Young massive evolved stars in the G23.3-0.3 complex

presented by

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Usefulness of young massive stars/clusters

Extragalactic distances

Galactic morphology / spiral arms / metallicity gradient

Supernova progenitors

Stellar evolution

Upper-mass cutoff / IMF (segregation, ejection, explosions)

One needs the entire content of massive stars in GMC, so to sample their spatial distribution (clustering versus isolation) and to detect short evolutionary phases (e.g. LBV).

Outline:

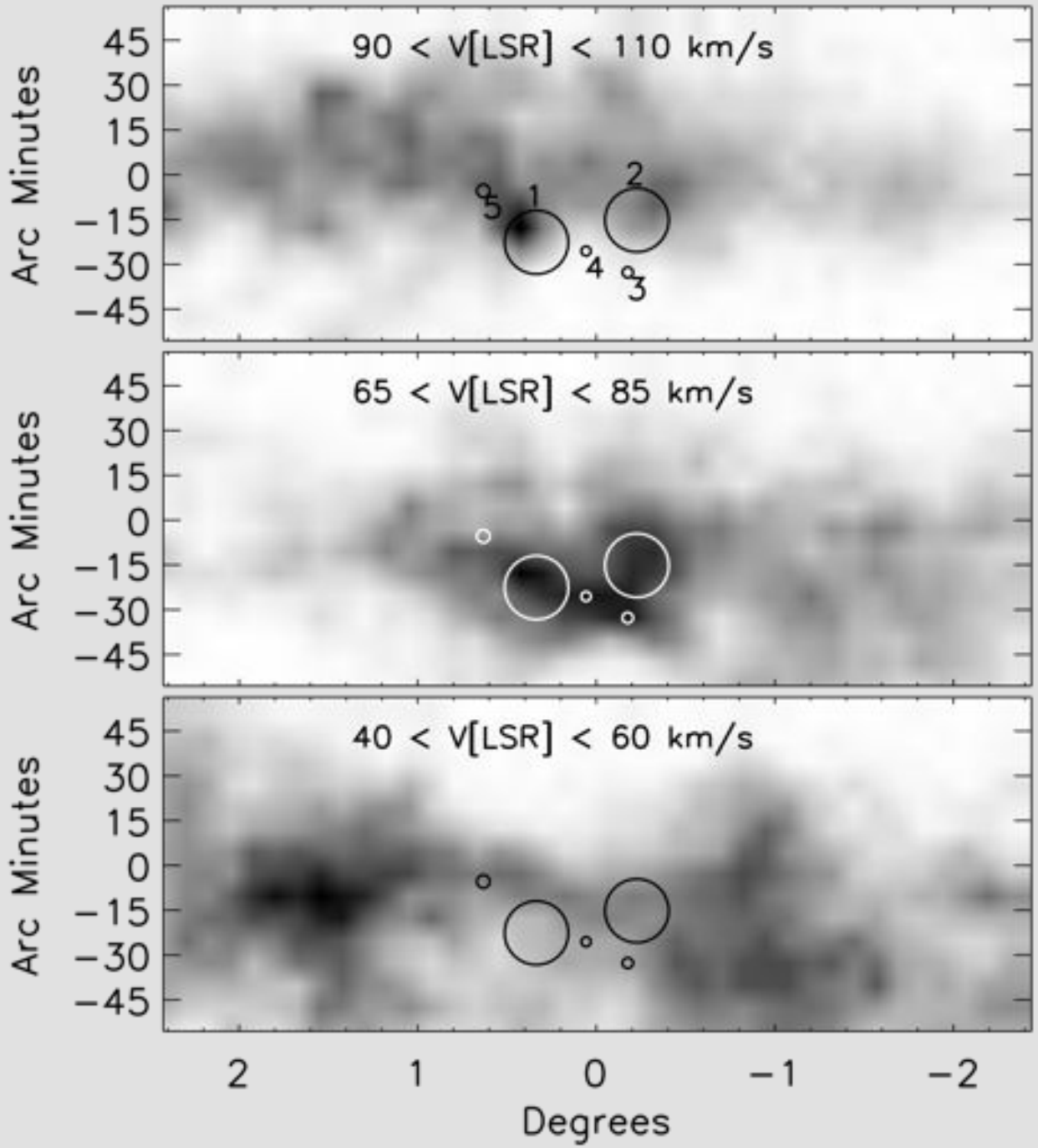
A. brief introduction to GMC G23.3-0.3, a beautiful star forming complex

B. Detected massive stars

C. Spatial and temporal distribution

Reference: Messineo at al. 2014 A\&A 569, 20

The G23.3-0.3 giant molecular complex

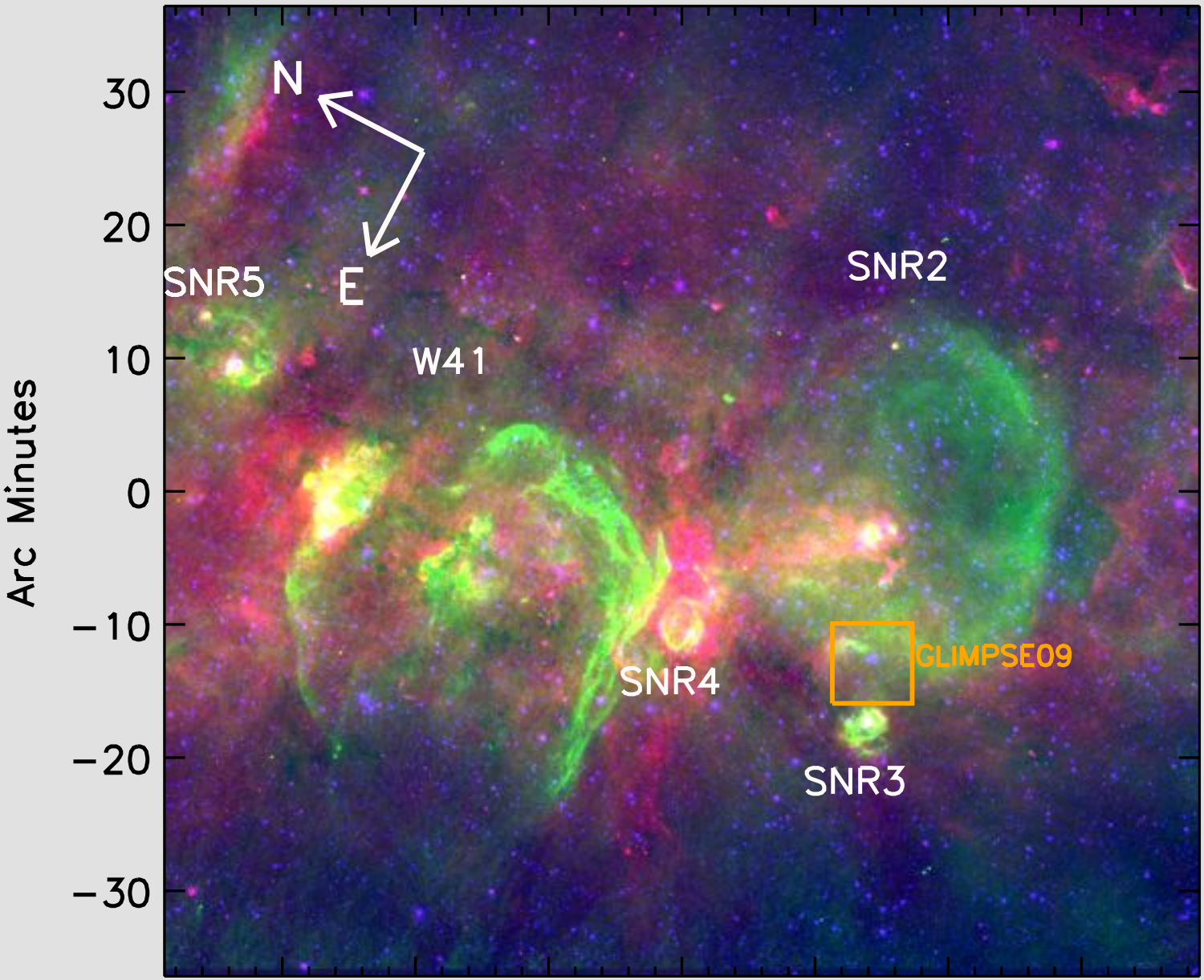


Object [23,78]--CO map
GMC of 2.1 X 10^6 Msun

Circles--SNRs

Ref:
Dame et al. (1986)
Dame et al. (2001)
Albert et al. (2006)
Helfand et al. (2006)
Green (1991)

The G23.3-0.3 giant molecular complex



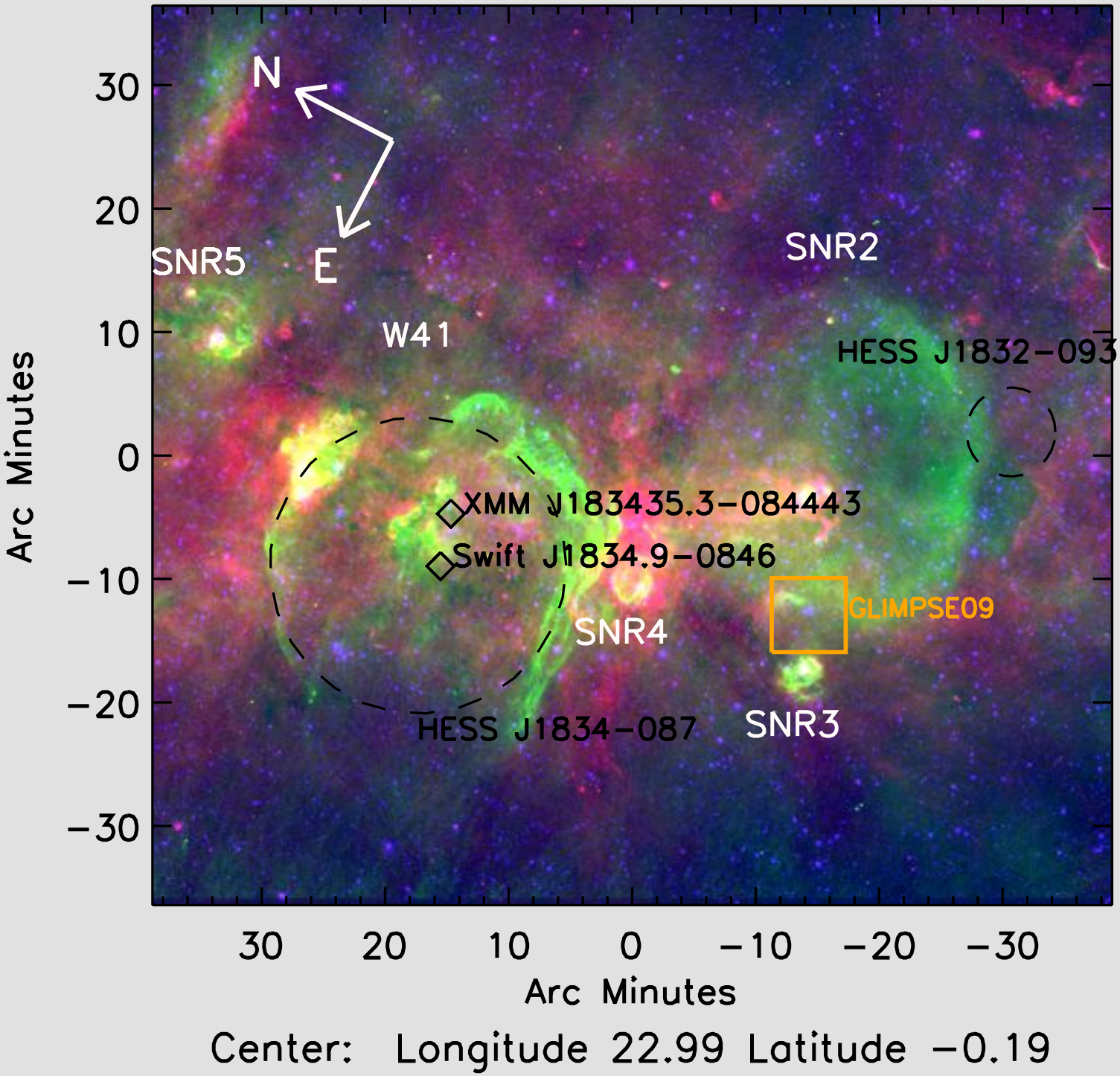
Blue = 3.6 um
GLIMPSE
Green = 20 cm
MAGPIS
Red = 8 um
GLIMPSE

SNRs from:
Green 1991
Helfand et al. 2006
2=G22.7-0.2
3=G22.7583-0.4917
4=G22.9917-0.3583
5=G23.5667-0.0333

High-energy
Aharonian et al. 2005
Laffon et al. 2011
Mukherjee et al. 2009
Kargaltsev et al. 2012

Center: Longitude 22.99 Latitude −0.19

The G23.3-0.3 giant molecular complex



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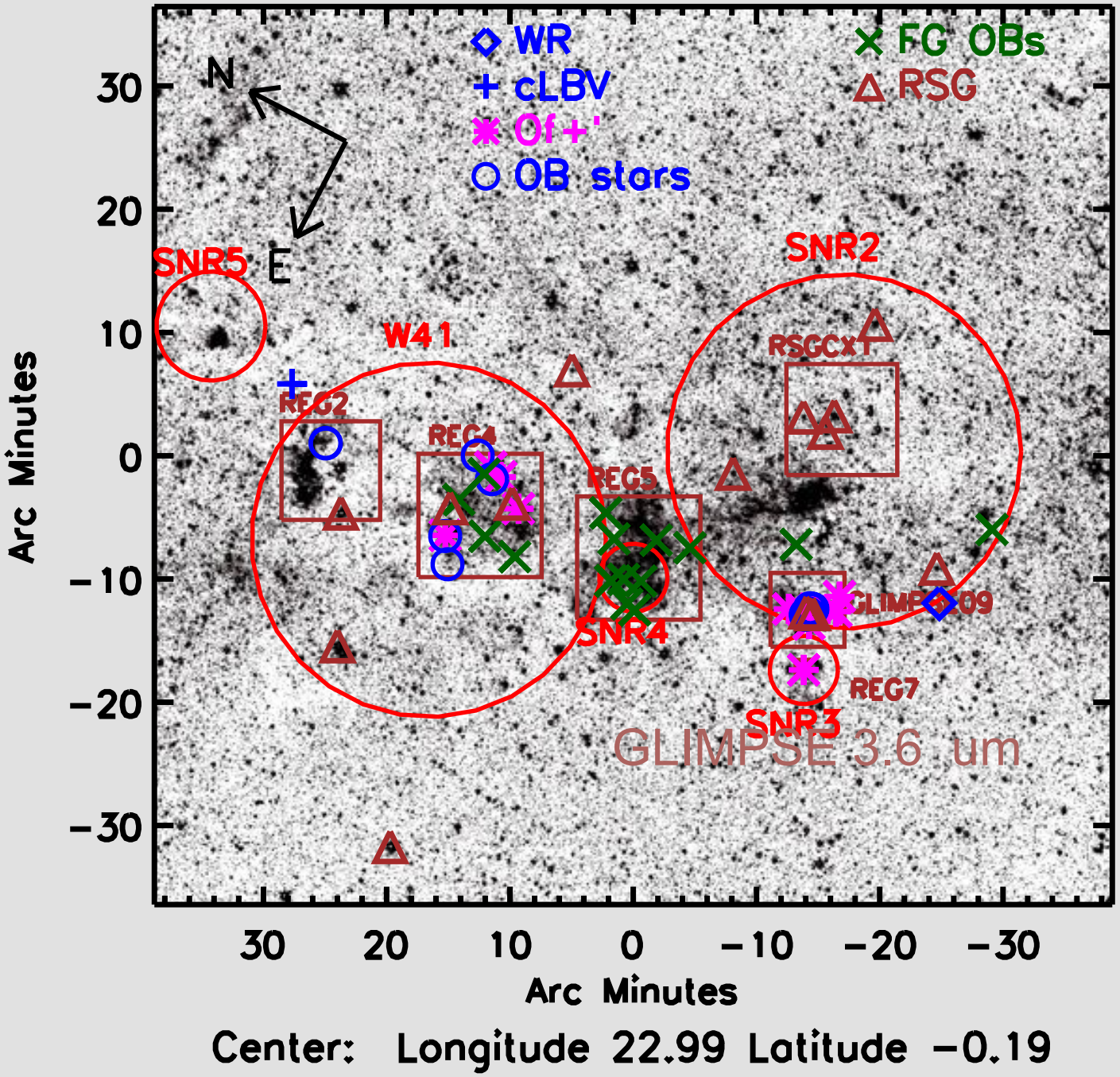
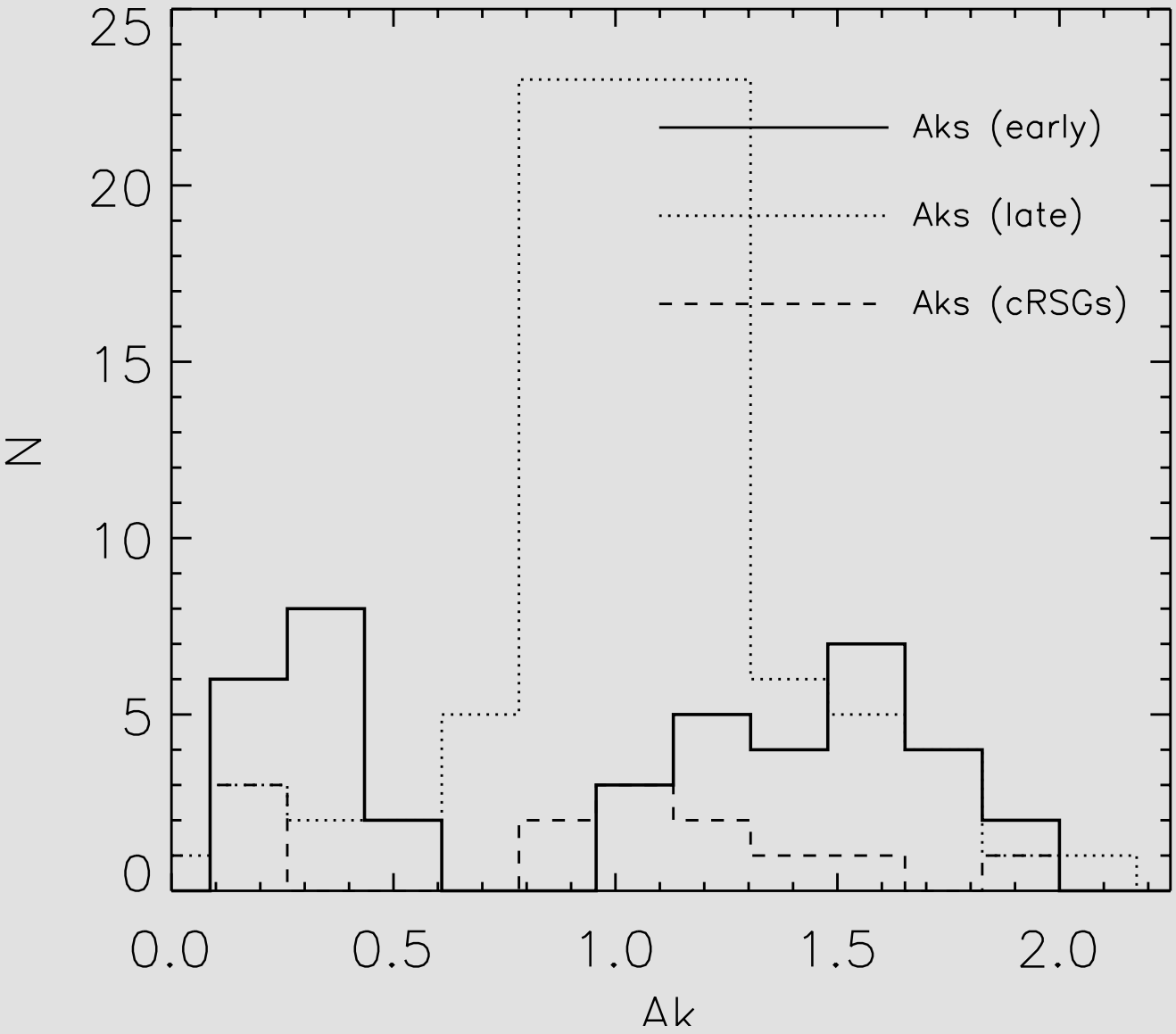
A K-band spectroscopic survey



40 new OB stars
10 new cRSGs



Likely in the cloud:

12 O I-III stars (11 OfI+)
7 B stars
1 cLBV

Plus 1 WC8 by Mauerhan et al. 2011

Spectrophotometric distance

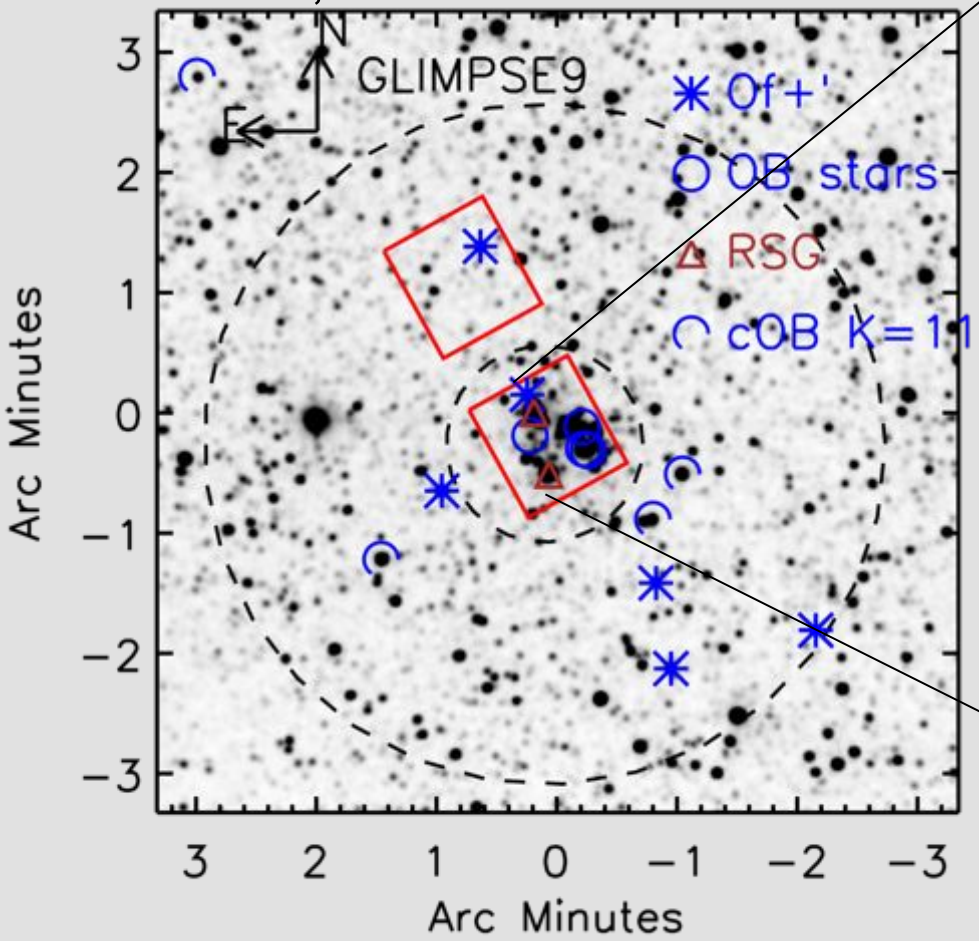
Spec	Nstar	Aks	Mk	DM
O4-6 I	1	1.34	-5.16	13.73
O6-7 I	4	1.73	-5.28	13.48
O7-8.5 I	1	1.62	-5.39	13.65
O9-9.5 I	1	1.68	-5.39	12.89
O6-7 III	3	1.67	-4.84	13.69
O7-8.5 III	1	1.75	-4.66	13.31
O9-9.5 III	1	1.37	-4.47	13.68
B0-3 I	2	1.57	-6.27	13.25

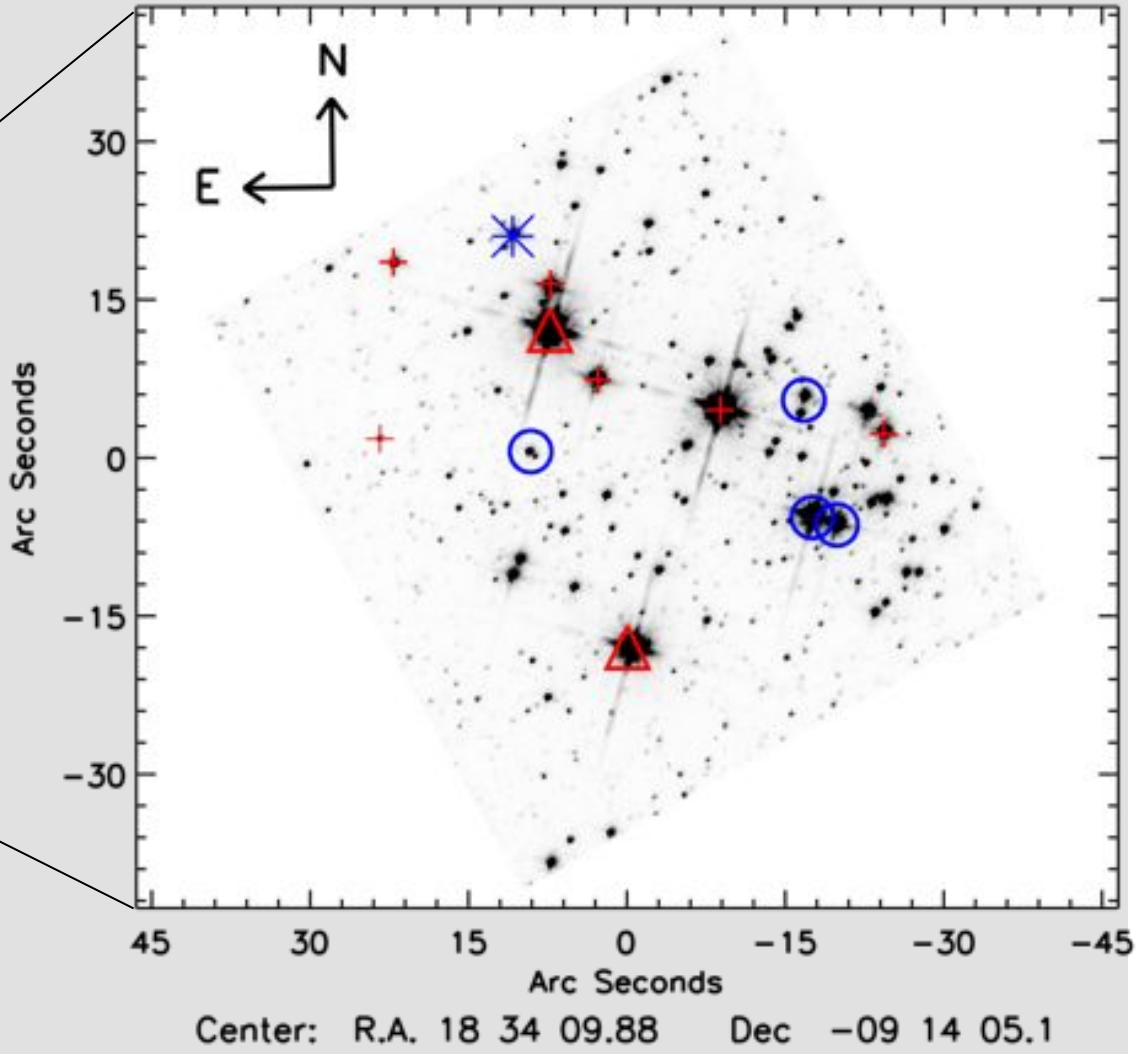
Region/component	Method	DM	
70.5-82.5	Kinematic	13.19 -- 13.39	Reid et al. 2009 Messineo et al. 2014
G23.01-0.41	Parallax	13.31 pm 0.17	Brunthaler et al. 2009

GLIMPSE9 and surrounding (SNR G22.7-0.2 South)

HST/NICMOS F160W, F222M
f.o.v. = 51.5”x51.5”; pixel scale = 0.2“
exptime = 19.94s, 55.94s
(Messineo et al. 2010).

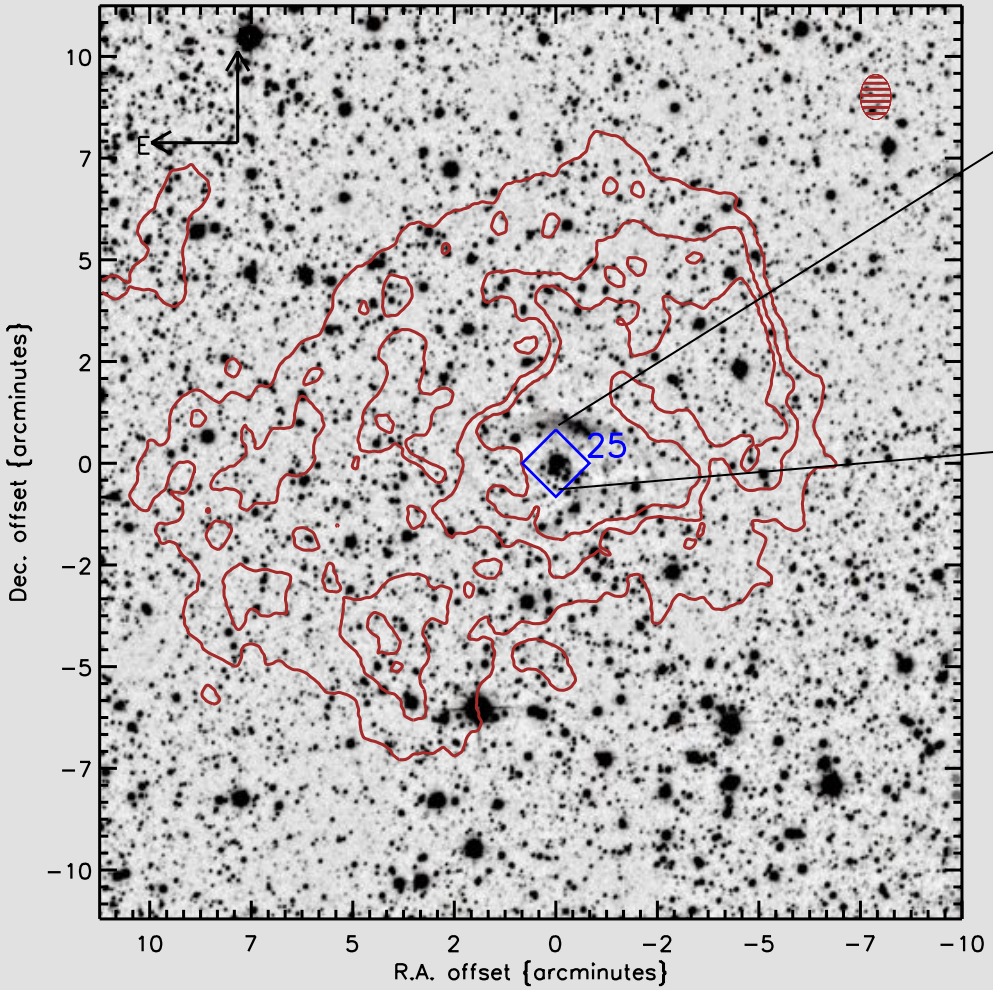
2MASS Ks, Messineo et al. 2014



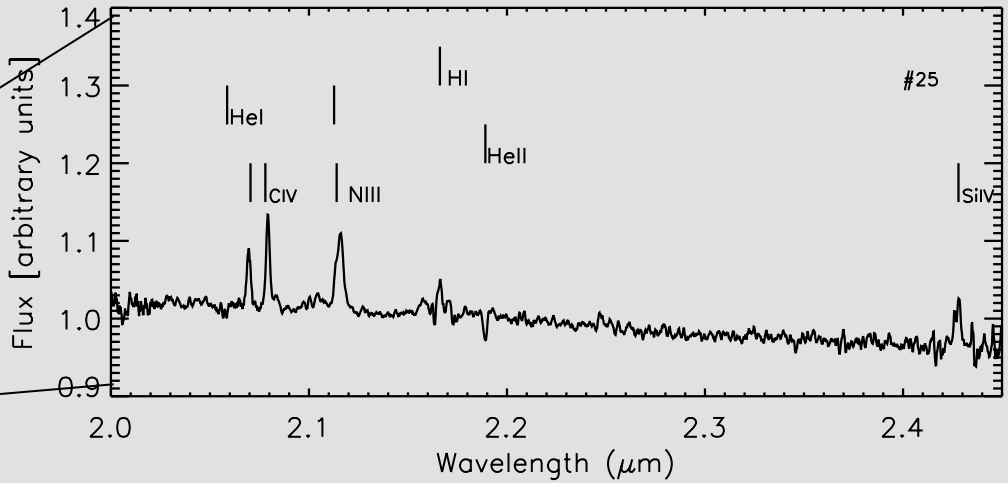


Star #25 in cSNR3-G22.7583-0.4917 (Helfand et al. 2006)
[BDS2003]117 (Bica et al. 2003)

UKIDSS K, MAGPIS 20cm

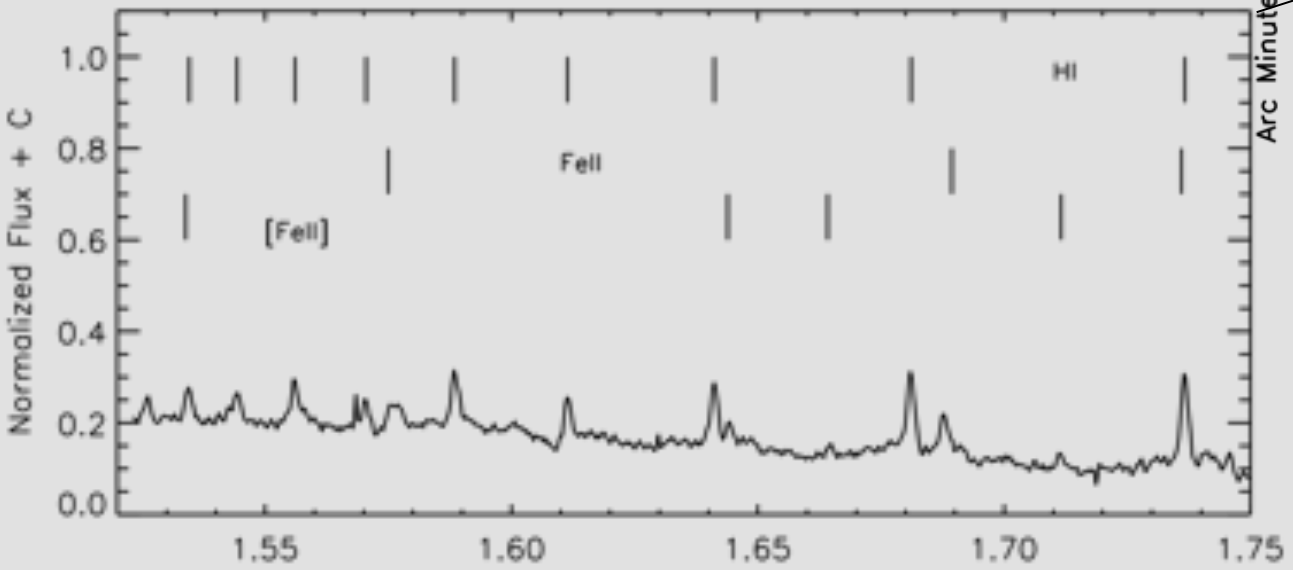


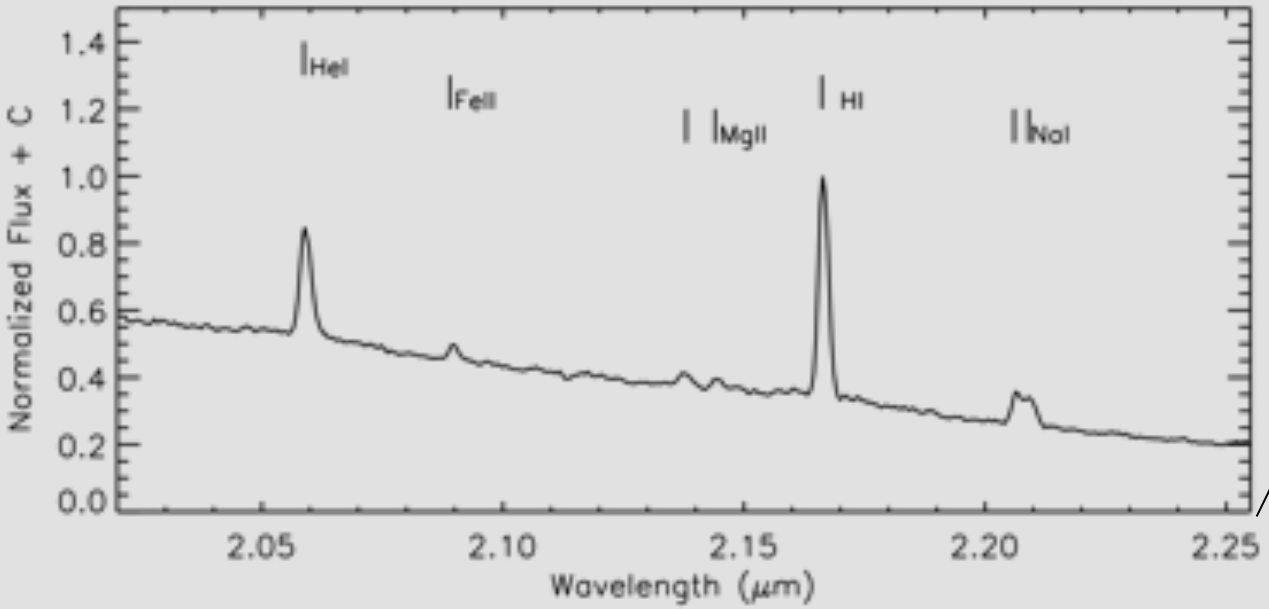
ESO-SINFONI

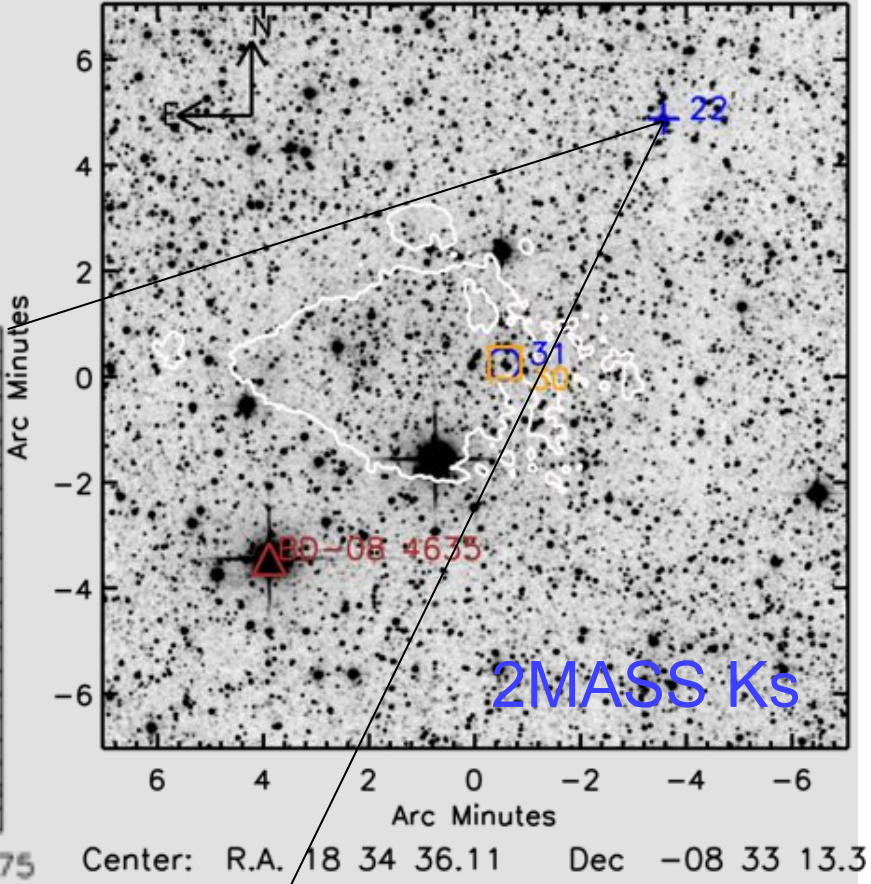


O4-6f+
Teff = 38500 K
K = 9.9 mag
Aks = 1.34 mag
Dist = 4.6 kpc
Mbol= -9.14 mag
logLum= 5.55 mag (28-36 Msun)

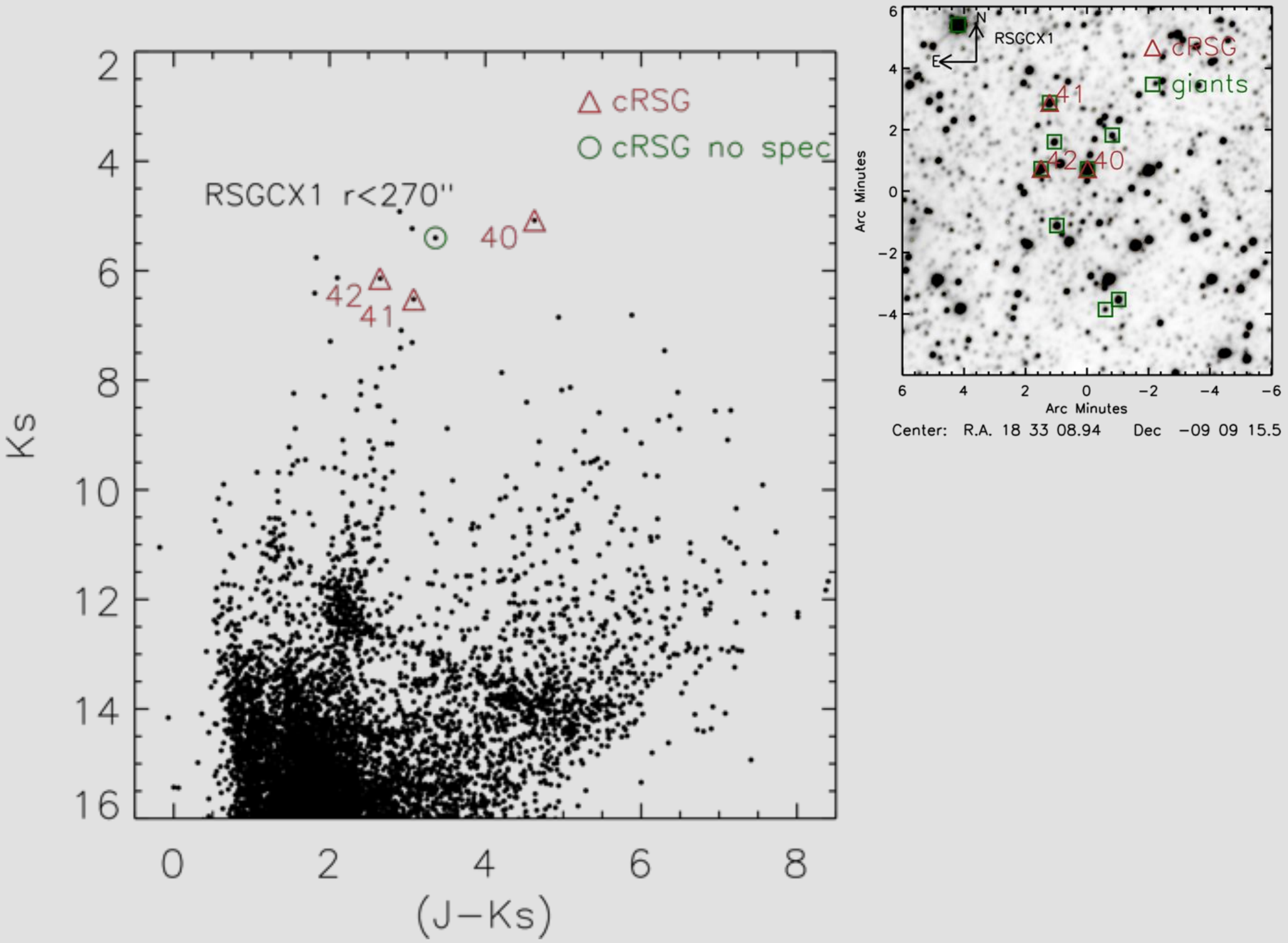
B supergiant, cLBV, ESO-SofI



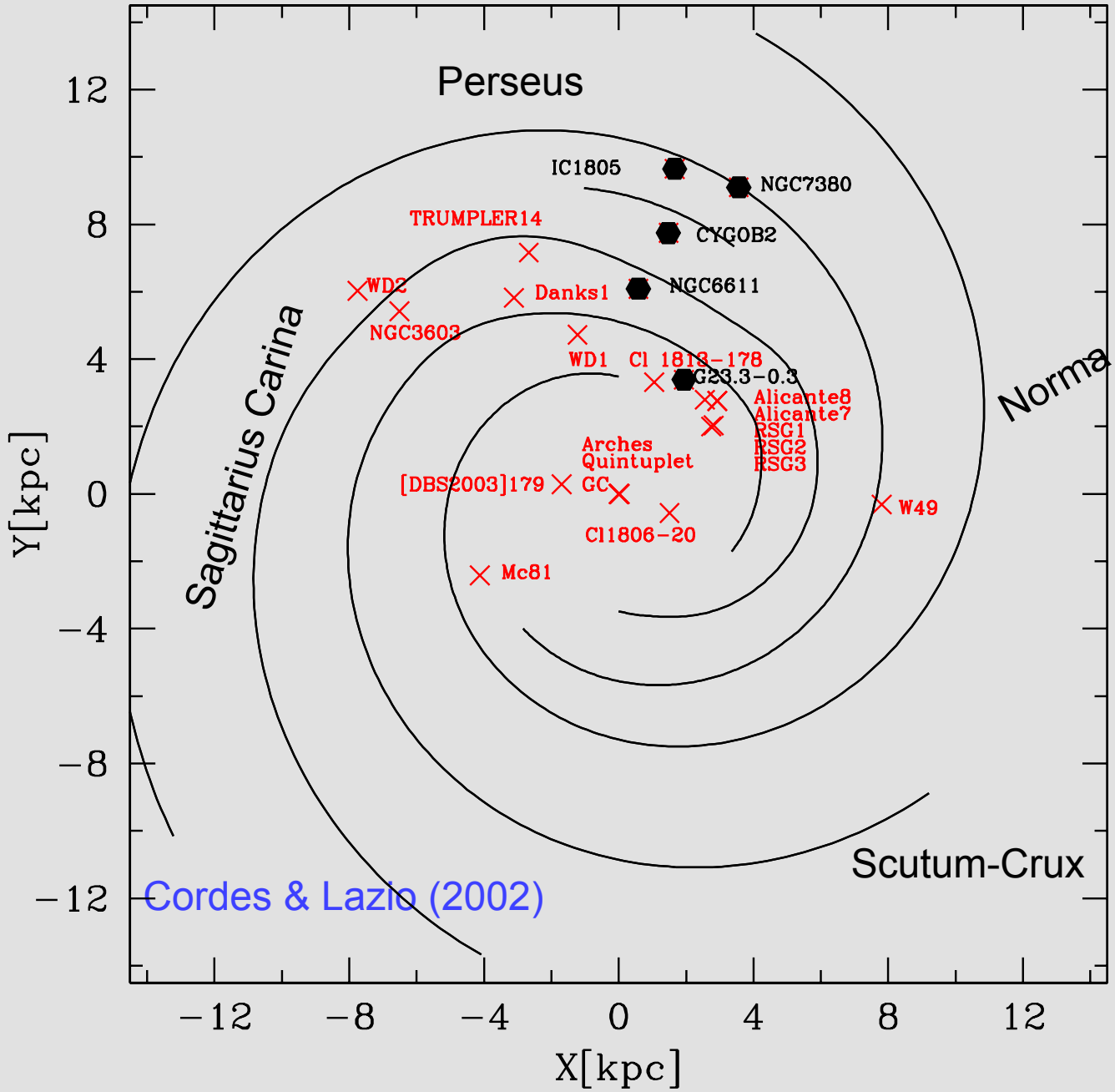




Teff = ~14000K
Ks = 7.63 mag
Aks = 1.13 mag
Dist= ~4.6 pm kpc
Mbol= -7.90 mag
Log L/Lsun= 5.06


cRSG
cRSG no spec
RSGCX1 r<270"
40
42
41
Ks
(J−Ks)
0
2
4
6
8
10
12
14
16
RSGCX1
N
E
cRSG
giants
41
42
40
Arc Minutes
Arc Minutes
Center: R.A. 18 33 08.94 Dec −09 09 15.5

Galactic location of the G23.3-0.3 complex



Summary

The combination of radio and infrared data
allowed us to detect their parental clouds, which appear rich in HII regions and SNRs.

With similar studies of other clusters and giant HII regions we will be able to shed light on the initial masses of the supernova progenitors, and therefore on the fate of massive stars.