Stellar Clusters Containing Massive Stars: A Nine Bands Photometric Survey

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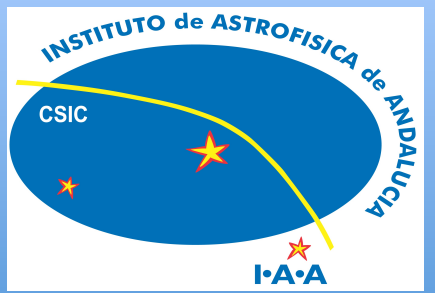
Stellar Systems Group



Gaia: III Reunión Científica de la REG

Sitges 23 – 25 Enero 2013

The talk

- Project Objectives
- Clusters under study and summary
- Preliminar results of NGC1893 and IC1805:
  - Observed area in optical and infrared
  - CMDs
  - Physical parameters

Project Objectives

- 3 Models for the formation of massive stars:
  - Partition of the cloud in one massive star
  - The competitive acretion model of the star formation
  - The core accretion model of low stars

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- Most massive stars in the clusters (properties ➔ GOSSS)
- Photometric survey in 9 bands (*UBVRIHa* + *JHKs*) of stellar clusters

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- Most massive stars in the clusters (properties ➔ GOSSS)
- Photometric survey in 9 bands (*UBVRIHa* + *JHKs*) of stellar clusters
- Characterization of stellar population coeval to the massive stars:
  - Obtain the physical parameters
  - Infrared excess for the study of circumstelar disks and extinction law
  - Stellar population MS + PMS (cluster + field)
  - Calculate the ratio of populations of differents masses and evolution stages
  - Determine the MF for both populations
  - Study the spatial distribution

Clusters under study

- Current database mainly southern clusters, extension to northern hemisp.
- Optical telescopes: OSN (CCD) & INT (WFC)
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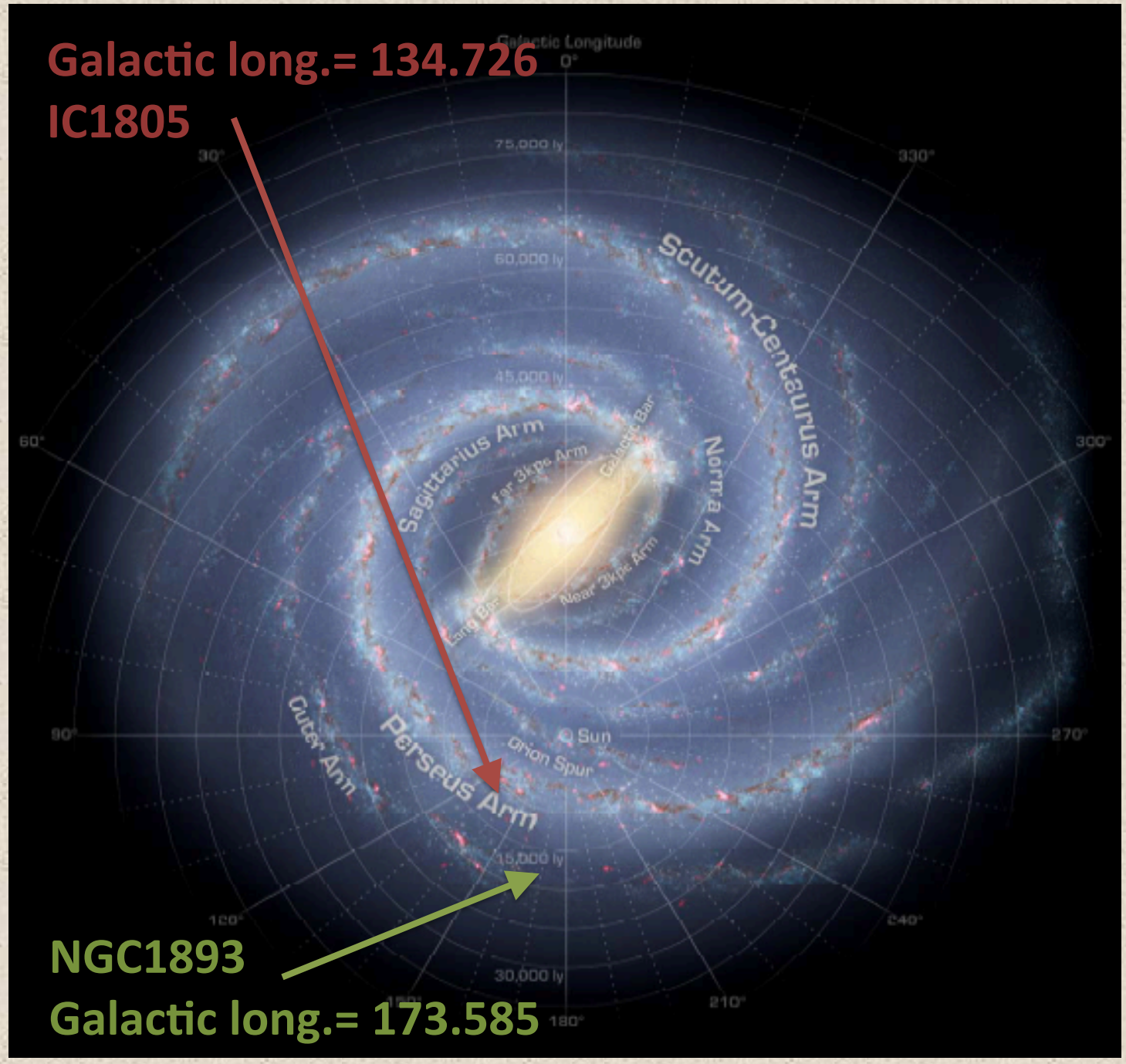
- Isolated clusters:
  - **Dolidze8 – Alicante1 – Collinder419**
- Inside star forming region:
  - **NGC1893 – IC1805 – IC1848 – NGC2244 – NGC6823**

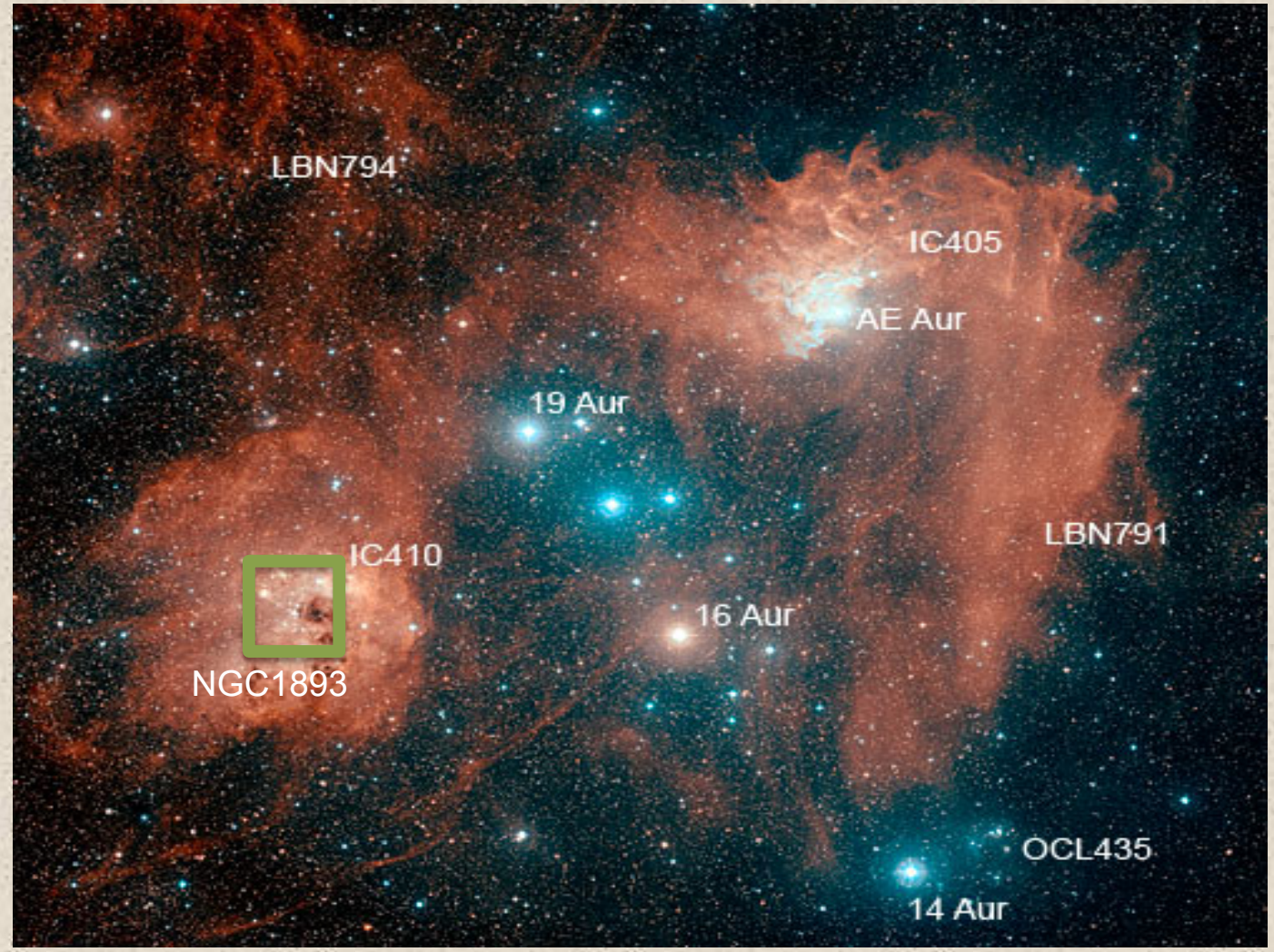
Clusters Summary

CLUSTER (name)	RA (^{h} ^{m} ^{s})	DEC (º ’ ”)	OSN/NOT (fn/fn)	MAG (*V*/*J*)	AREA (arcmin^2)
IC1805	02:32:47	+61:29:29	3/4	20.5/21	176/55
NGC1893	05:22:42	+33:25:00	3/3	21.5/21	148/44
Alicante1	03:59:10	+57:14:00	1/1	20/?	64/16
Dolidze8	20:24:21	+42:15:54	1/4	20/?	64/56
IC1848	02:49:20	+60:34:30	3/-	20.5/-	176/-
Collinder419	20:17:48	+40:41:30	9/-	21/-	324/-
NGC6823	19:43:09	+23:18:00	4/-	21/-	196/-
NGC2244	06:31:54	+04:56:00	1/-	20/-	64/-

NGC2244 also observed with INT/WFC in December 2012

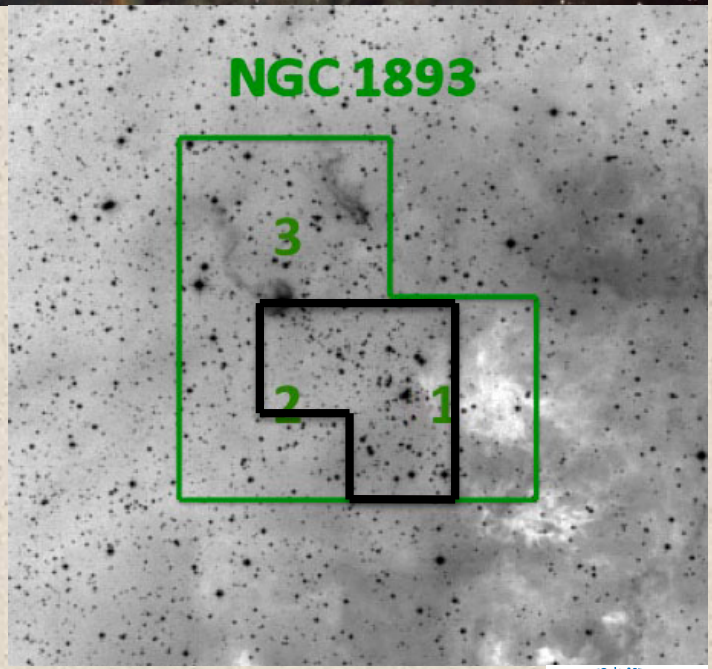

Galactic long.= 134.726
IC1805
Galactic Longitude
0°
30°
330°
60°
300°
90°
270°
120°
240°
150°
210°
180°
75,000 ly
60,000 ly
45,000 ly
30,000 ly
15,000 ly
Scutum-Centaurus Arm
Sagittarius Arm
Norma Arm
Perseus Arm
Outer Arm
Far 3kpc Arm
Near 3kpc Arm
Galactic Bar
Long Bar
Sun
Orion Spur
NGC1893
Galactic long.= 173.585

NGC1893: the Tadpoles of Auriga



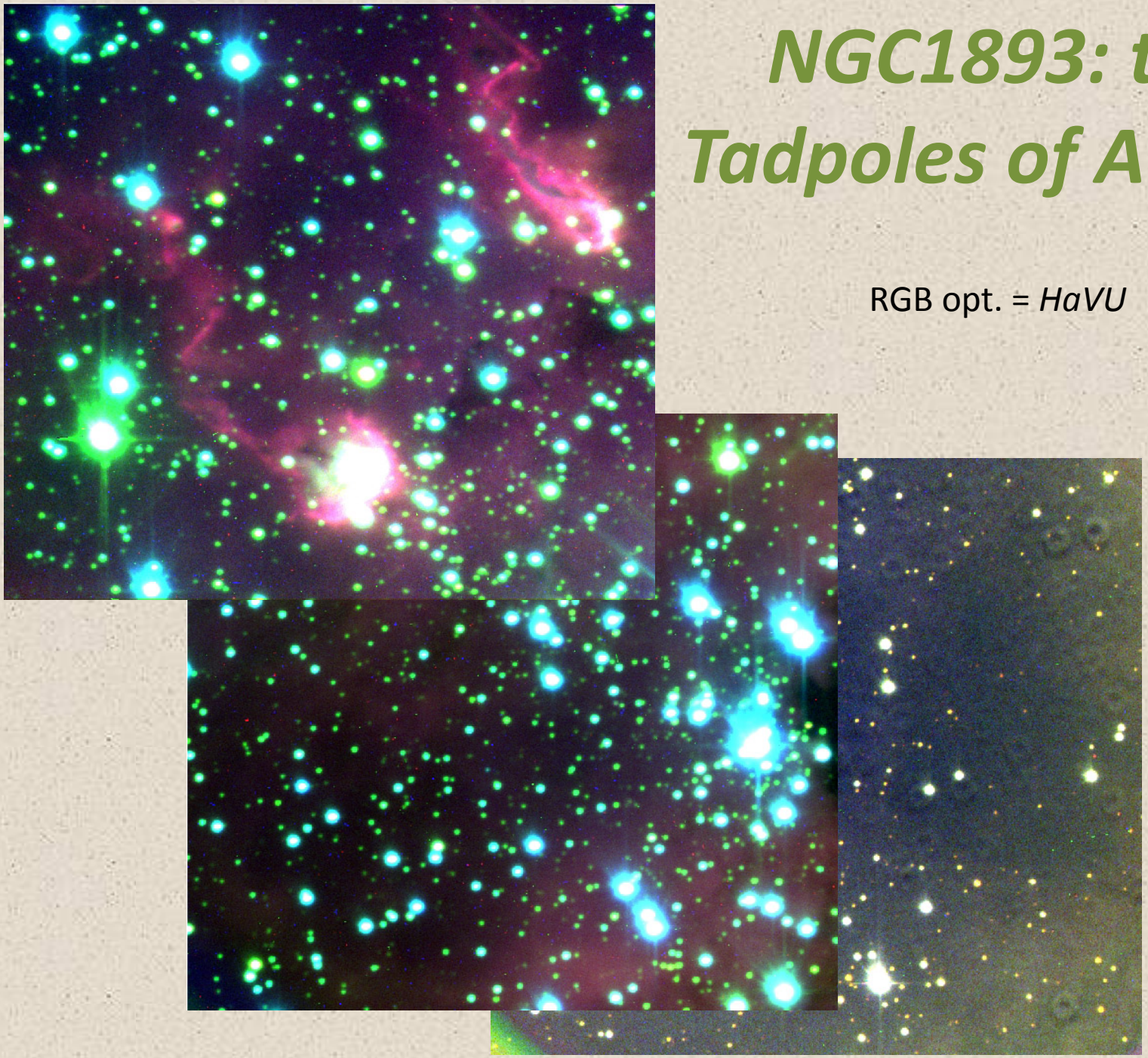
NGC1893: the Tadpoles of Auriga

- Constelation of Auriga (Cygnus Arm)
- RA = $05^h:22^m:42^s$; DEC = $+33^o:25':00"$
- IC410 emission nebula
- Distance of 4 – 6 kpc
- Age 1-5 Myr
- Optical study in *UBVRIHa* with 3 pointings with 1.5m Telescope at OSN – 12/2009 & 01/2011 & 02/2012 – *V*=21.5 – 1200 stars
- Infrared study in *JHKs* with 3 pointings with NOT Telescope at ORM – 09/2012 – *J*=21 – *Ks*=19.5 – 2360 stars
- Tadpoles – cold remains of the cloud – continuous formation regions



NGC1893: the Tadpoles of Auriga

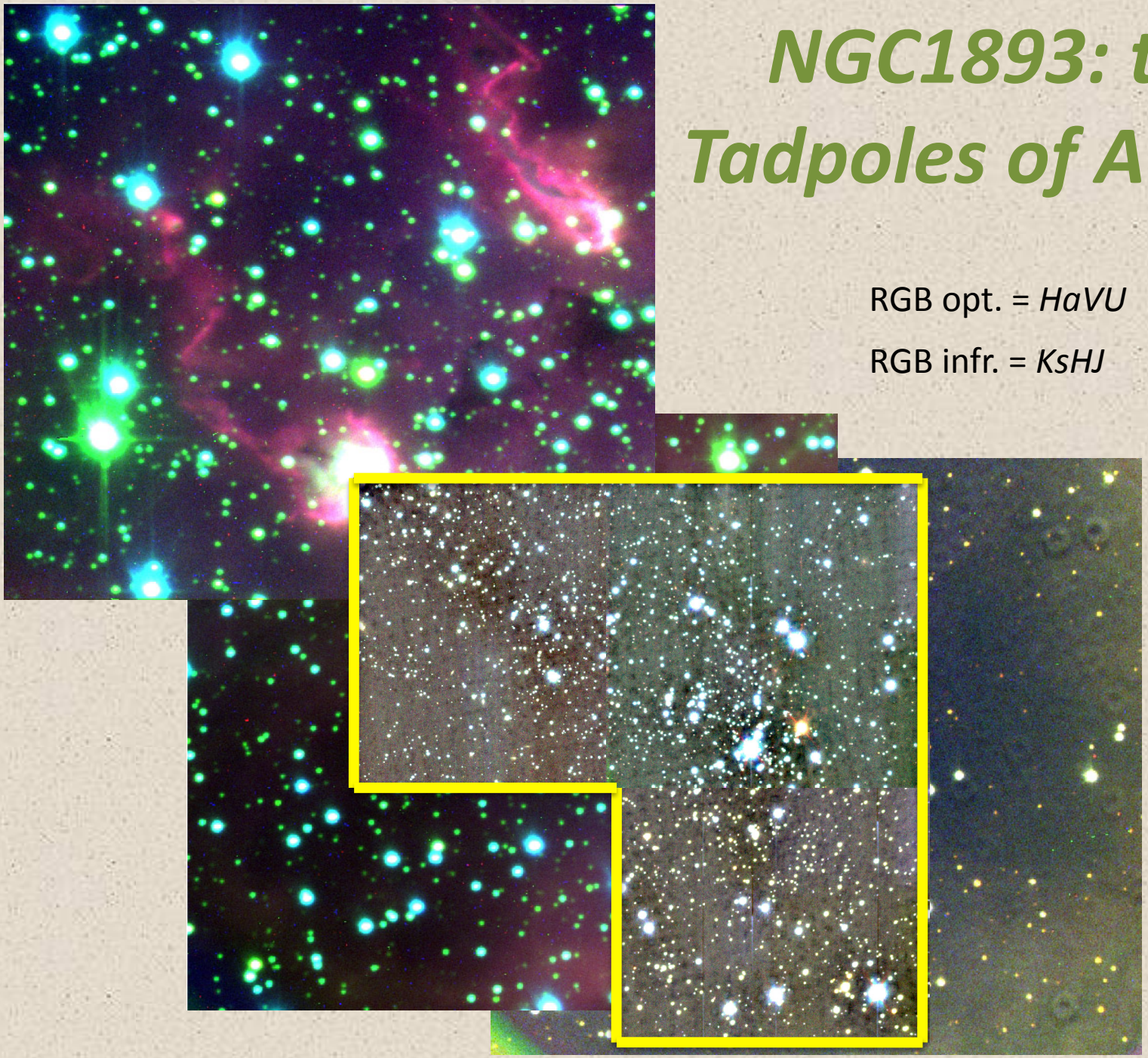
RGB opt. = *HaVU*



NGC1893: the Tadpoles of Auriga

RGB opt. = *HaVU*

RGB infr. = *KsHJ*



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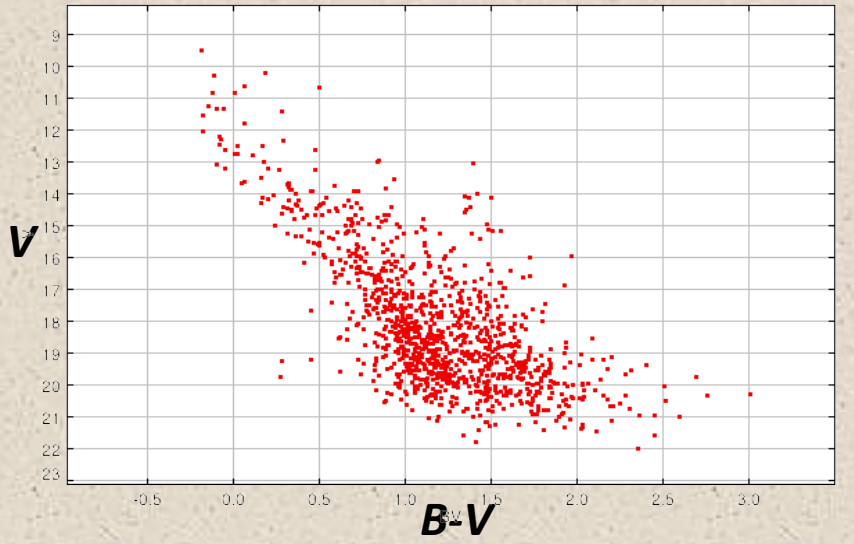
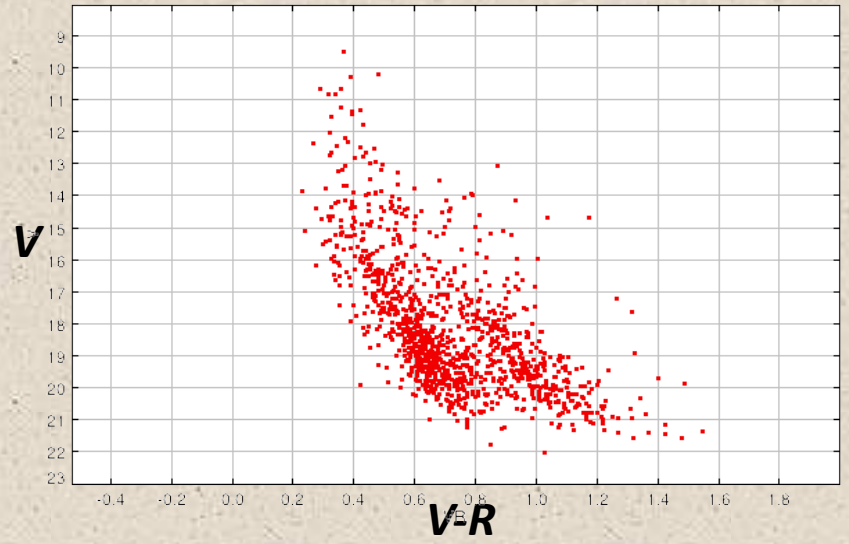
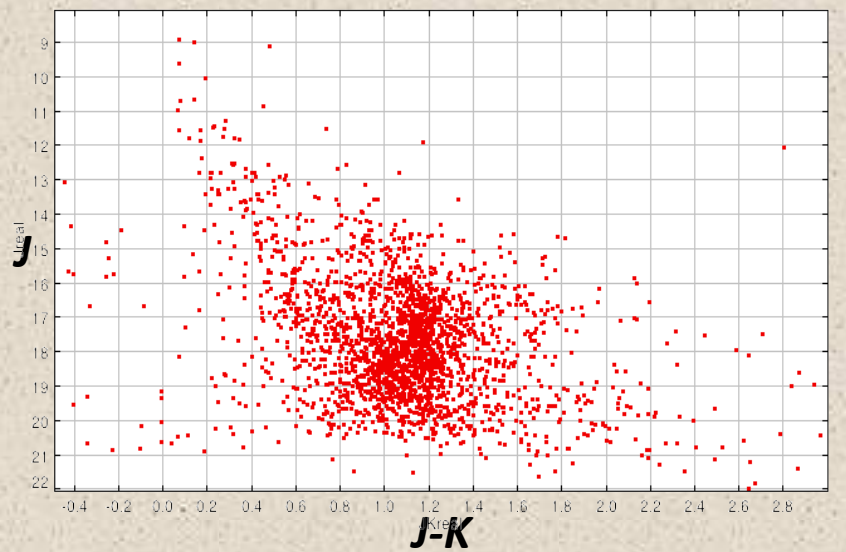
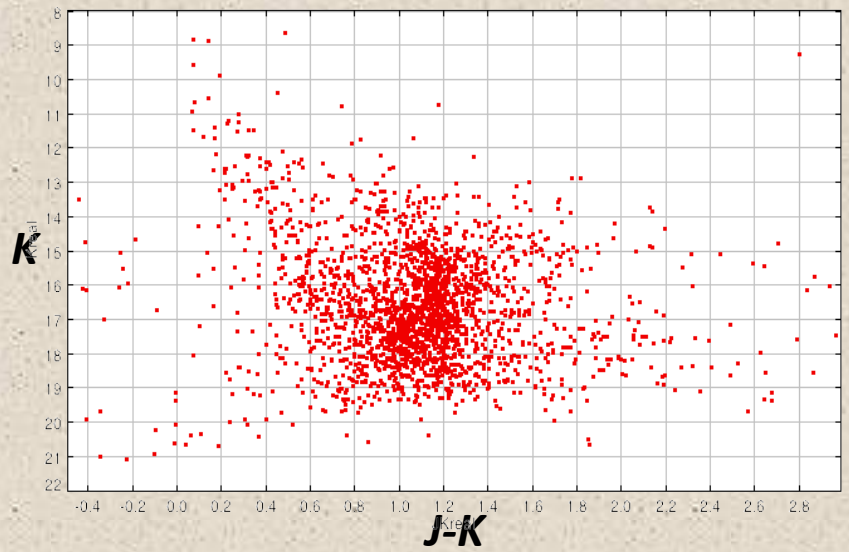






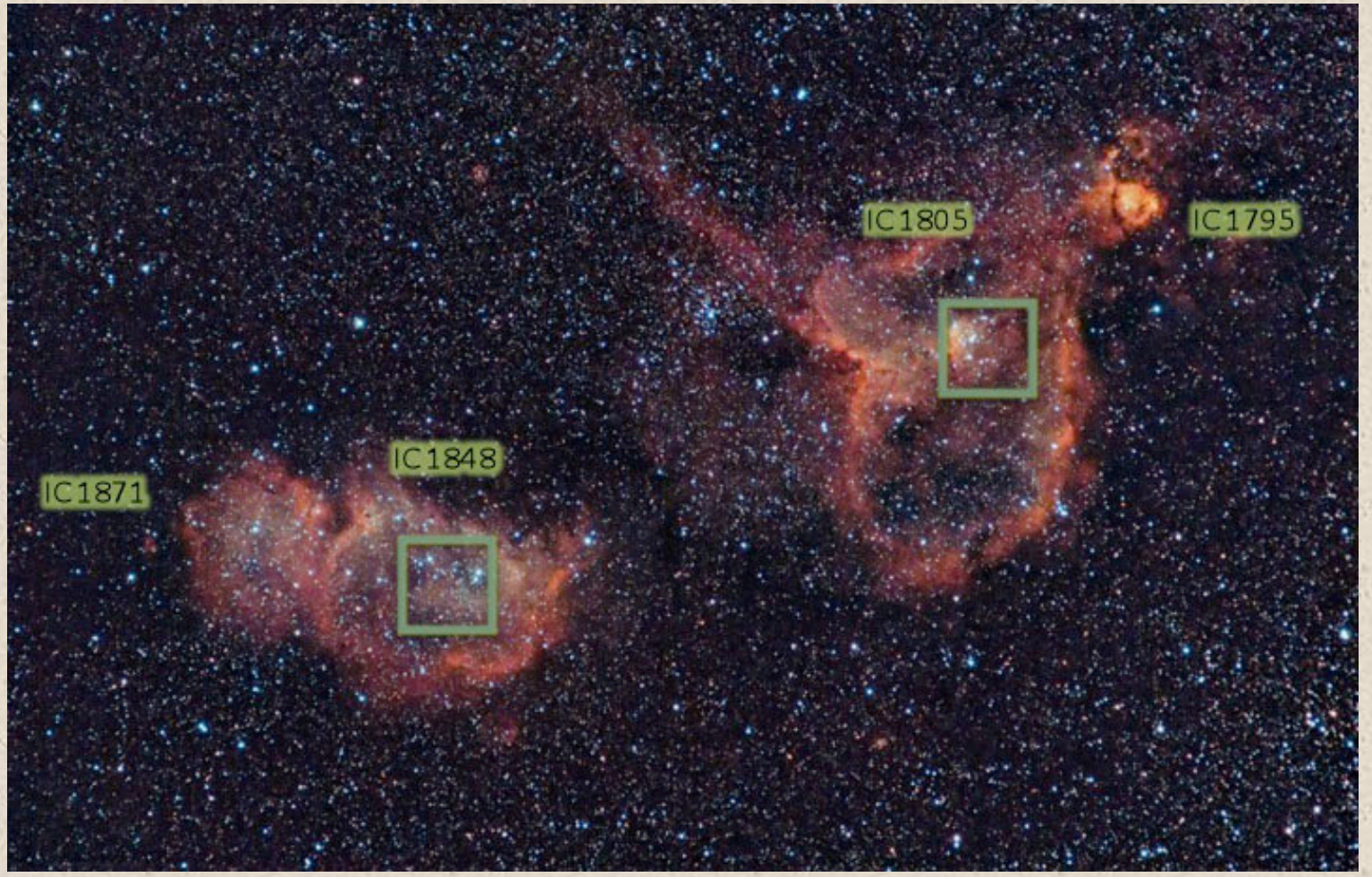


NGC1893: the Tadpoles of Auriga

Parameters	Massey	Sharma	Costado
E(B-V)	0.530	0.4 – 0.6 (0.4)	0.520
E(U-B)	0.381	0.288	0.374
A_V (R_V=3.1)	1.643	1.240	1.612
DM	13.21	13.80	12.99

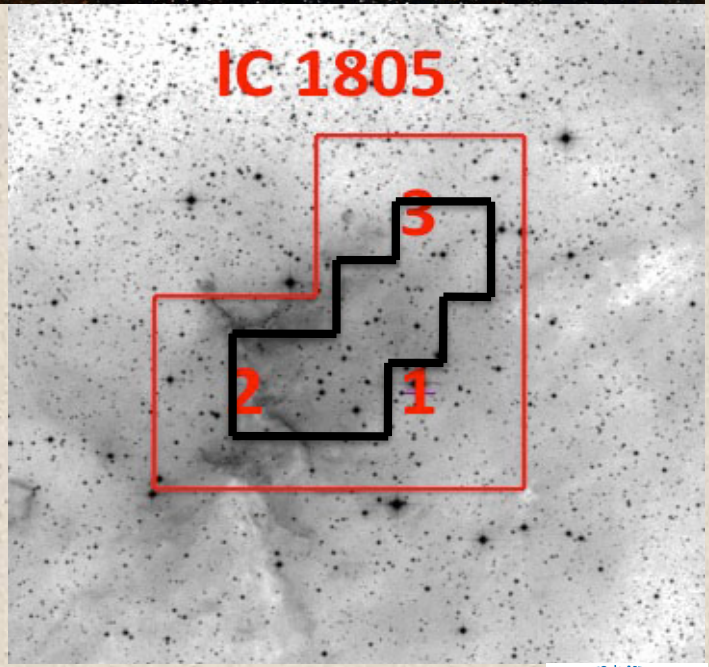
* Massey P. et al. 1995, ApJ 454, 151 – not infrared only 3 colors *UBV*
* Sharma S. et al. 2007, MNRAS 380, 1141 – not infrared only 6 colors *UBVRIHa*
* Costado M. T. et al. 2013 – 9 colors – deeper photometry 3.5mag/Massey; 0.5mag/Sharma and 4mag/2MASS

IC1805: the Heart of Cassiopeia



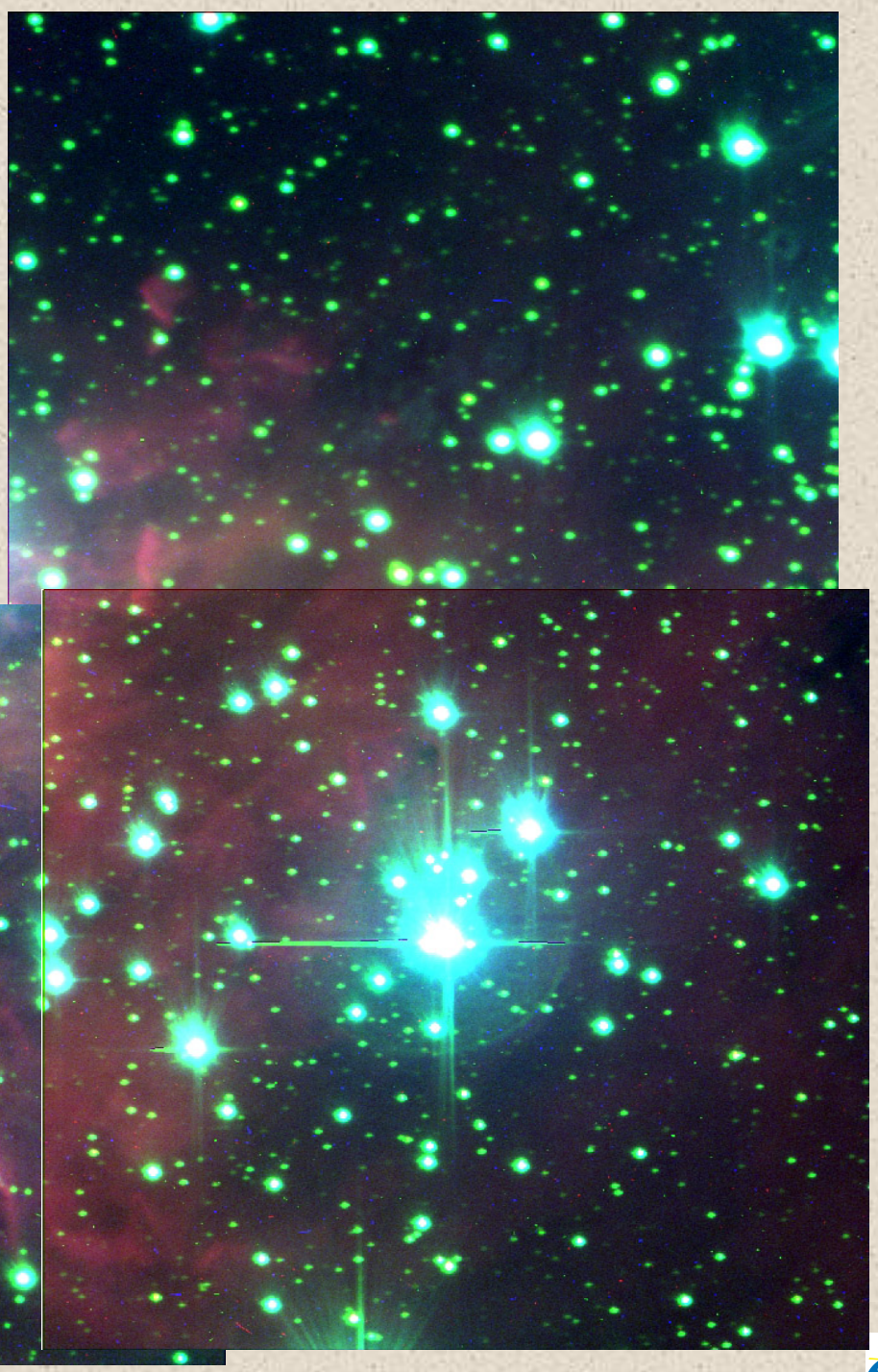
IC1805: the Heart of Cassiopeia

- Constelation of Cassiopeia (Perseo Arm)
- RA = $02^h:32^m:47^s$, DEC = $+61^o:29':29''$
- Heart emission nebula
- Distance 2.3 – 2.4 kpc
- Age 1.5 Myr
- Optical study in *UBVRIHa* with 3 pointings with 1.5m Telescope at OSN – 11/2011 & 01/2012 – *V*=20.5 – 1000 stars
- Infrared study in *JHKs* with 4 pointings with NOT Telescope at ORM – 09/2012 – *J*=21 – *Ks*=19.5 – 2400 stars



IC1805: the Heart of Cassiopeia

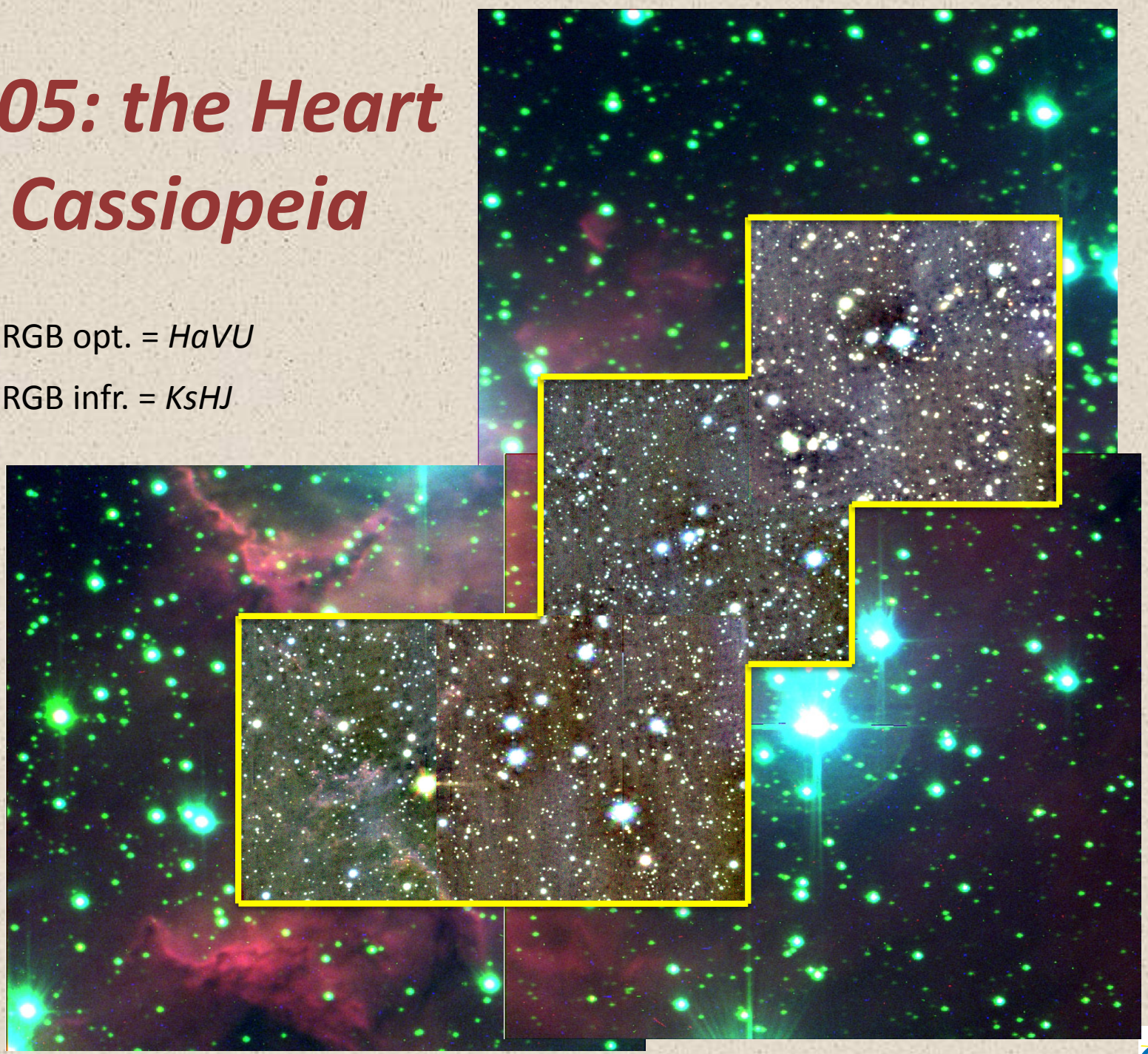
RGB opt. = *HaVU*



IC1805: the Heart of Cassiopeia

RGB opt. = *HaVU*

RGB infr. = *KsHJ*



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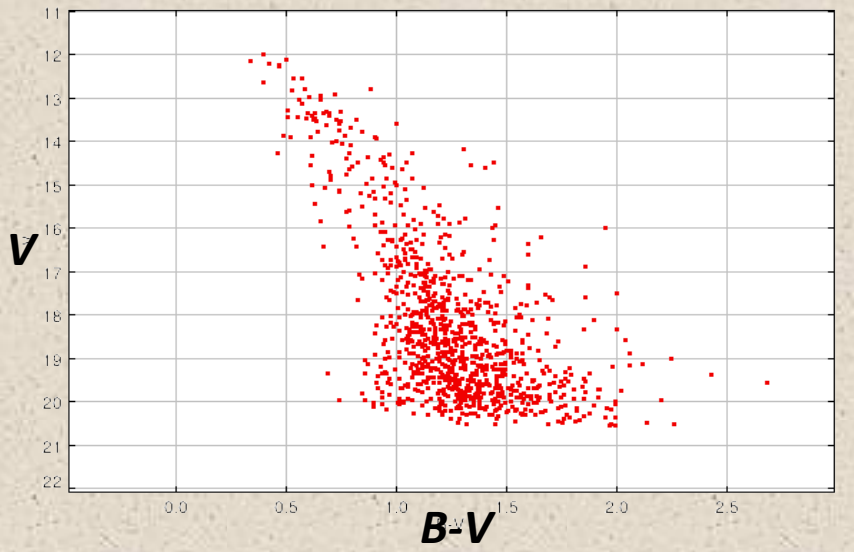

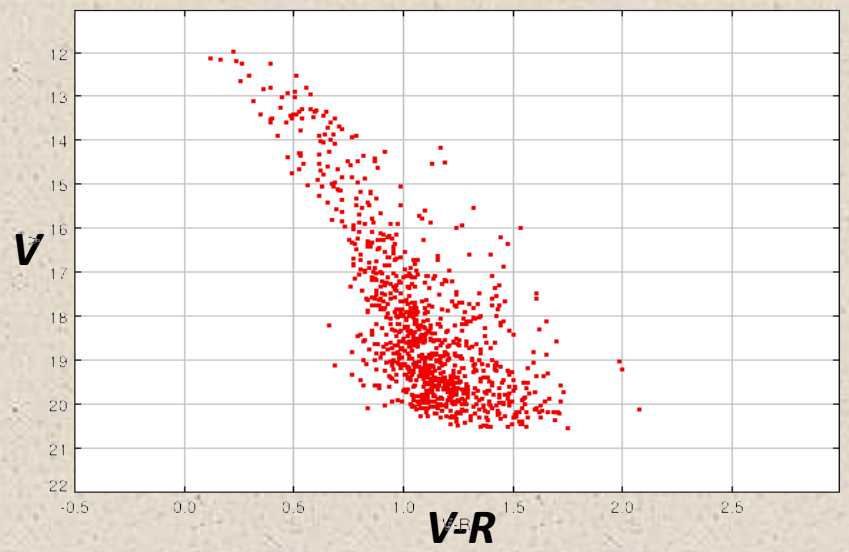

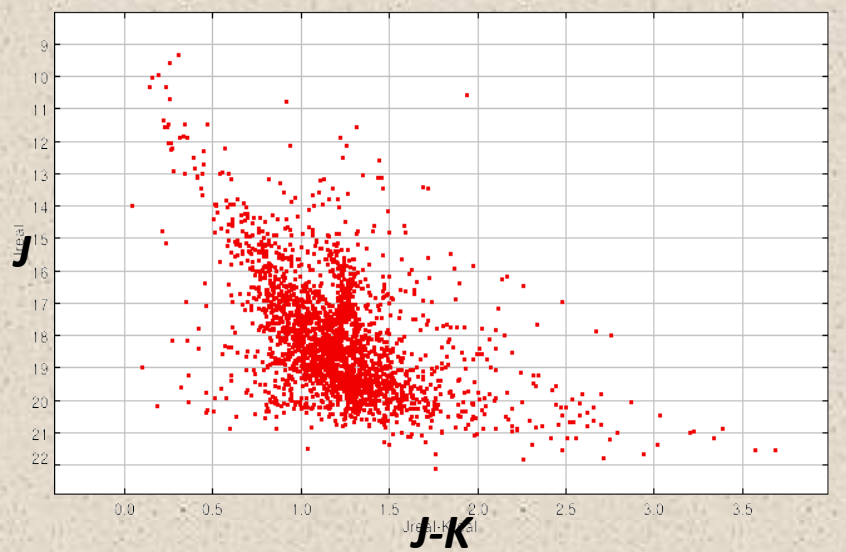

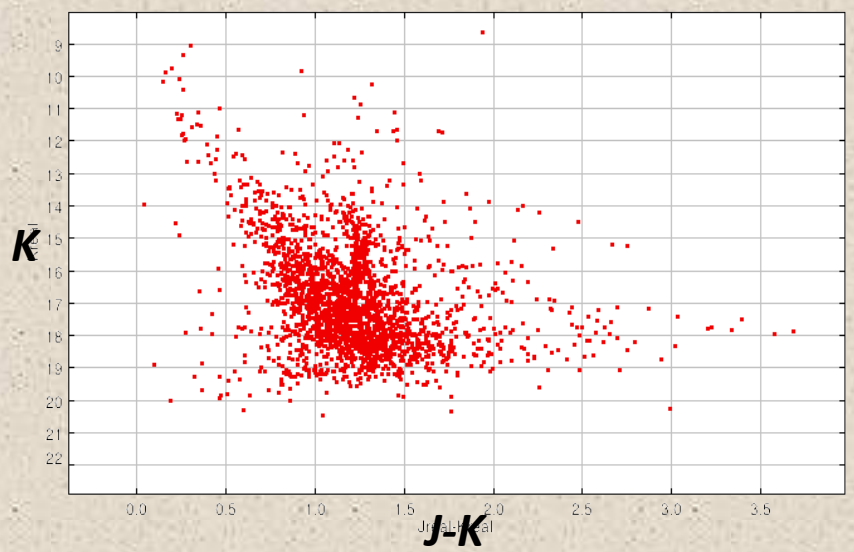

IC1805: the Heart of Cassiopeia

Parameters	Massey	Ninkov	Costado
E(B-V)	0.870	0.6 – 1.24 (0.8)	0.837
E(U-B)	0.626	0.576	0.602
A_V (R_V=3.1)	2.697	2.480	2.595
DM	11.85	11.90	11.83

* Massey P. et al. 1995, ApJ 454, 151 – not infrared only 3 colors *UBV*
* Ninkov Z. et al. 1995, AJ 110, 2242 – not infrared only 5 colors *UBVRI* not *Ha*
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Future work

- Calculate the rest of physical parameters
- Extinction law and infrared excess
- Determine the stellar population (MS and PMS)

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Thanks for your atention !!