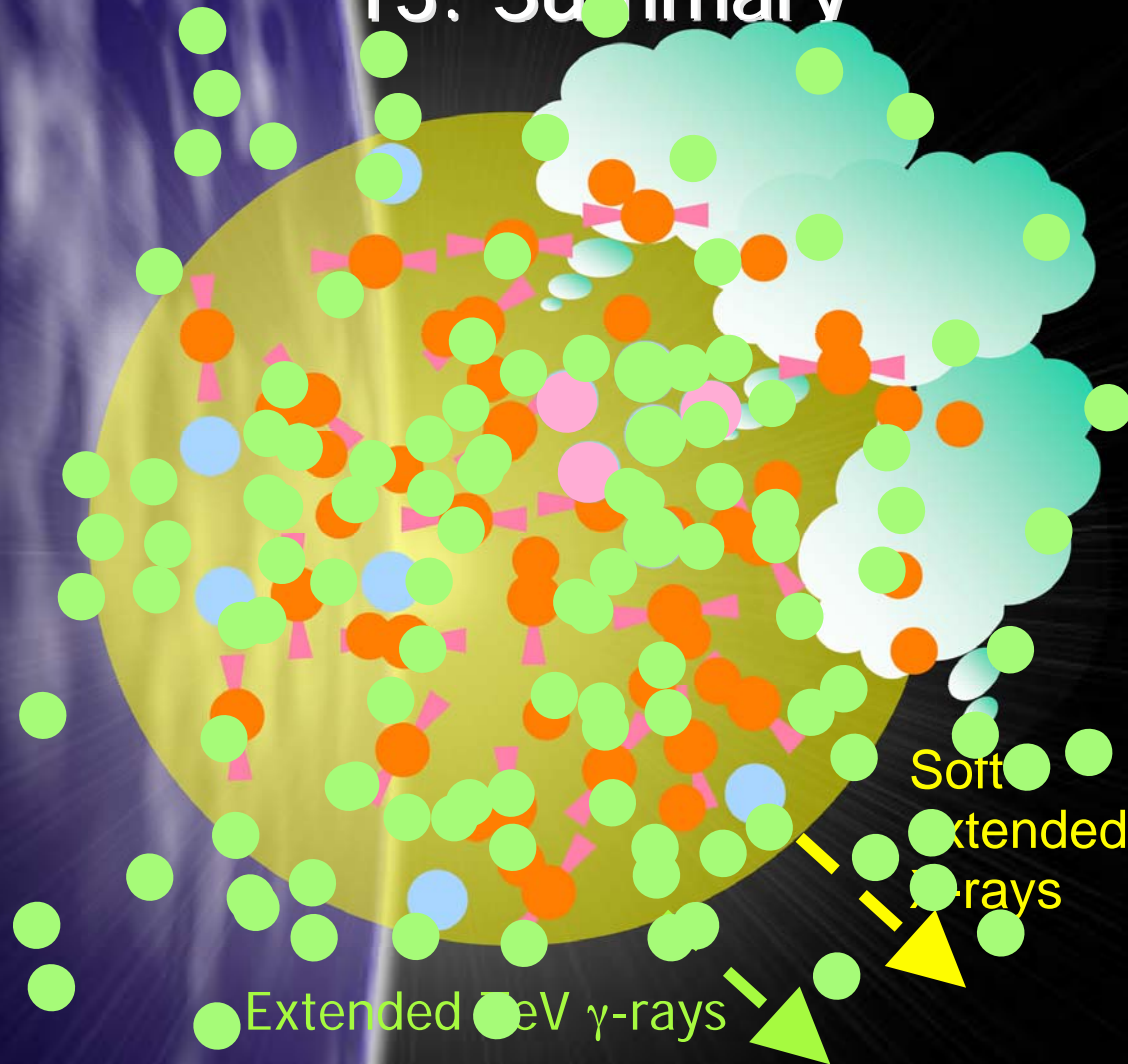
TeV γ -ray emission

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

Diffuse hard X-rays

- Soft extended emission
- 1.38GHz enhancement

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.