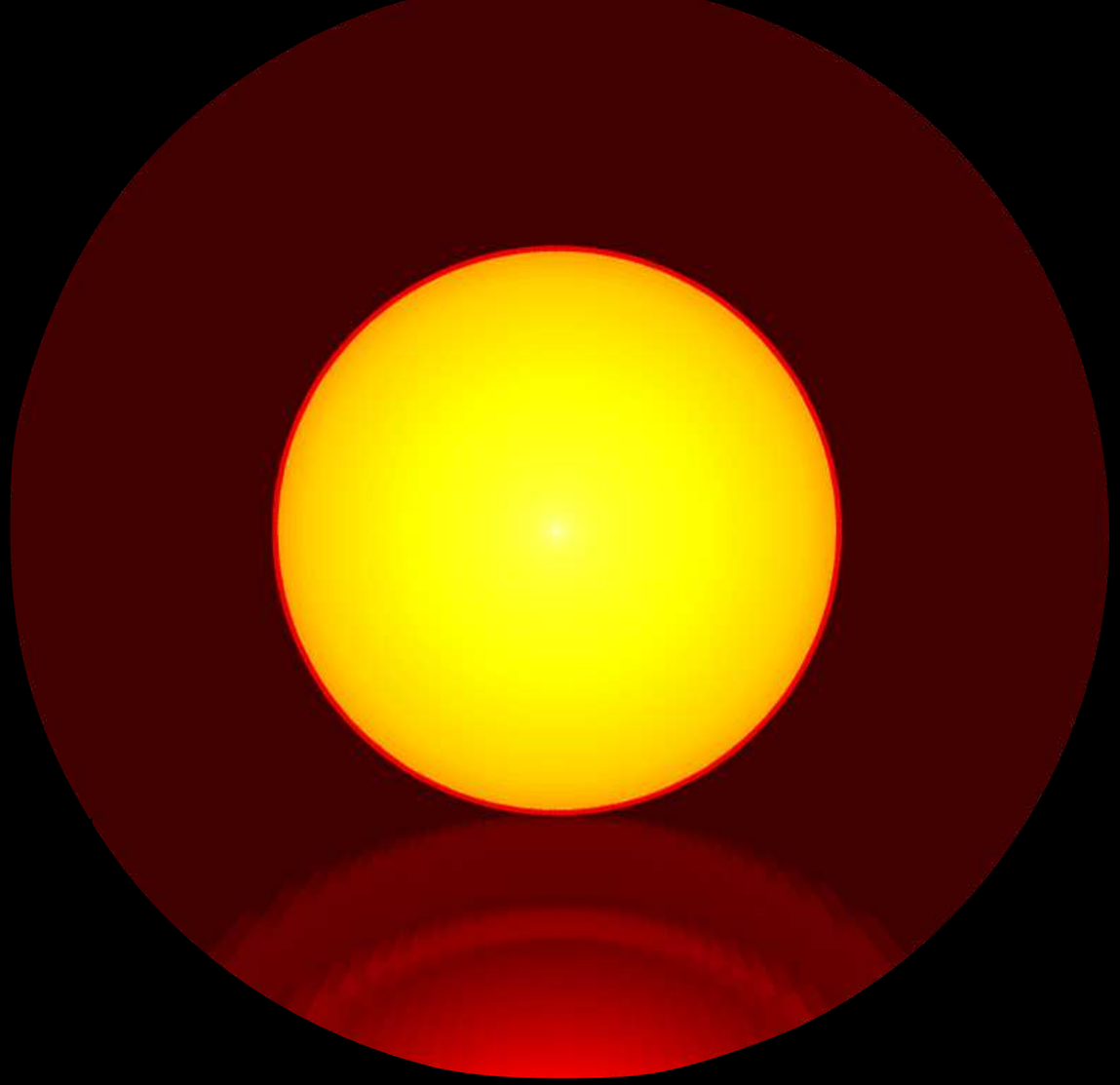
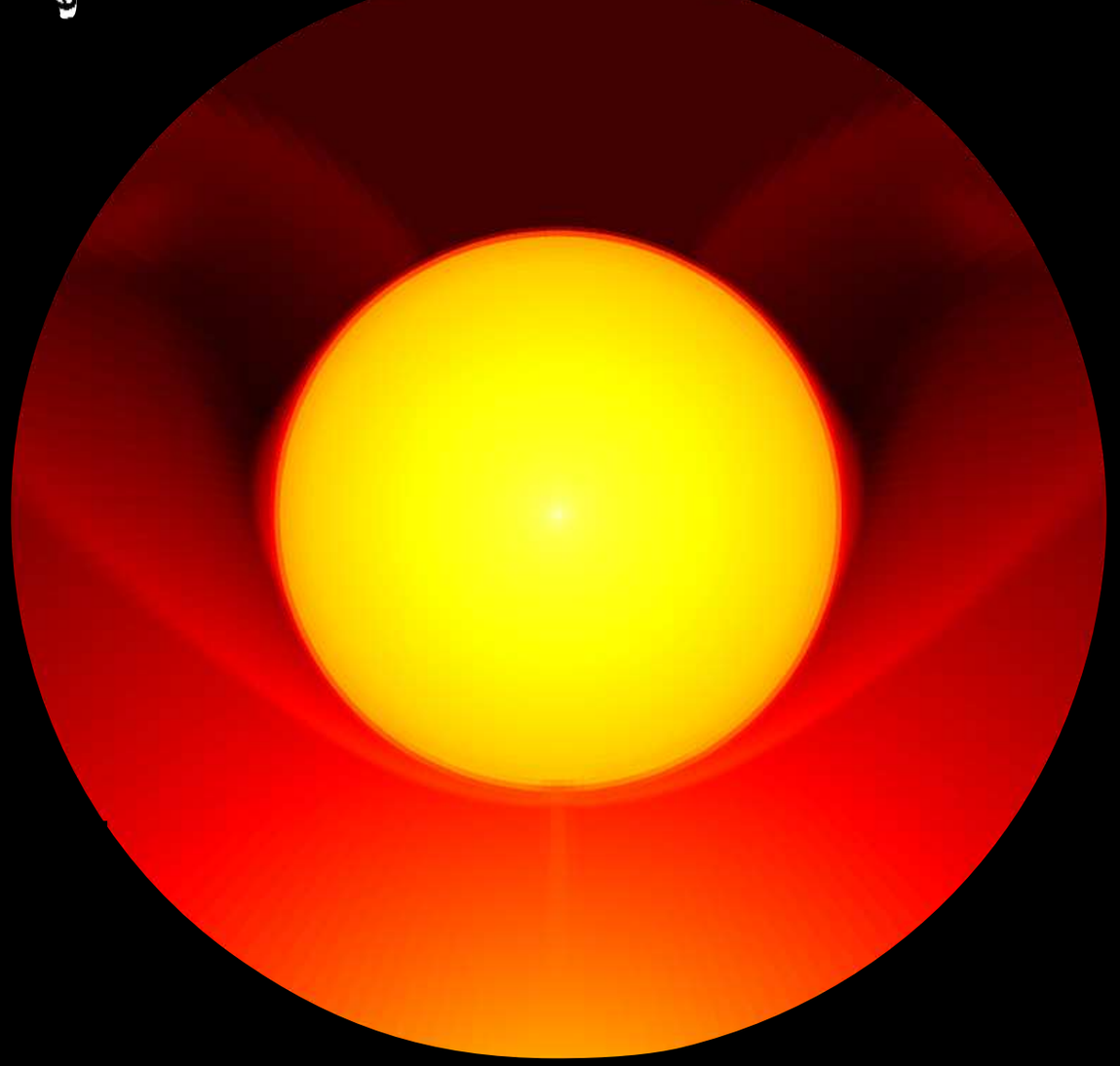
Impact Studies

http://goo.gl/snW5SL

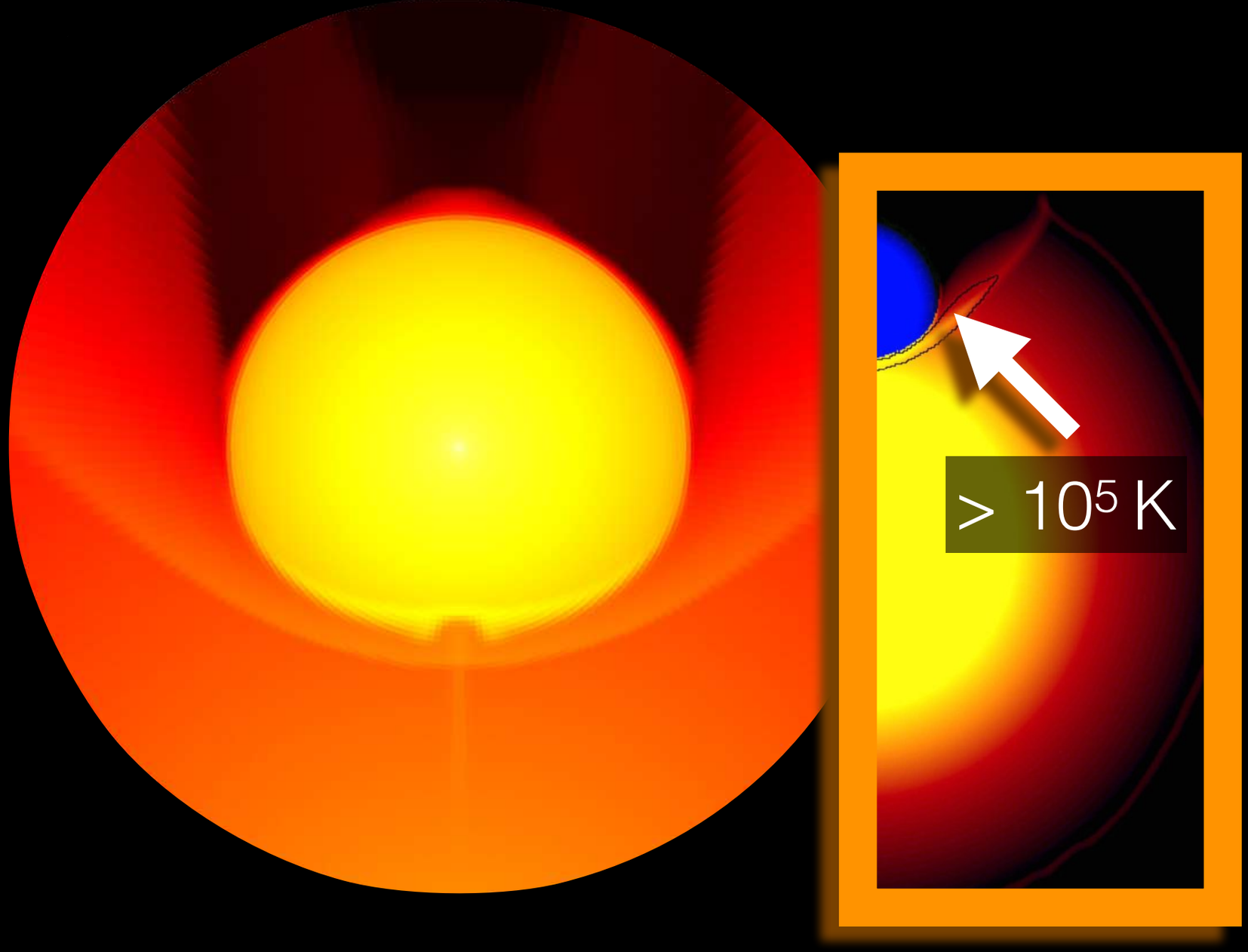


10 Msun Red Super Giant Companion

Hirai et al. 2014

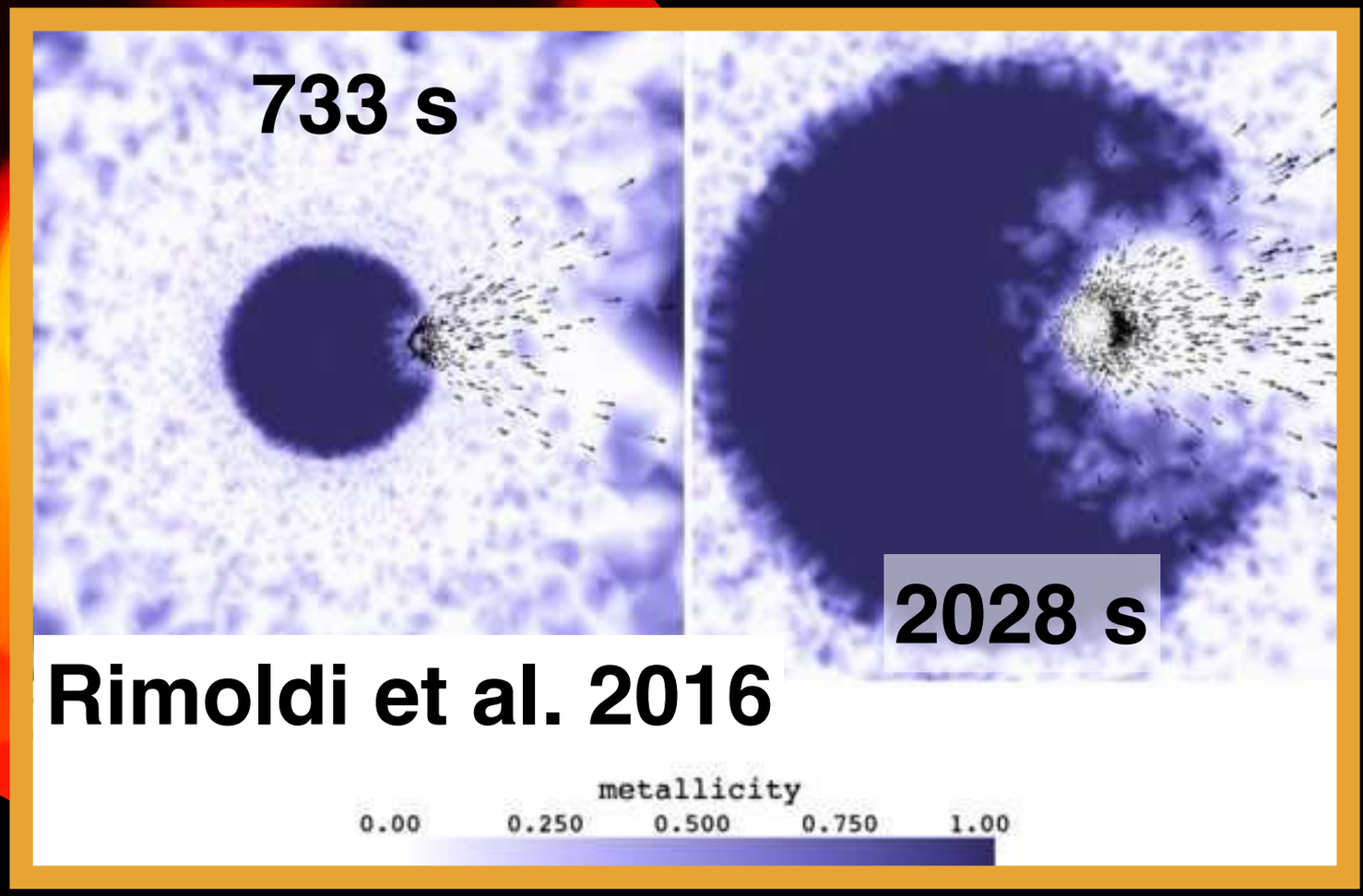


Hirai et al. 2014



Kasen et al. 2010

Hirai et al. 2014



Hirai et al. 2014

t = 100 y

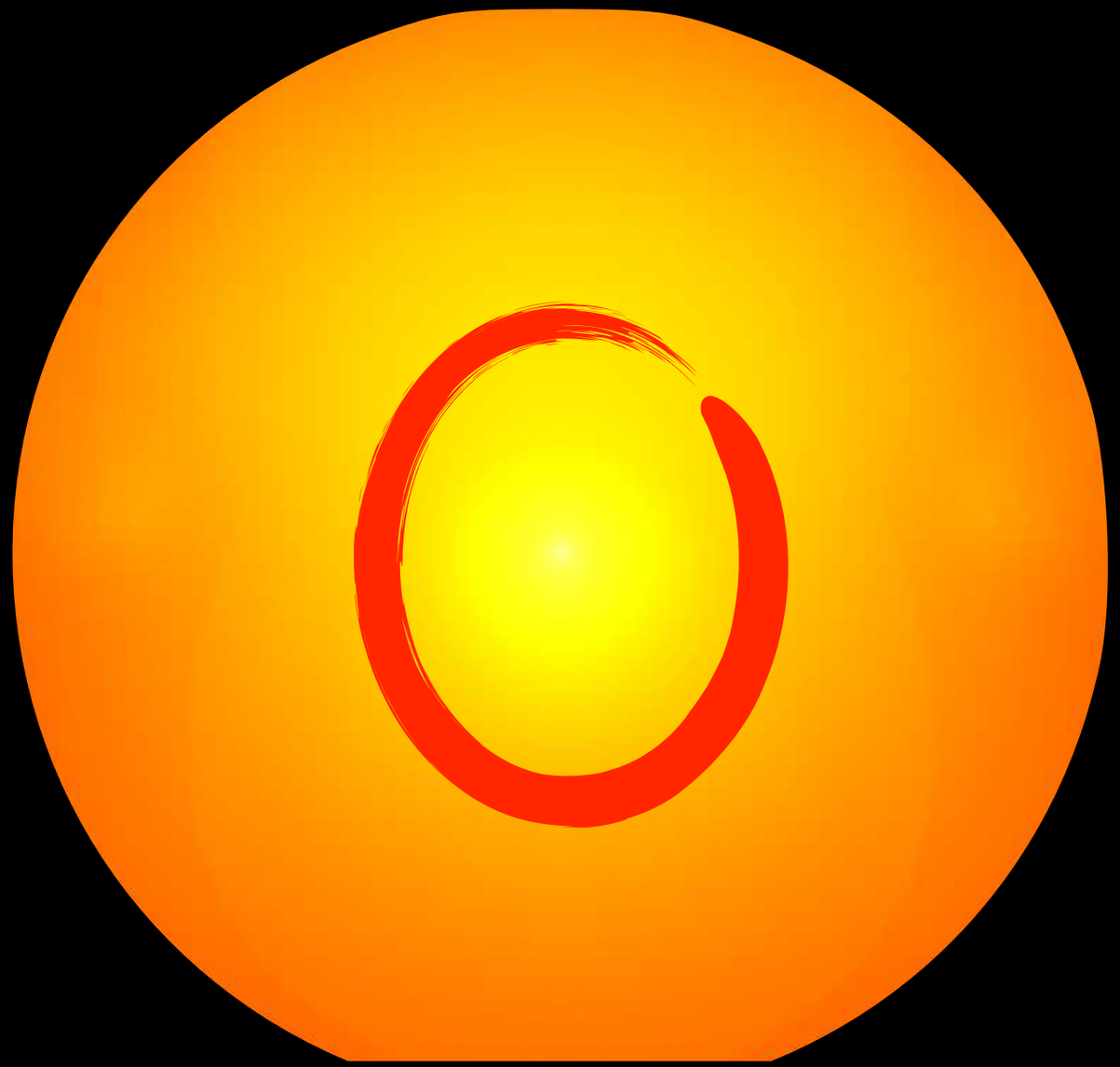
t = 215 y

t = 440 y

t = 1000 y

Garcia-Senz et al. 2012

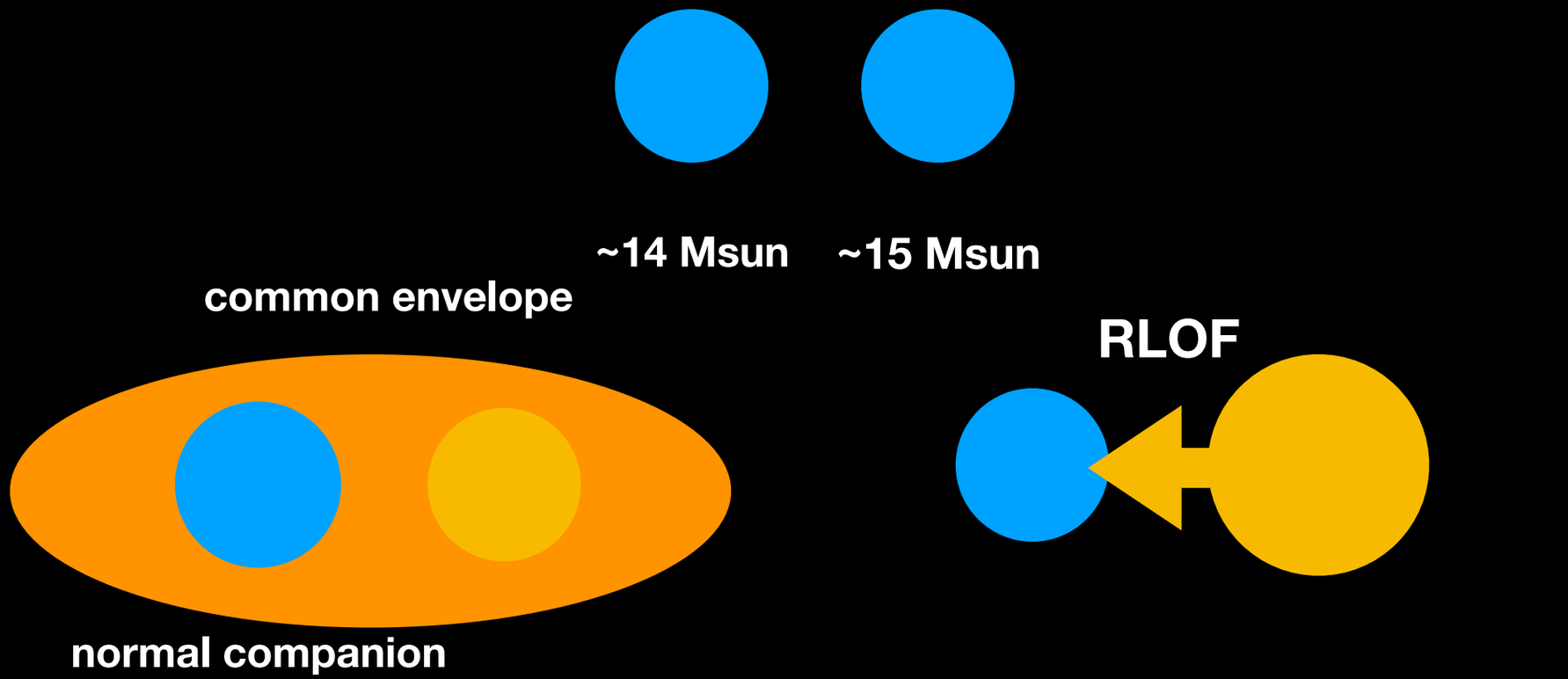
Hirai et al. 2014

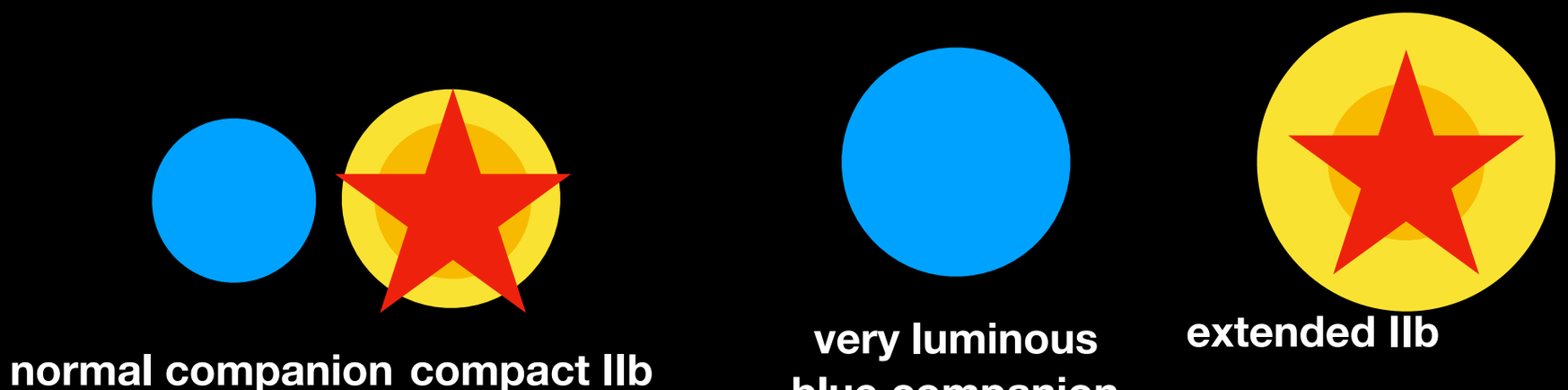


Hirai et al. 2014

The case for surviving SN IIb companions

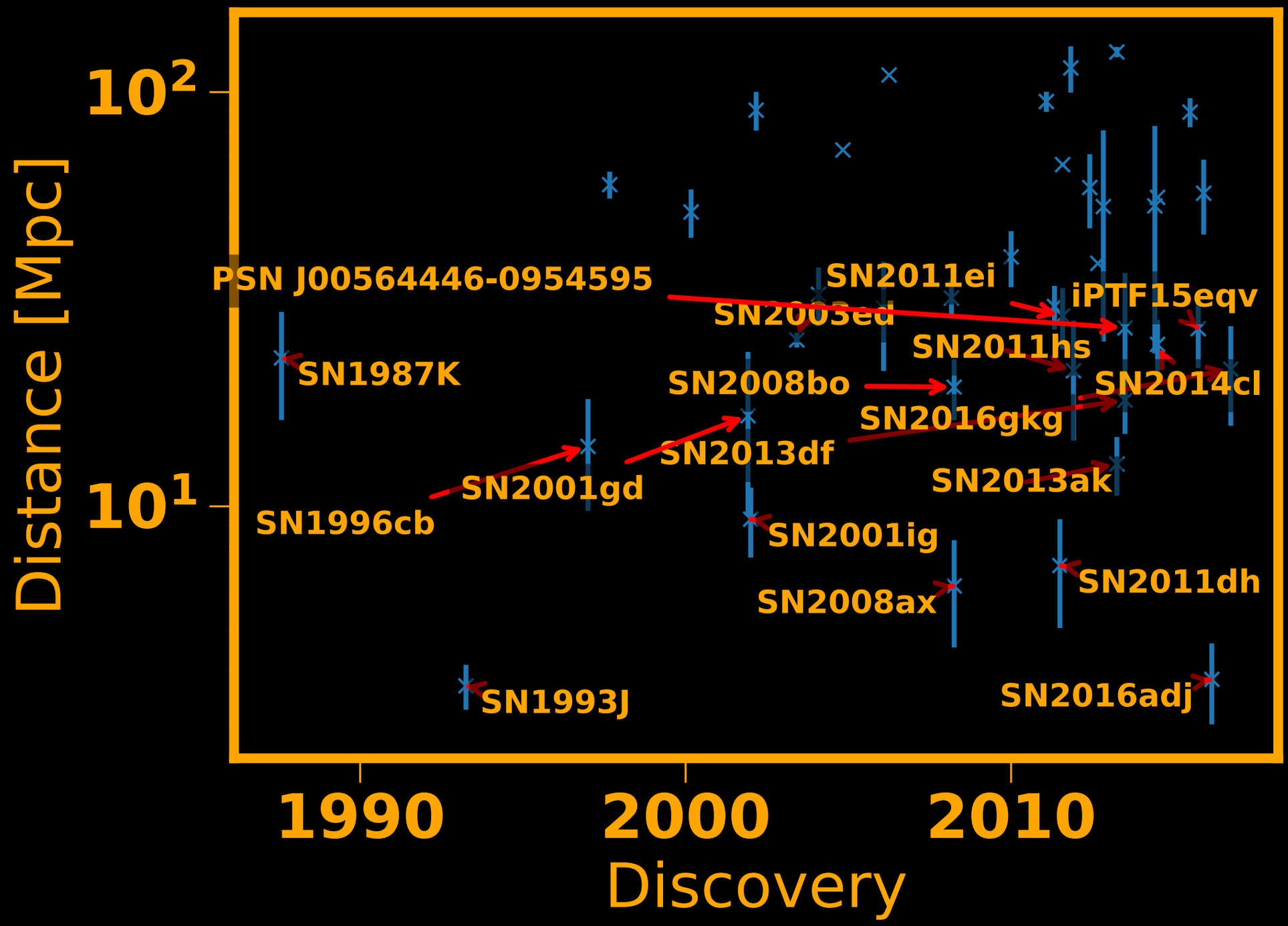
Type IIb from binary



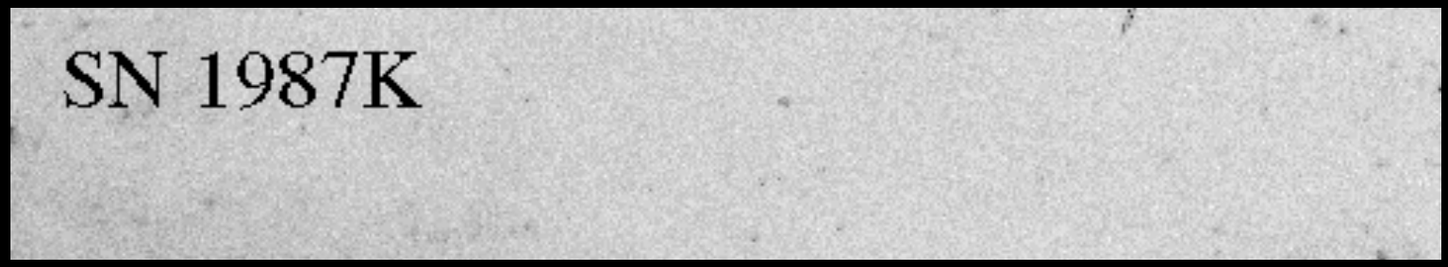


with Philipp Podsiadlowski

Meet the IIbs



SN1987K

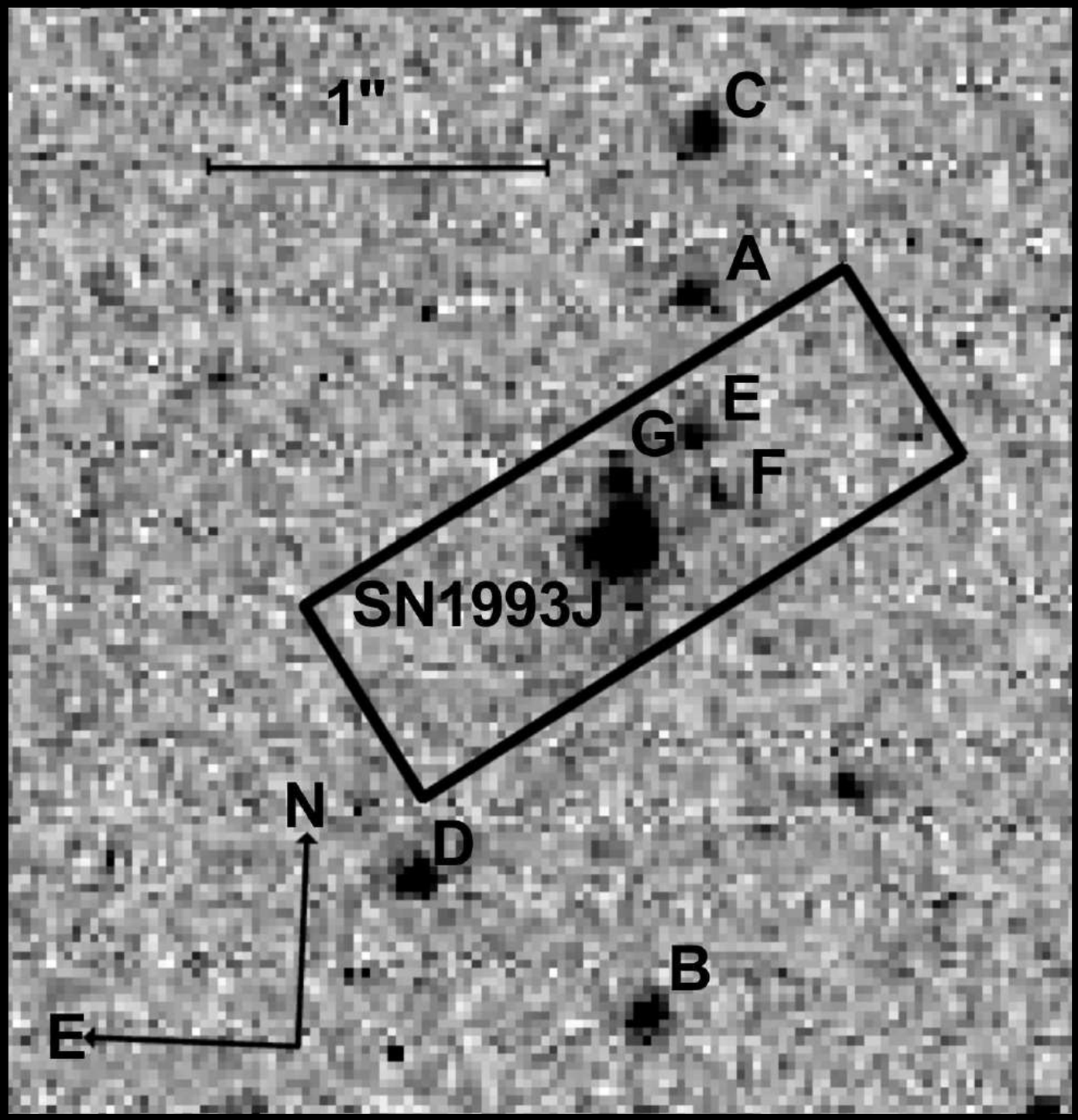


Van Dyk+ 1999

We used the finding chart for the SN IIb 1987K from Filippenko (1988) to aid in locating the SN environment on the images. We show the SN environment in the F555W image in Figure 5. Adopting an error of 2” in the SN position, we find that the SN occurred along a faint northern spiral arm in the galaxy. No individual stars or clusters are detected within the error circle in the F555W and F814W images. We measure a color F555W - F814W ~ 1.1 mag for the SN environment, but we note that the environment appears dusty in both bands.

van Dyk+ 1999

SN1993J



Maund+ 2004;
cf Fox+ 2014

The surviving Companion of Cassiopeia A

with Philipp Podsiadlowski, Selma de Mink, Tuan Do, Rob Fesen, Dan Milisavljevic, Ylva Götberg, Manos Zapartas

Wolfgang Kerzendorf
(ESO Fellow)
28th of July
Ringberg - Germany

The Good

- exploded ~1680
- maybe seen - but not reported
- at 3.4 kpc
- neutron star detected
- light echo consistent with IIb (see Krause, Rest)

WFC3 F098M

Center of Expansion

Thorstensen+ 2001

X-ray Point Source

Pavlov+ 2000

20″

20.0"

49'00.0"

40.0"

20.0"

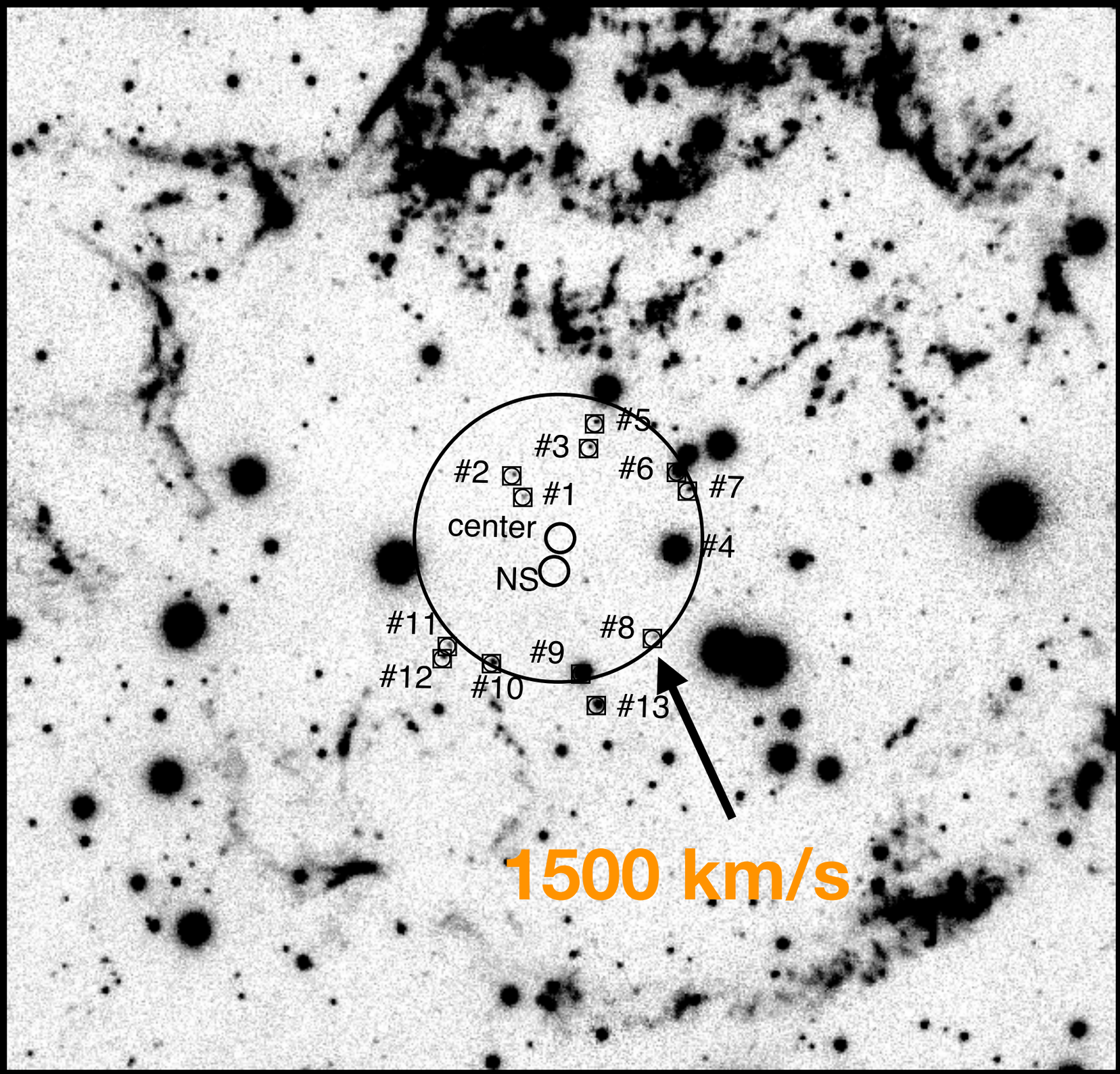
+58°48'00.0"

33.00s

30.00s

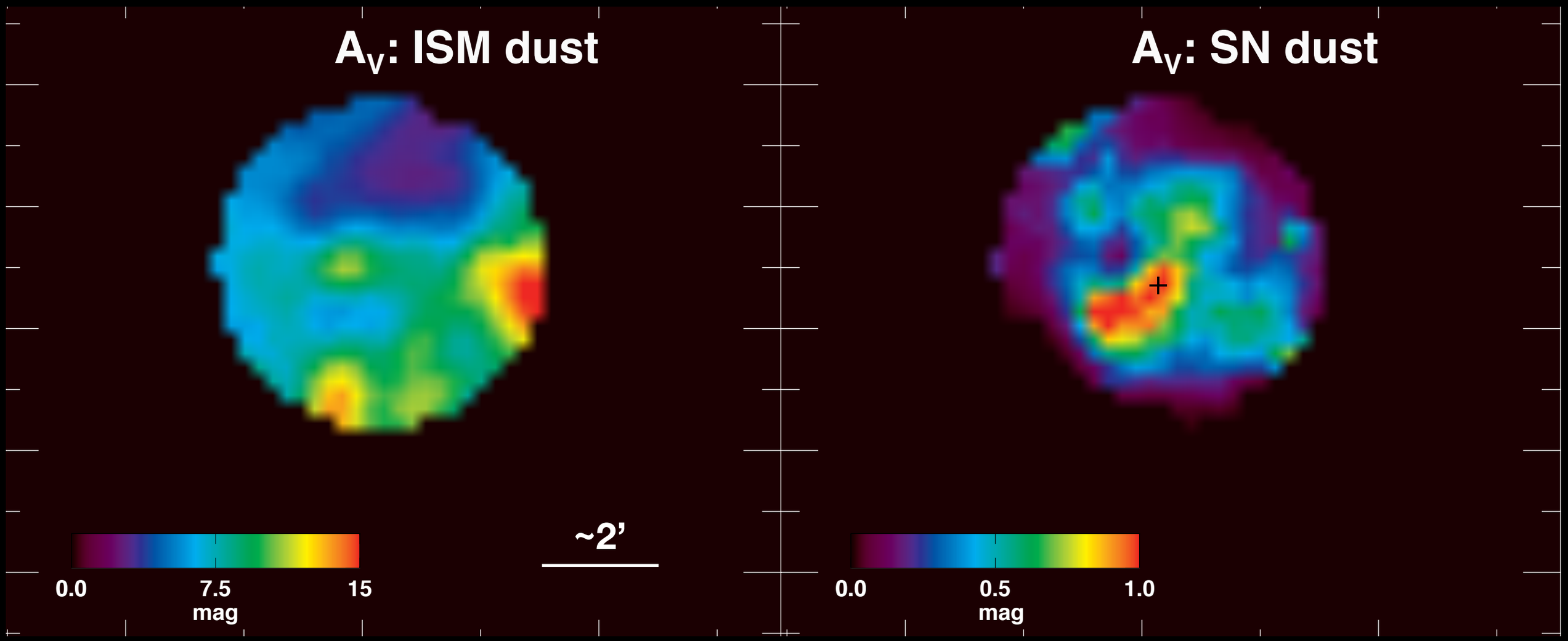
27.00s

23h23m24.00s



Kochanek 2017

The Bad

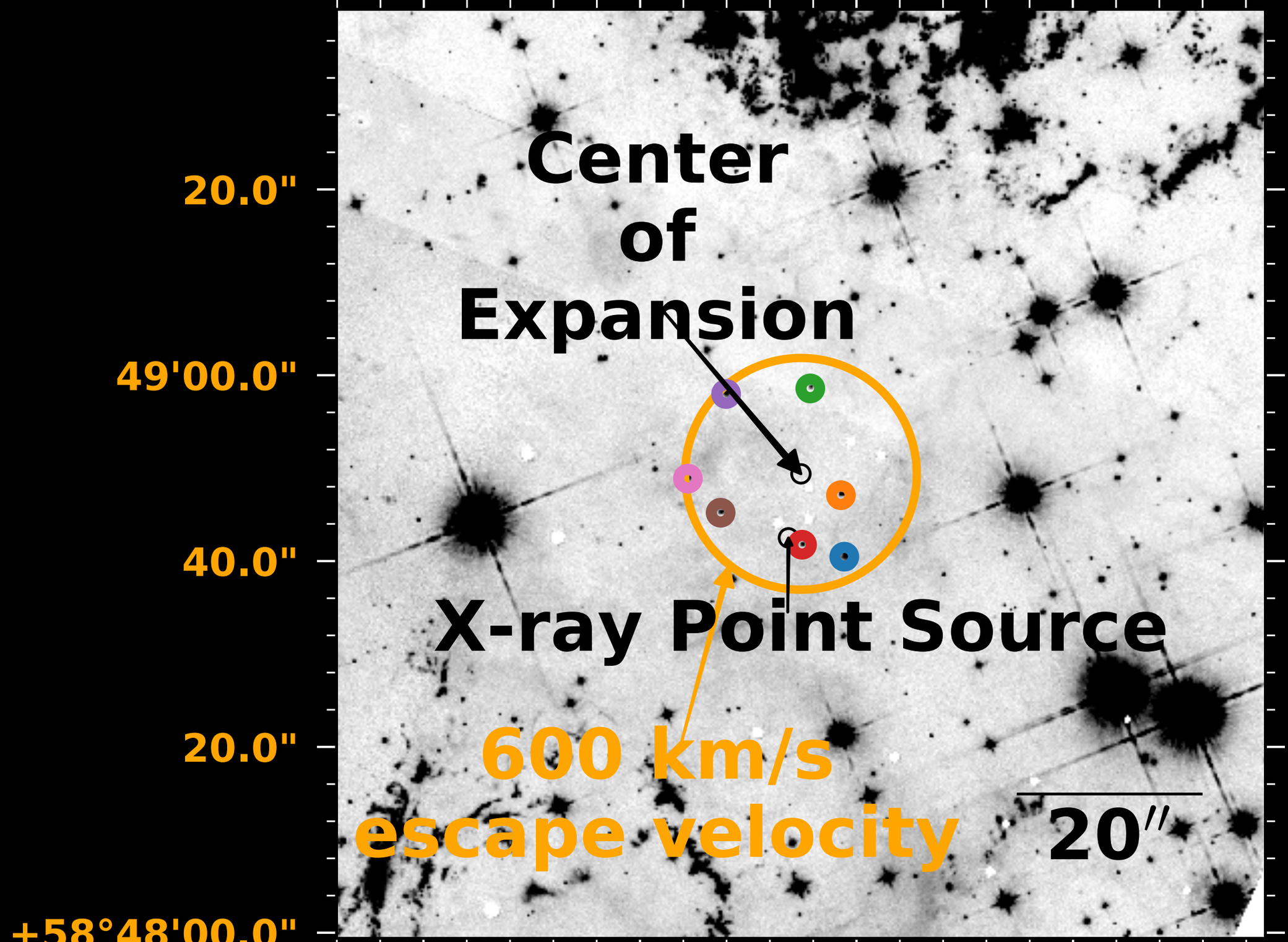


De Looze+ 2017

Revisiting the problem

Kerzendorf+ to be subm. 2017

WFC3 F098M



WFC3 F098M

Arrows indicating positions in 1680

20″

12.0"
49'00.0"
48.0"
36.0"
+58°48'24.0"
30.00s
28.00s
26.00s
23h23m24.00s

F450W

F675W

F098M

10^{-17}

10^{-18}

10^{-19}

Flux [erg $s^{-1}cm^{-2}Å^{-1}$]

F098M upper limit ↓

4000

6000

8000

10000

Wavelength [Å]

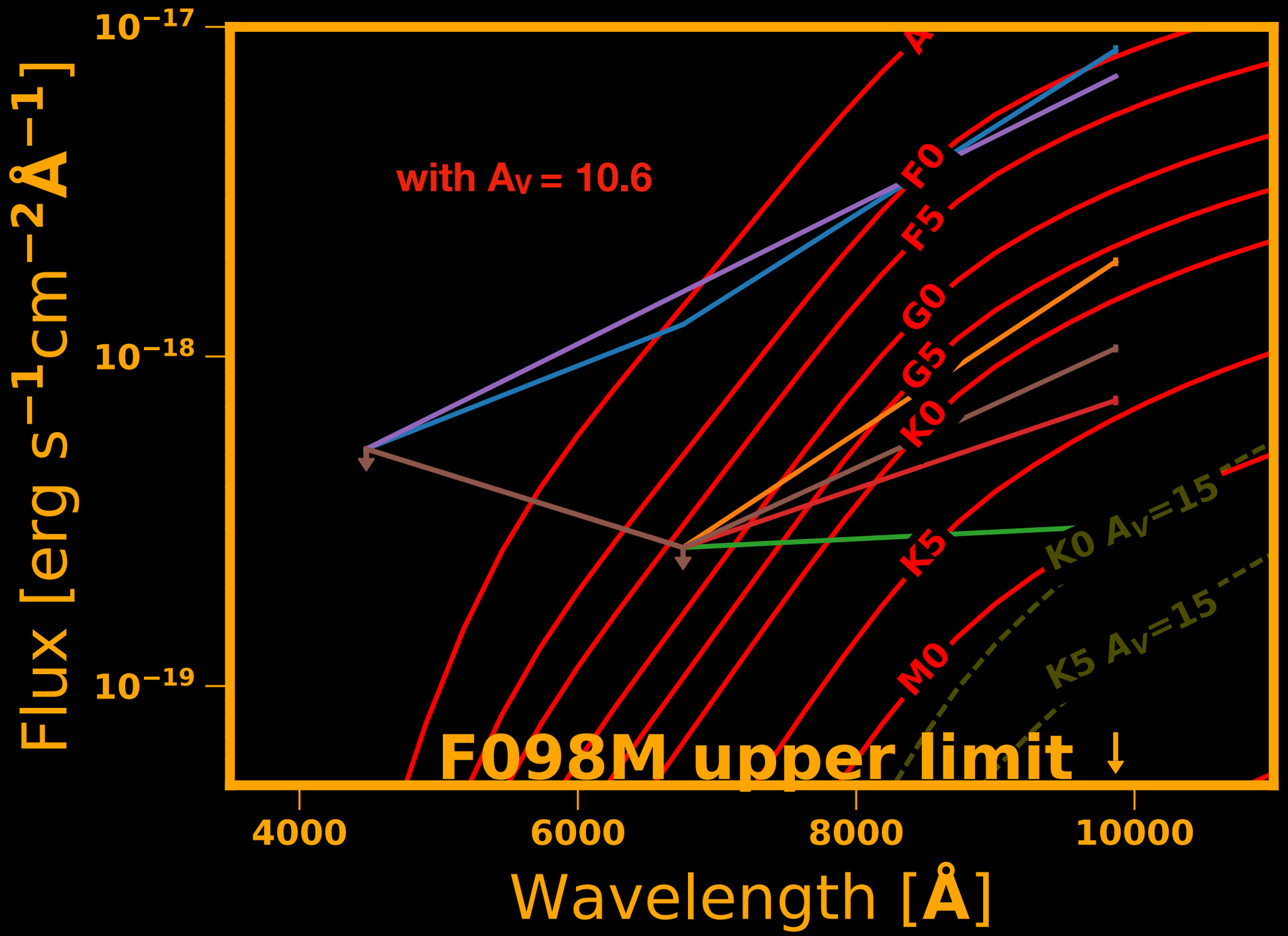
Companion?

“Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth”

– Sherlock Holmes (Arthur Conan Doyle)

12.0"
49'00.0"
48.0"
36.0"
+58°48'24.0"
Dec (J2000)
30.00s
28.00s
26.00s
23h23m24.00s
RA (J2000)
20″
12
11
10
9
8
7
Av (ISM + SNR)
De Looze+ 2017 dust map

Main Sequence Companion


Flux [erg s⁻¹cm⁻²Å⁻¹]
10⁻¹⁷
10⁻¹⁸
10⁻¹⁹
with Av = 10.6
A0
F0
F5
G0
G5
K0
K5
M0
K0 Av=15
K5 Av=15
F098M upper limit ↓
4000
6000
8000
10000
Wavelength [Å]

Stripped star companion

Ylva Götberg models

7.4 M⊙

4.9 M⊙

3.3 M⊙

2.2 M⊙

7.4 M⊙ $A_V = 15$

4.9 M⊙ $A_V = 15$

3.3 M⊙ $A_V = 15$

2.2 M⊙ $A_V = 15$

F098M upper limit

10^{-17}

10^{-18}

10^{-19}

Flux [erg s^{-1}cm^{-2}Å^{-1}]

4000

6000

8000

10000

Wavelength [Å]

White Dwarf companion

--- White Dwarf 1.2 $M_\odot$ at 10^5 years (Tremblay et al. 2011)

F098M upper limit ↓

Av = 10.6

Av = 15.0

Flux [erg $s^{-1}cm^{-2}Å^{-1}$]

10^{-17}

10^{-18}

10^{-19}

10^{-20}

10^{-21}

4000

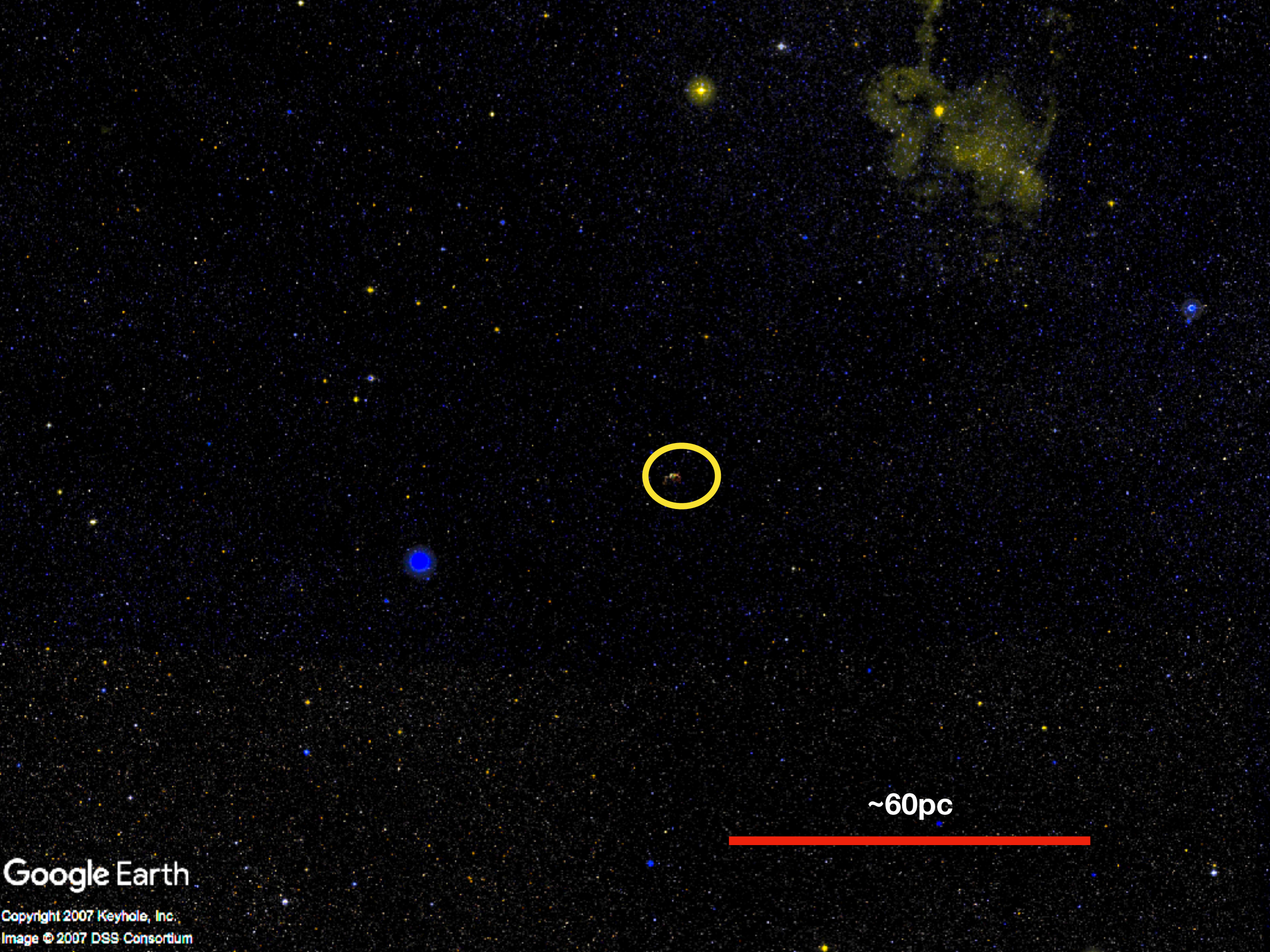
6000

8000

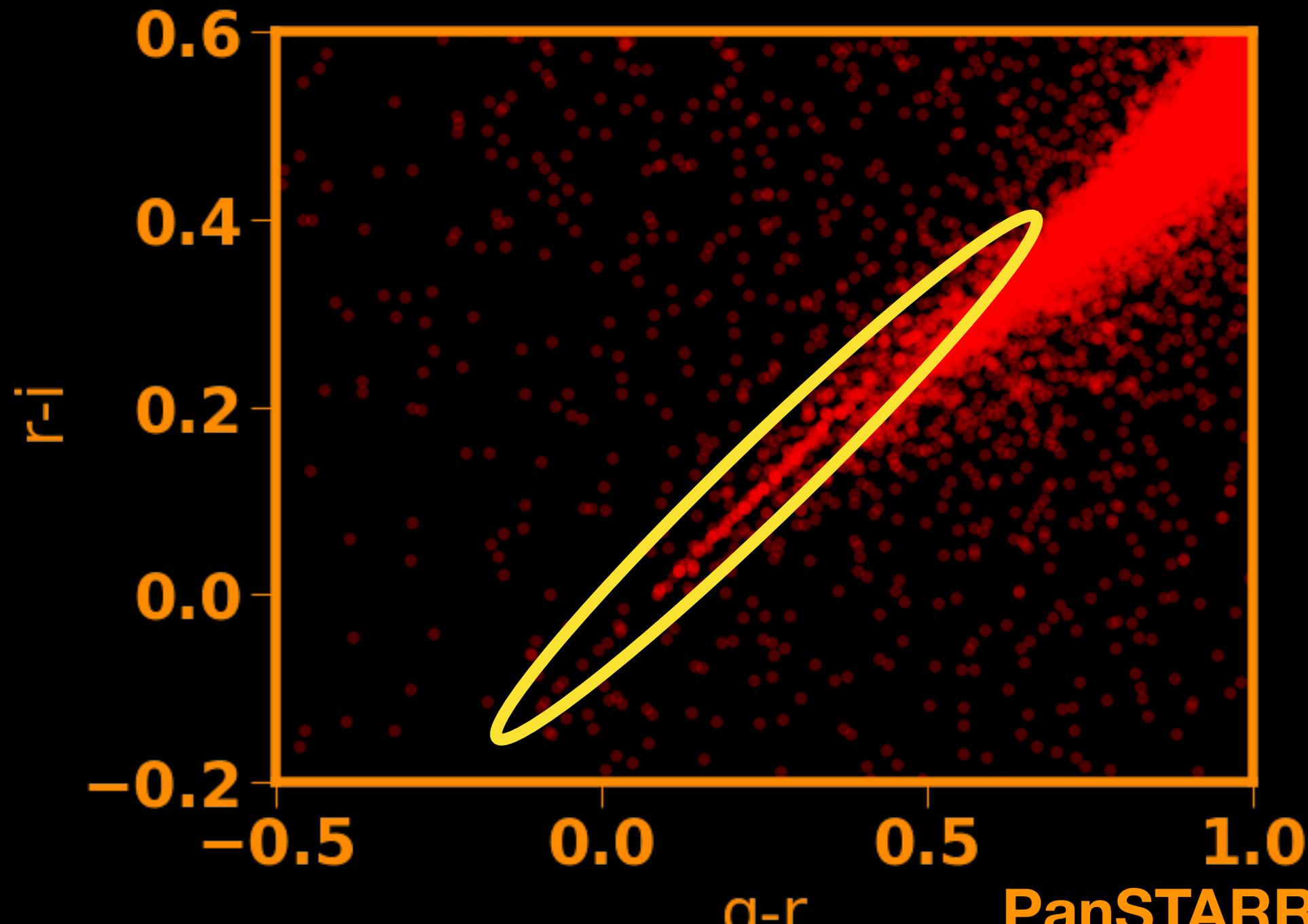
10000

Wavelength [Å]

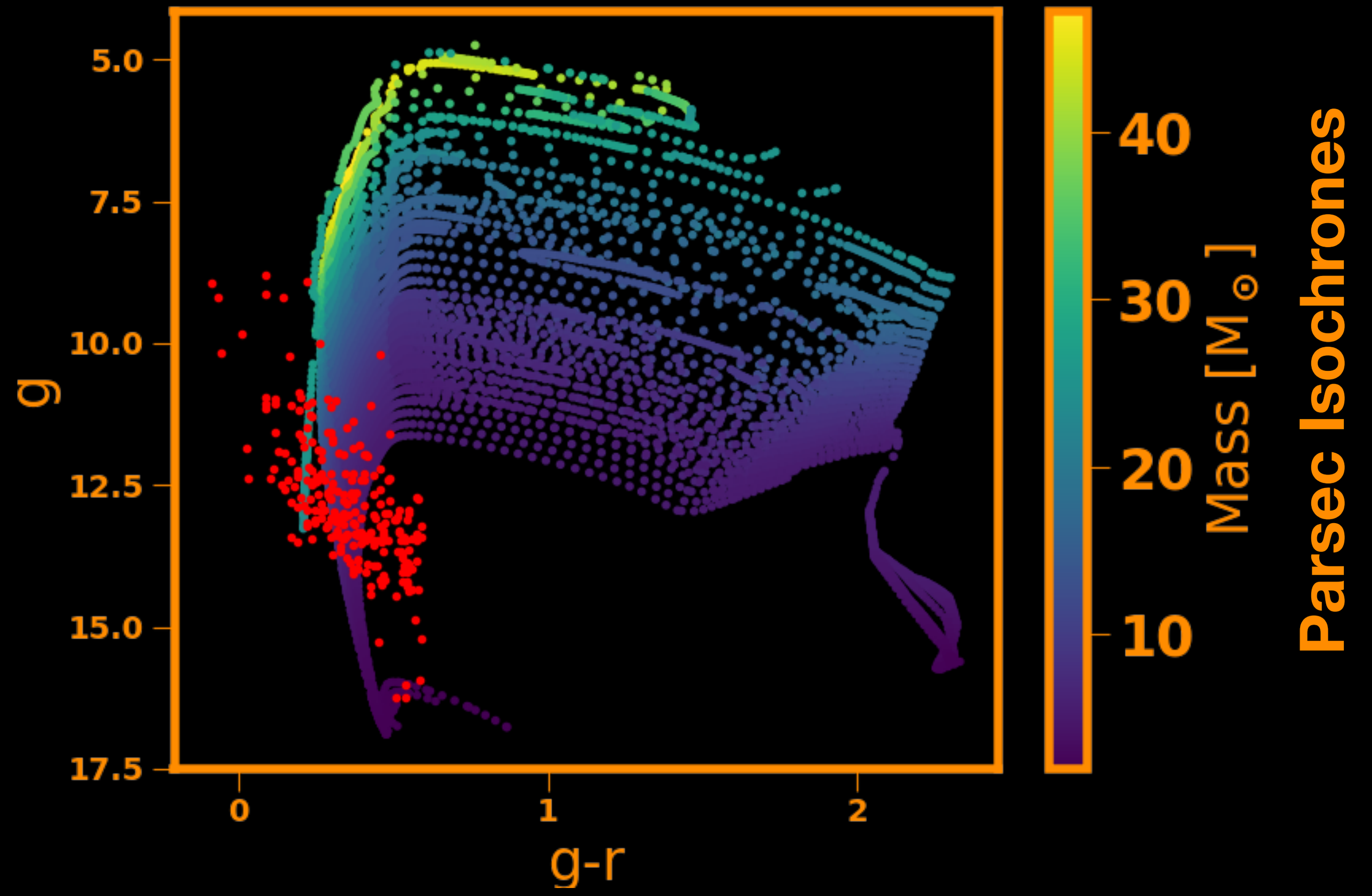
Single Star


~60pc
Google Earth
Copyright 2007 Keyhole, Inc.
Image © 2007 DSS Consortium

Siblings of Cas A



Assuming E(B-V)=0.8 and 3.4 kpc



Summary

The Impossible and the Probable

	AV=10.6	AV=15
Main Sequence	below M0	below K5
Stripped Stars	< initial mass of 2 Msun	
White Dwarfs	allowed	
Single Star	Stars with >30 Msun available or merger	
NS, BH	allowed	

Thank you