# *Formation of High-Mass Stars: Environment of Stellar Clusters containing High-Mass Stars*

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# Project objetives

- 2 Models for the Formation of High-Mass Stars :
  - The competitive accretion model of star formation (Bonnell et al. 2004)
  - The core accretion model (Krumholz et al. 2009)
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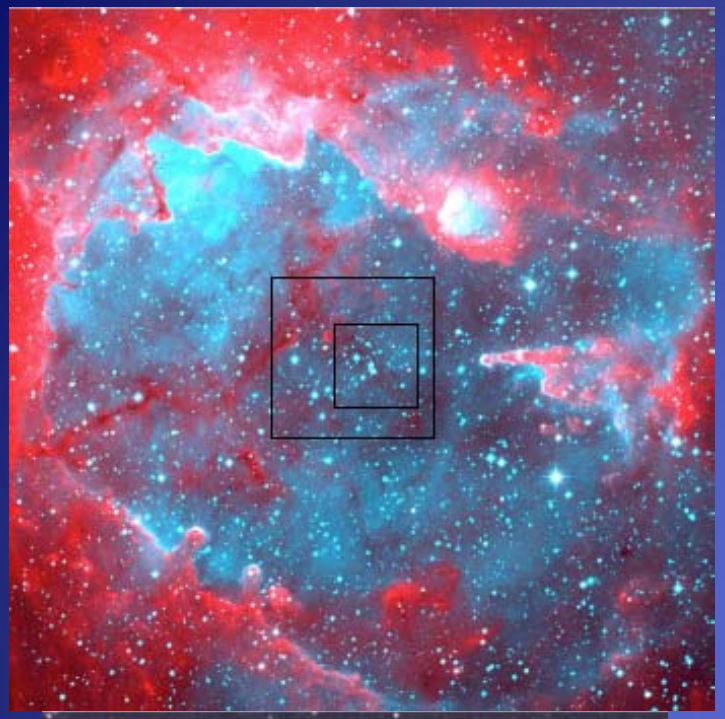
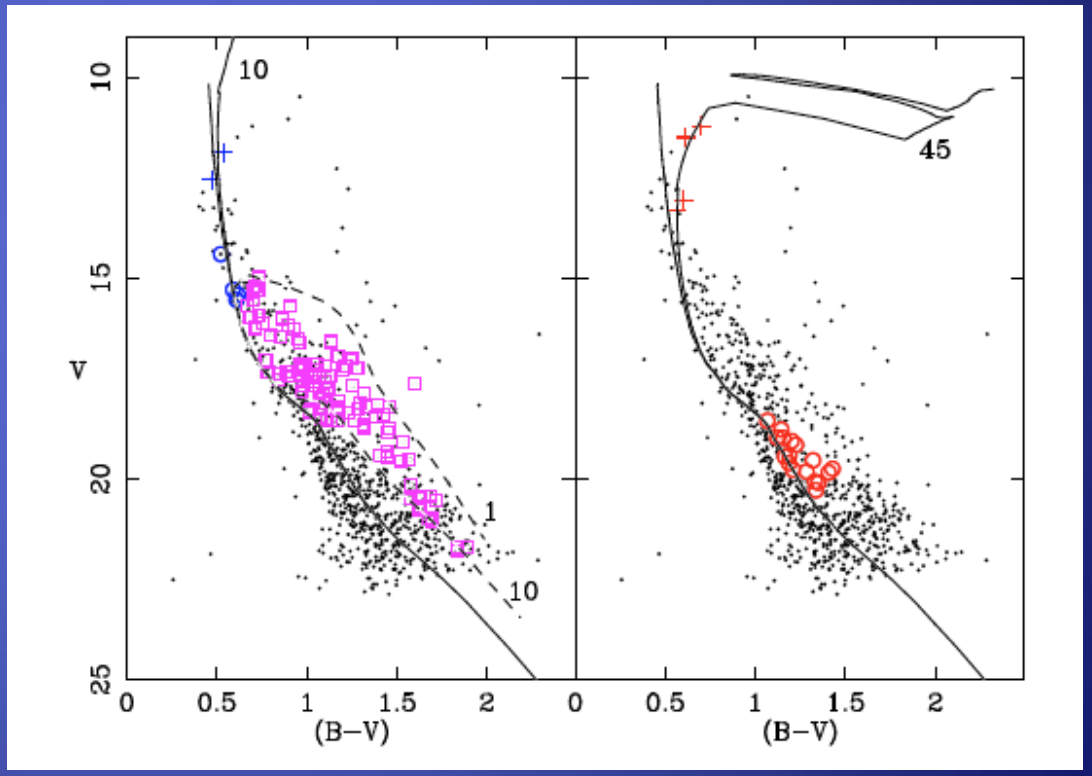
  - LM -> MF for both Populations
  - Internal Spatial & Kinematic (when available) Structures

# Stellar Population

## Dolidze25 (Sh2-284)



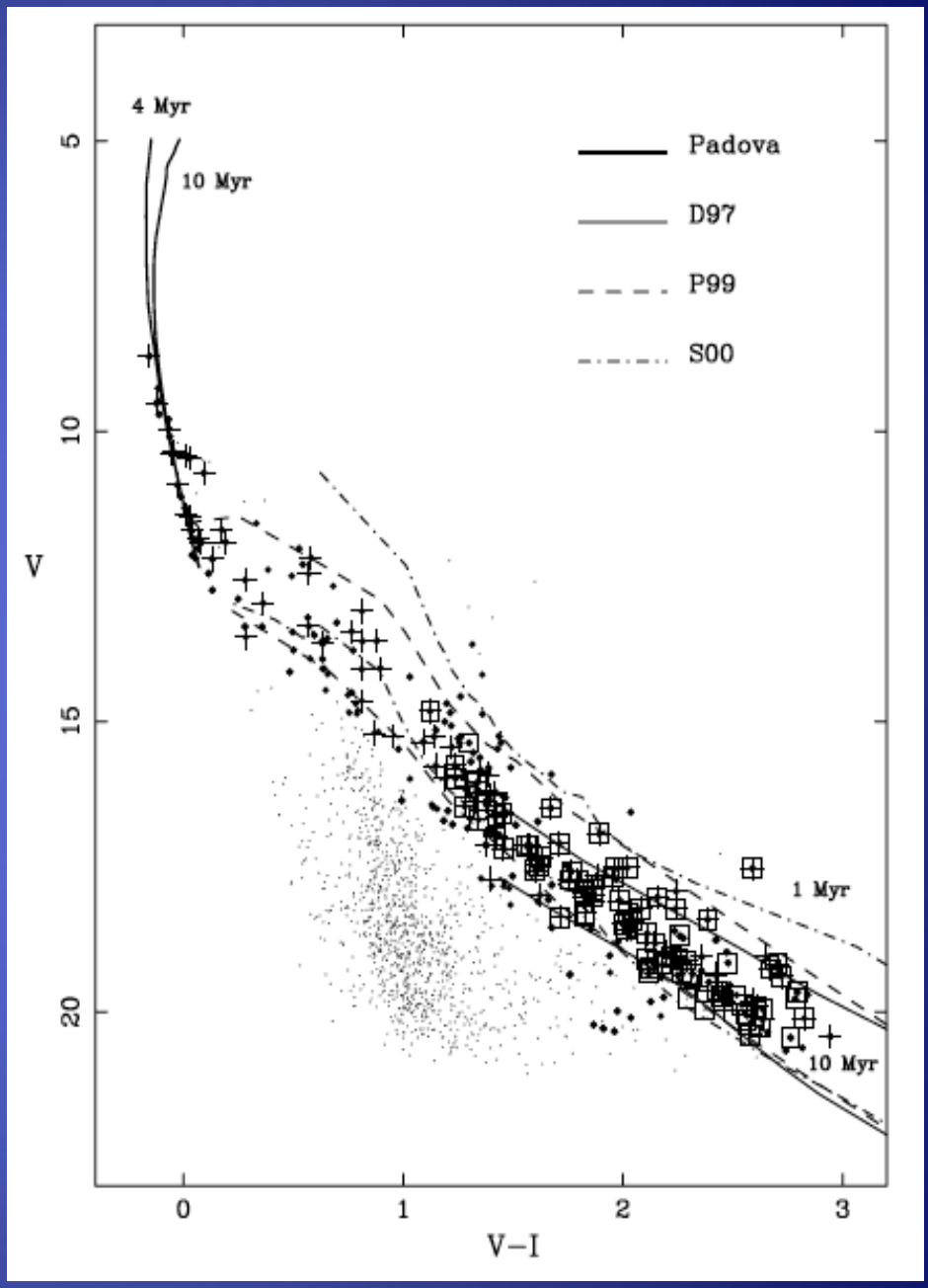



Delgado et al. 2010

# Stellar Population

## NGC2362

Delgado et al. 2006



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# Mass Function

NGC 2362

NGC 2367

NGC 3293

Collinder 228

Hogg 10

Hogg 11

Trumpler 18

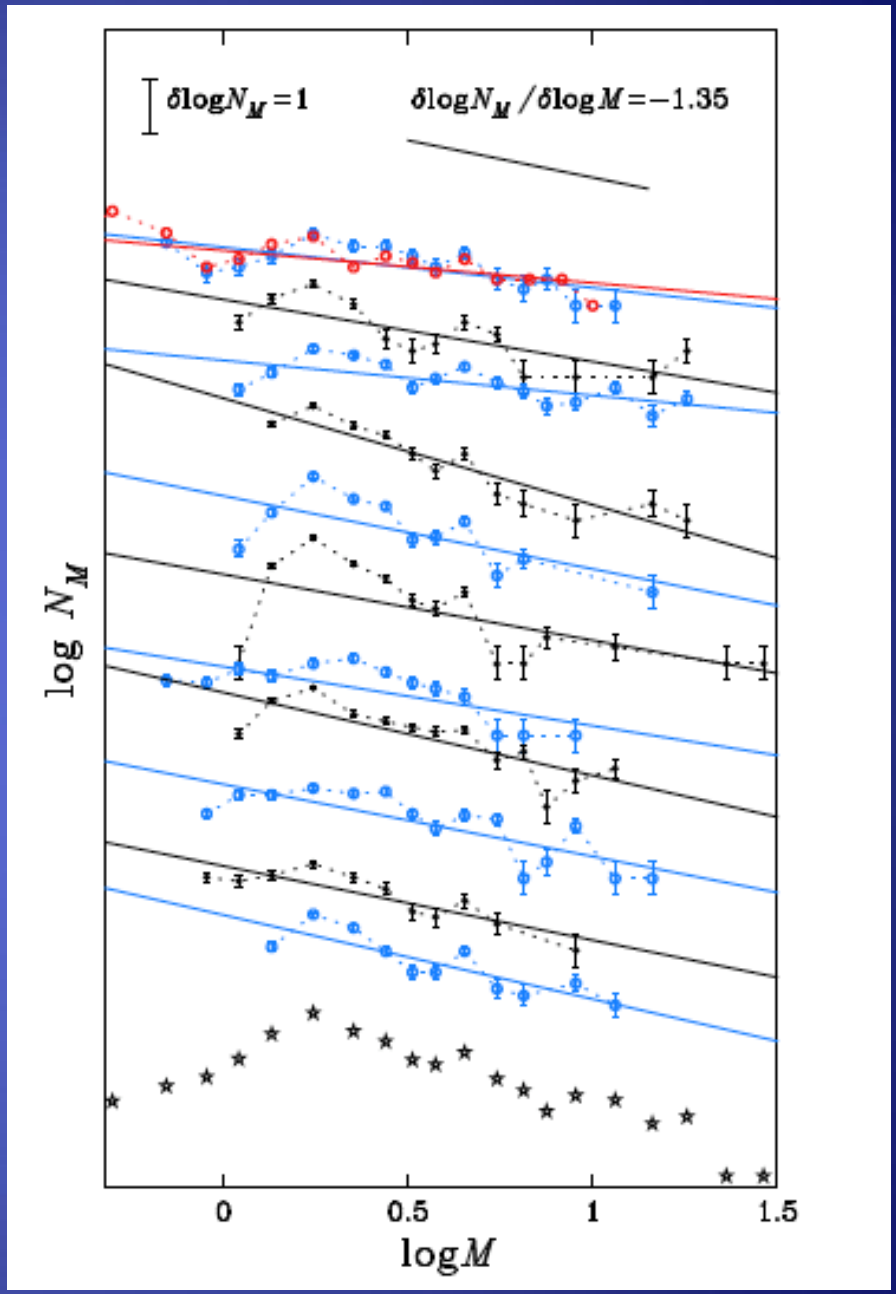
NGC 3590

NGC 4103

NGC 4463

NGC 5606

Delgado et al. 2011



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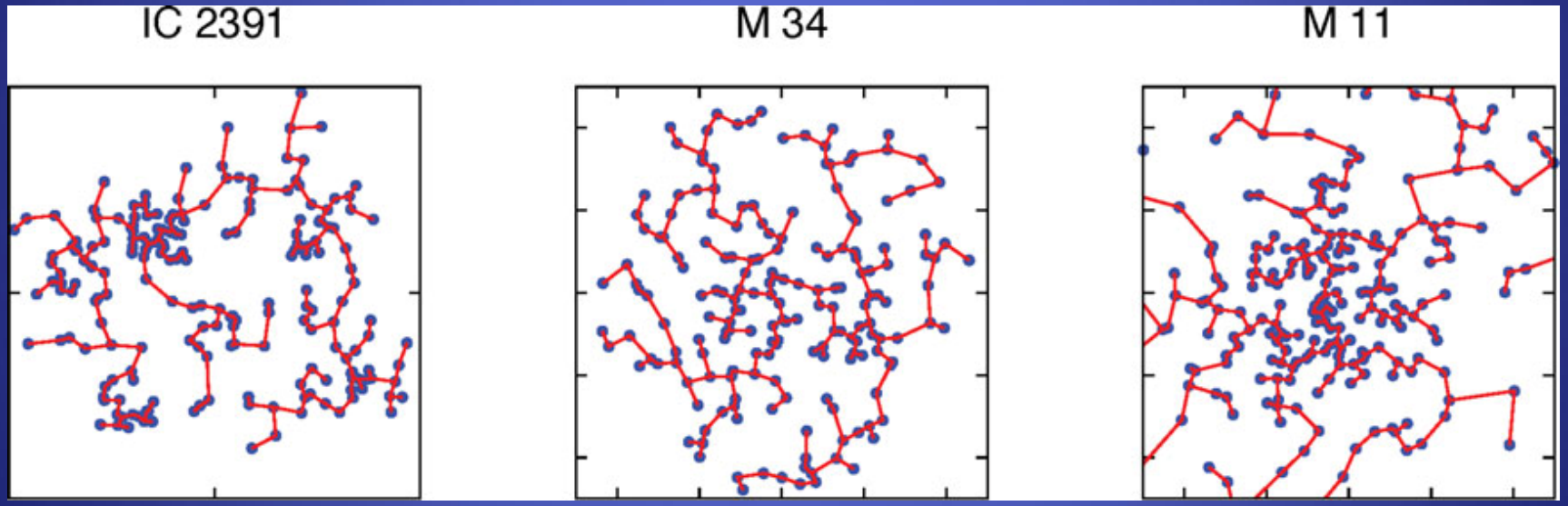
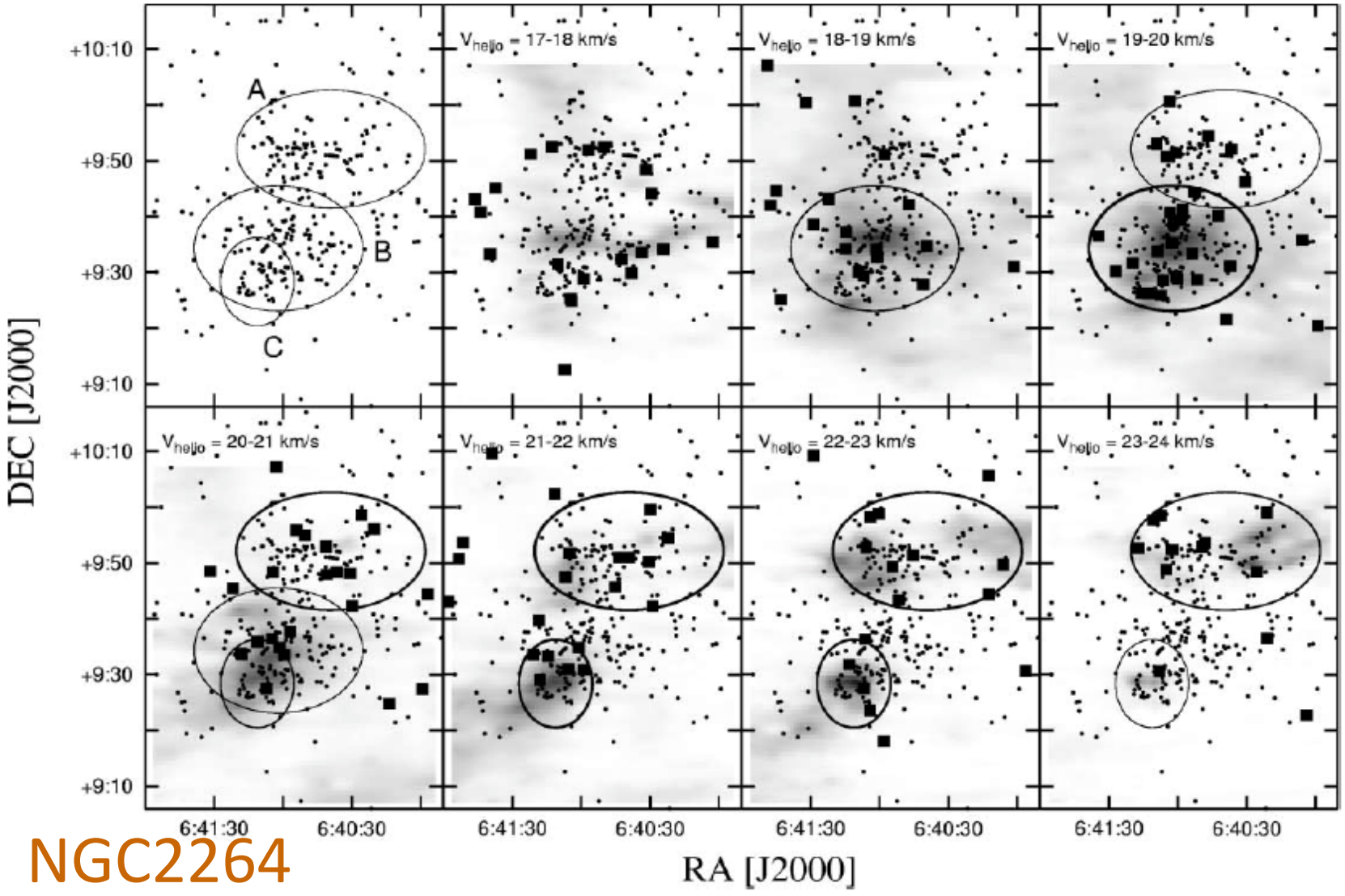
# Internal Spatial Structure for Cluster and Field




Sánchez & Alfaro 2010

# Internal Kinematic Structure




NGC2264

Fürész et al. 2006

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  - Internal Spatial & Kinematic (when available) Structures
- Taxonomy (High-Mass Star Properties, Environment Descriptors)
- Current Database, mainly Southern Clusters (Delgado et al. 2011)
- Extension to North Hemisphere 7 clusters obs. with OSN - NOT (ALFOSC)

# Clusters under study

- Alicante 1 [Ra = 03:59:10, Dec = +57:14:00] - Cygnus
- IC1848 [Ra = 02:49:20, Dec = +60:34:30] - Casiopea
- NGC2244 [Ra = 06:31:54 Dec = +04:56] - Monoceros
- Dolidze8 [Ra = 20:24:21 Dec = +42:15:54] - Cygnus
- Collinder419 [Ra = 20:17:48 Dec = +40:41:30] - Cygnus
- IC1805 [Ra = 02:32:47 Dec = +61:29:29] - Casiopea
- NGC1893 [Ra = 05:22:42 Dec = +33:25] - Auriga

# Clusters under study

## ✧Alicante 1

- OSN next obs. Oct - Nov 2011 UBVRIHα
- NOT service time 02/10/11 (URHα)
- 1 study uvby CCD, V=17, 38 stars

## ✧IC1848

- OSN next obs. Oct - Nov 2011 UBVRIHα
- NOT no proposal
- 2 studies UBV, V=16-16, 19-55 stars

# Clusters under study

## ✧NGC2244

- OSN January 2011 UBVRIHα – unanalyzed
- NOT no proposal
- 3 studies UBV CCD, V=18-17-18, 771-574-112 stars
- 2 studies VRI CCD (Hα), V=17-19, 577-126 stars
- Herschel:
  - » Spatial distribution of most massive dense cores
  - » Census of high-intermediate mass young objects
  - » Study of protostars and the energy distribution → classification as Class0 – Class1 objects

# Clusters under study

- Dolidze8
  - OSN UBVRIHα July 2010 (V=21, ?80 stars) + July 2011 (in process)
  - NOT July + August 2011 (UR,i,Hα) + JHK 2012?
  - 1 study of bright stars in NGC6910 with UBVR

# Clusters under study

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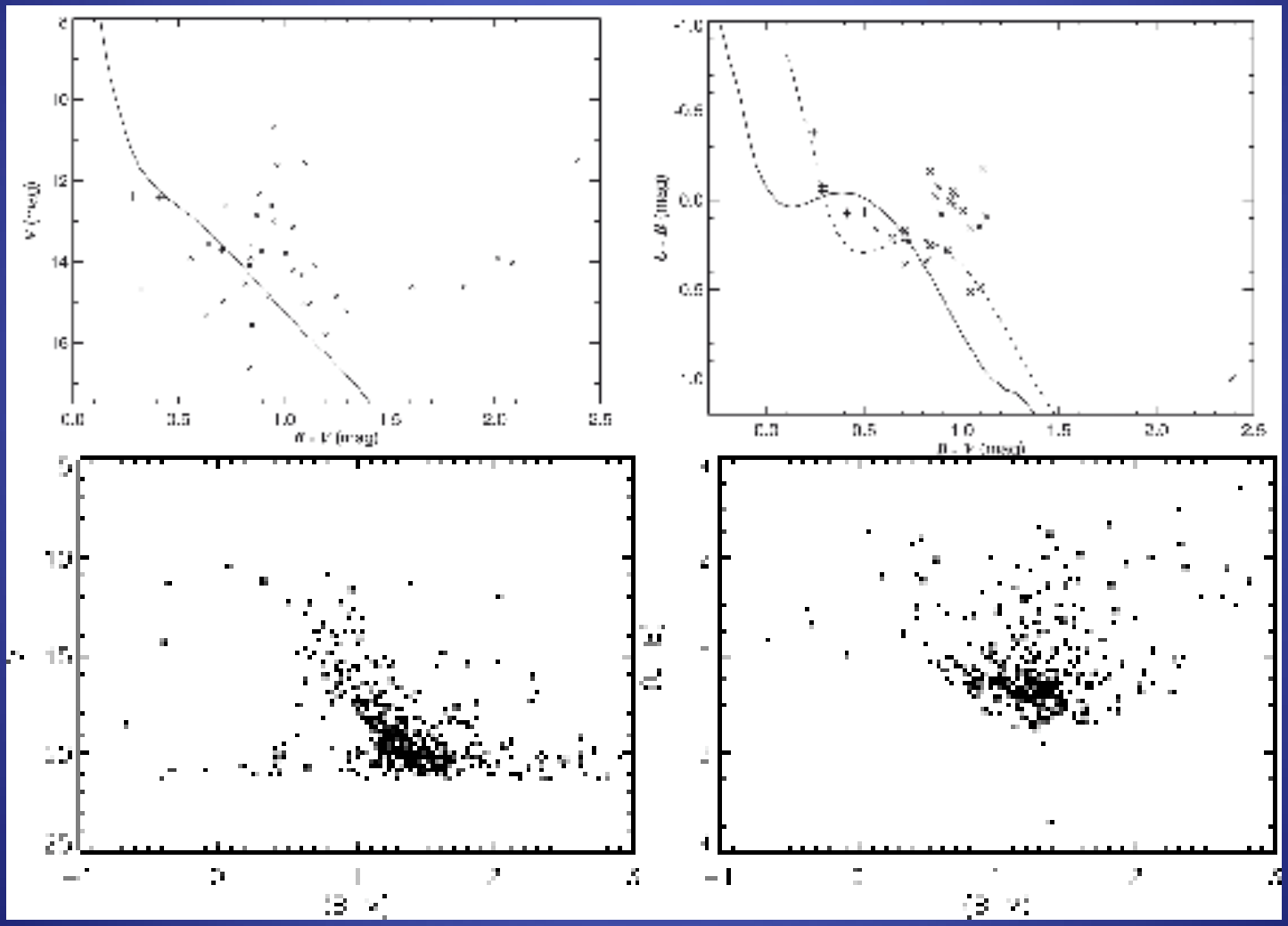
- NOT July + August 2011 (UR,i,Hα) + JHK 2012?
- 1 study of bright stars in NGC6910 with UBVR

## ✧Collinder 419

- OSN UBVRIHα July 2010 (V=22, ?430 stars) + July 2011 (in process)
- NOT July 2011 (R, i, Hα – in process) + JHK 2012?
- 2 studies UBV CCD, V=12-16, 39-79 stars

# Clusters under study

Roberts et al. 2010

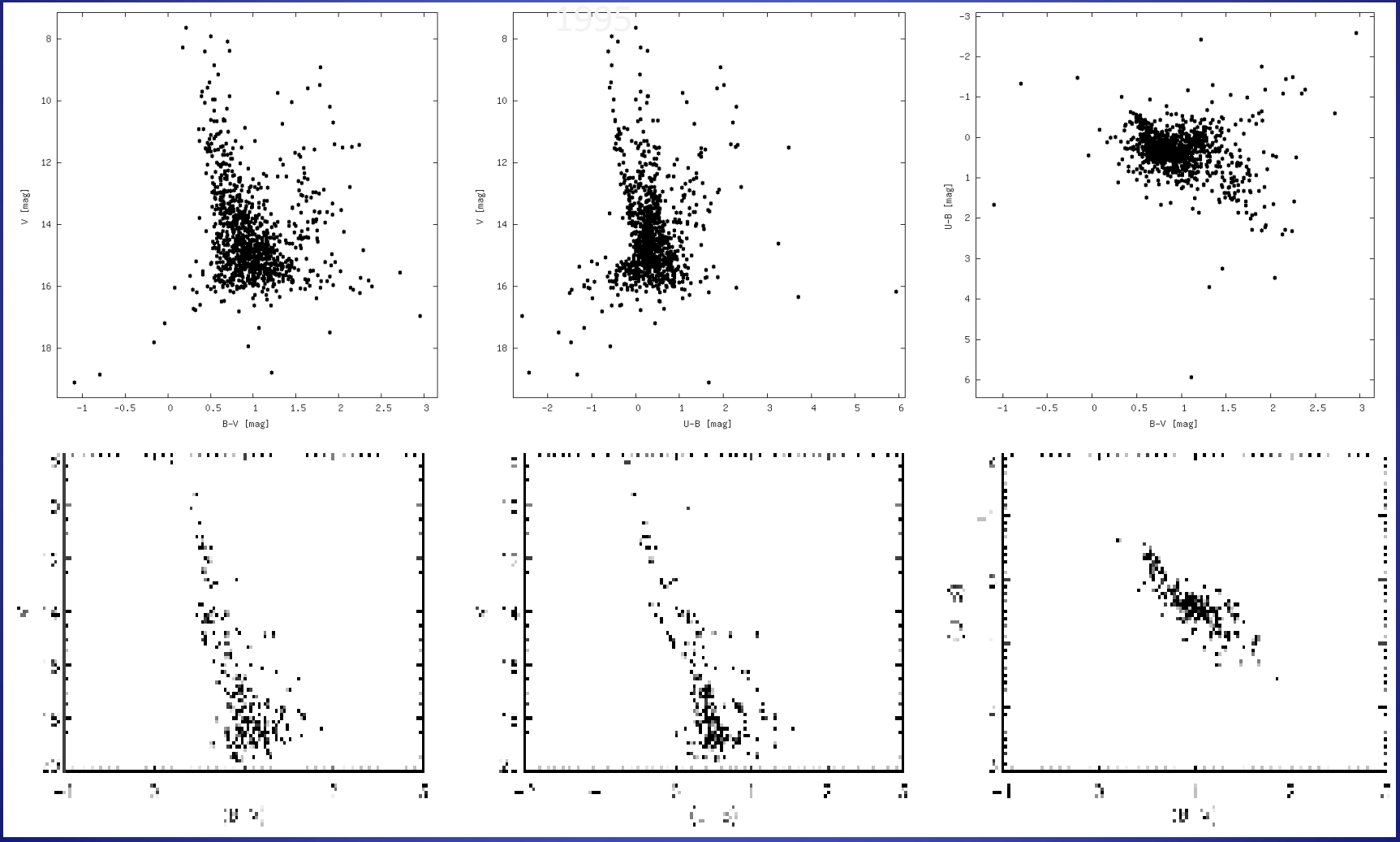


# Clusters under study

- IC1805
  - OSN January 2011, UBV CCD, V=20, ?200 stars
  - OSN next obs. Oct - Nov 2011 VRIHα
  - NOT no proposal
  - 3 studies UBV CCD, V=16-18-15, 52-1023-175 stars
  - 1 study VRI CCD, V=18, 157 stars

# Clusters under study

Massey et al.



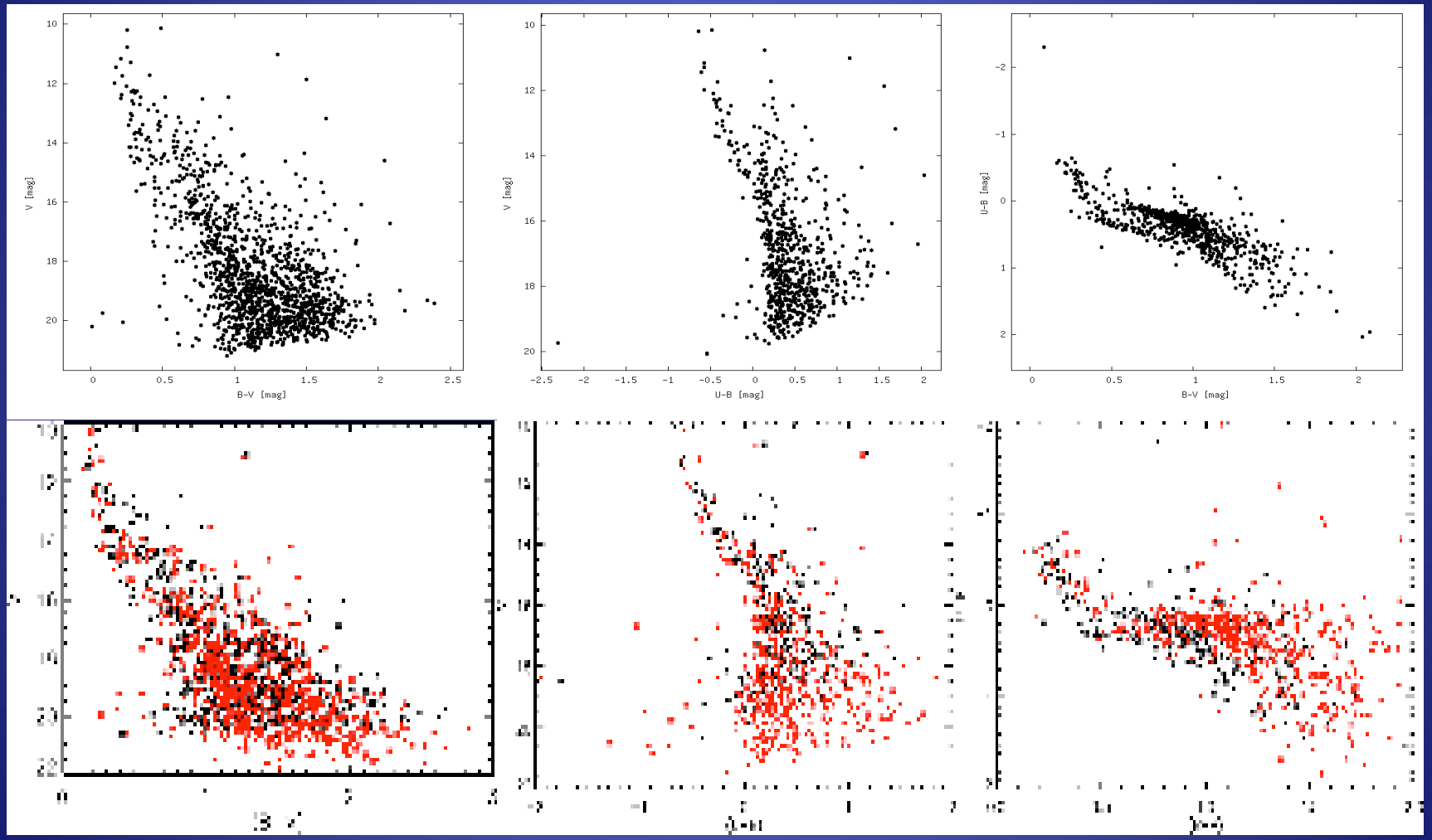
# Clusters under study

## ✧NGC1893

- OSN Dec. 2009 + January 2011 UBVRIHα V= 22, ?1000 stars ; next obs. Oct - Nov 2011
- NOT no proposal
- 2 studies UBV CCD, V=18-21, 1023-1458 stars
- 1 study VRIHα CCD, V=21, 2181 stars
- Spectroscopy + photometry (strömgren+jhonson+2MASS)
- Study of members with/without disc (VRIHα+JHK)

# Clusters under study

Sharma et al. 2007



# Future work

- ✧Collinder419 + Dolidze8
  - Submit a JHK NOT proposal
  - Complete analysis in process
  - Analize NOT data
- ✧NGC2244
  - Analize observed data, possible obs. to extend field of view
- ✧IC1805 + NGC1893
  - New observations (other filters/extend field of view)
- ✧Alicante1 + IC1848
  - Observe + analize new data of the next campaign

# Clusters summary

| | Other studies | | Our study | | |
|---|---|---|---|---|---|
| CLUSTER | FILTER | MAG. V | FILTER | MAG. V | FUTURE |
| Alicante1 | --- | --- | --- | --- | UBVRIHα |
| IC1848 | --- | --- | --- | --- | UBVRIHα |
| NGC2244 | UBV<br>UBVRIHα<br>UBVRI | 18(Massey)<br>17(Park-Sung)<br>18 (Berghöfer) | UBVRIHα | --- | JHK<br>+field of view |
| Dolidze8 | --- | --- | UBVRIHα | 21 | JHK |
| Collinder419 | UBV | 16(Roberts) | UBVRIHα | 22 | JHK |
| IC1805 | UBV<br>UBV<br>UBVRI | 18(Massey)<br>15(Sung-Lee)<br>16(Ninkov) | UBV | 20 | RIHα–JHK<br>+field of view |
| NGC1893 | UBV<br>UBVRIHα | 18(Massey)<br>21(Sharma) | UBVRIHα | 22 | JHK<br>+field of view |