Galaxy evolution through resolved stellar populations: from the Local Group to Coma

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Brief summary of the science cases presented at the Local Universe session of the RIA/E-ELT meeting Madrid 16-17 April 2009

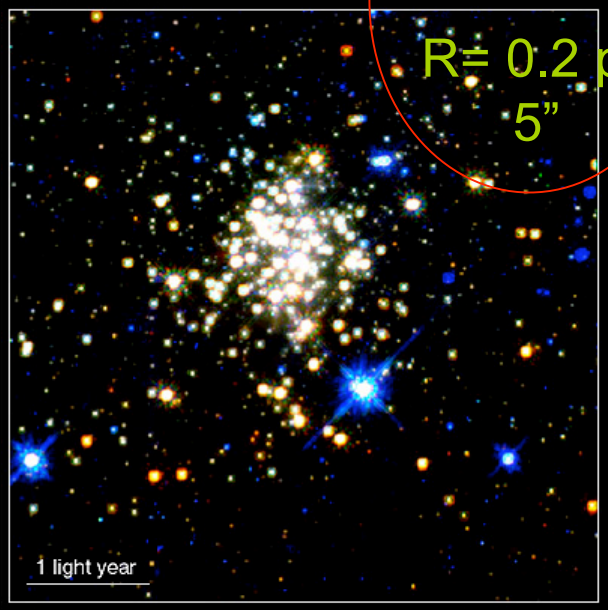
http://riastronomia.es/opencms/opencms/Workshops/R_2009023.html

1. The M31 M33 science cases:

- ✓ Massive Stellar Clusters in M31 and M33
- ✓ Super massive black hole formation
- ✓ Detailed and unambiguos star formation histories
- ✓ The stellar cluster system of M33 and M31: accurate ages

1. The M31 M33 science cases:

- ✓ Massive Stellar Clusters in M31 and M33
  (A. Herrero, IAC)



Properties and distributions of these massive clusters in the Local Group spirals (Milky Way, M31, M33)

- ✓ Important to disentangle the role of the local conditions in the formation and evolution of massive stars and clusters

(e.g determine the influence of the presence or absence of a central supermassive black hole, a bar or an interaction region between the bar and the spiral arms.)

✓ Massive Stellar Clusters in M31 and M33

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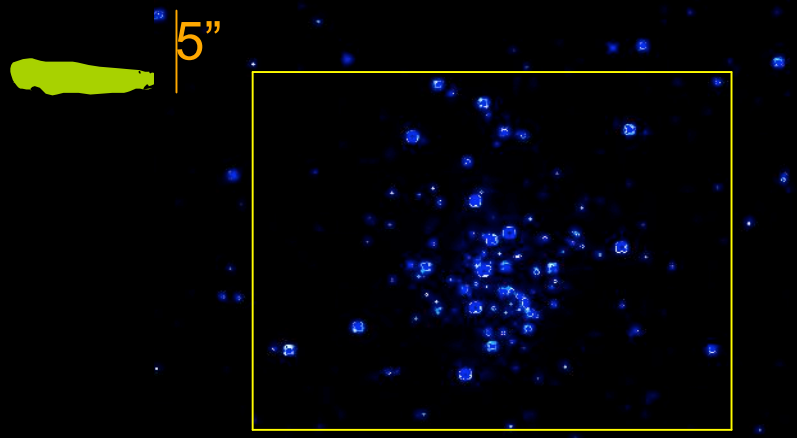
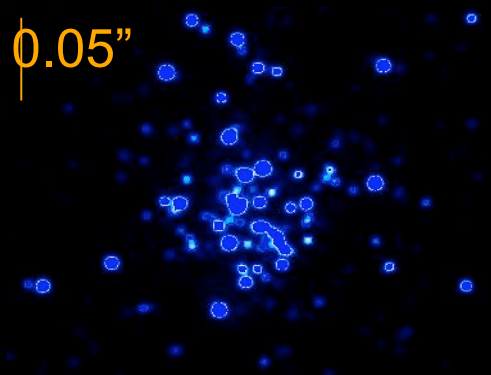


NICMOS NIC2 camera 0”.08/pix
PSF: 2 pix FWHM



Degraded image: 100 x farther
x16 better resolution

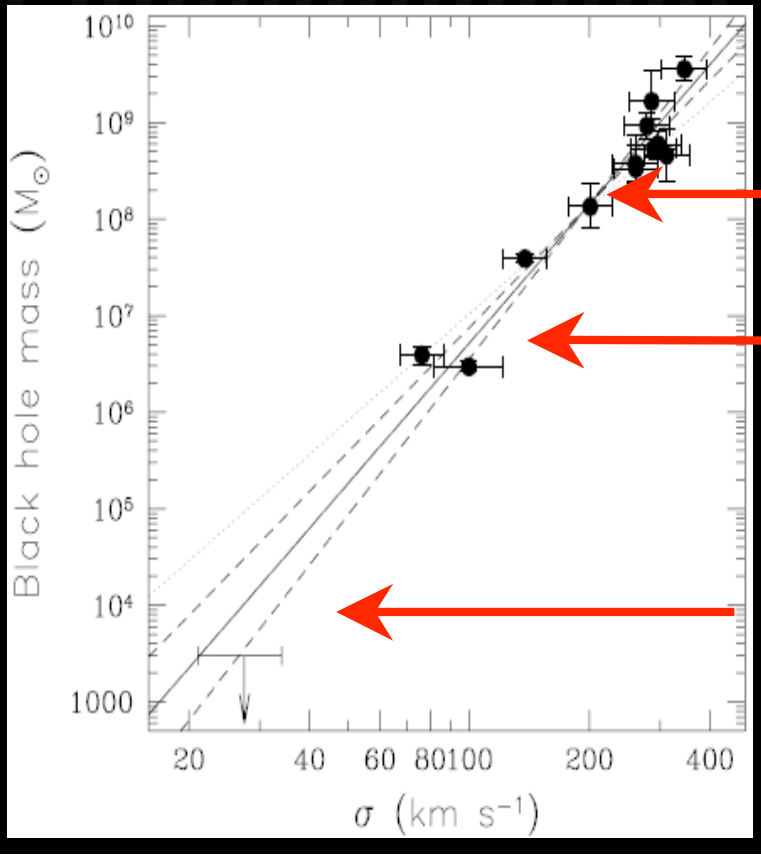
- ✓ These clusters have typical radii of 1 pc (in M31 and M33 represents angular sizes of only 0.25arcsec) . To carry out photometry and spectroscopy of individual stars we need NIR diffraction-limited images and high-resolution spatial spectroscopy R=4000 in a telescope of ~ 40m .

- ✓ Feasible with the E-ELT

1. The M31 M33 science cases:

- Super massive black hole formation

(I. Trujillo, IAC; C. del Burgo, Dublin Institute for advance studies)



Merrit et al. 2001

1. The M31 M33 science cases:

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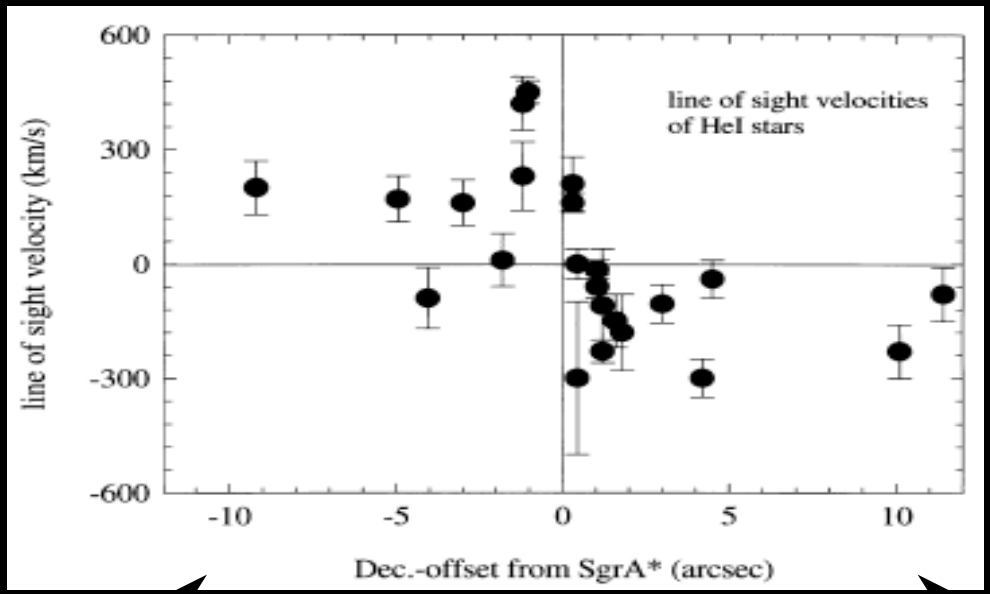
- What E-ELT can do?

BH determination from individual stellar kinematics (example in the MW)

Explore the dynamics (e.g. anisotropy, counterrotation) and stellar populations of he innermost stars (e.g correlations with SMBH, pop. segregation, SF enhancement)

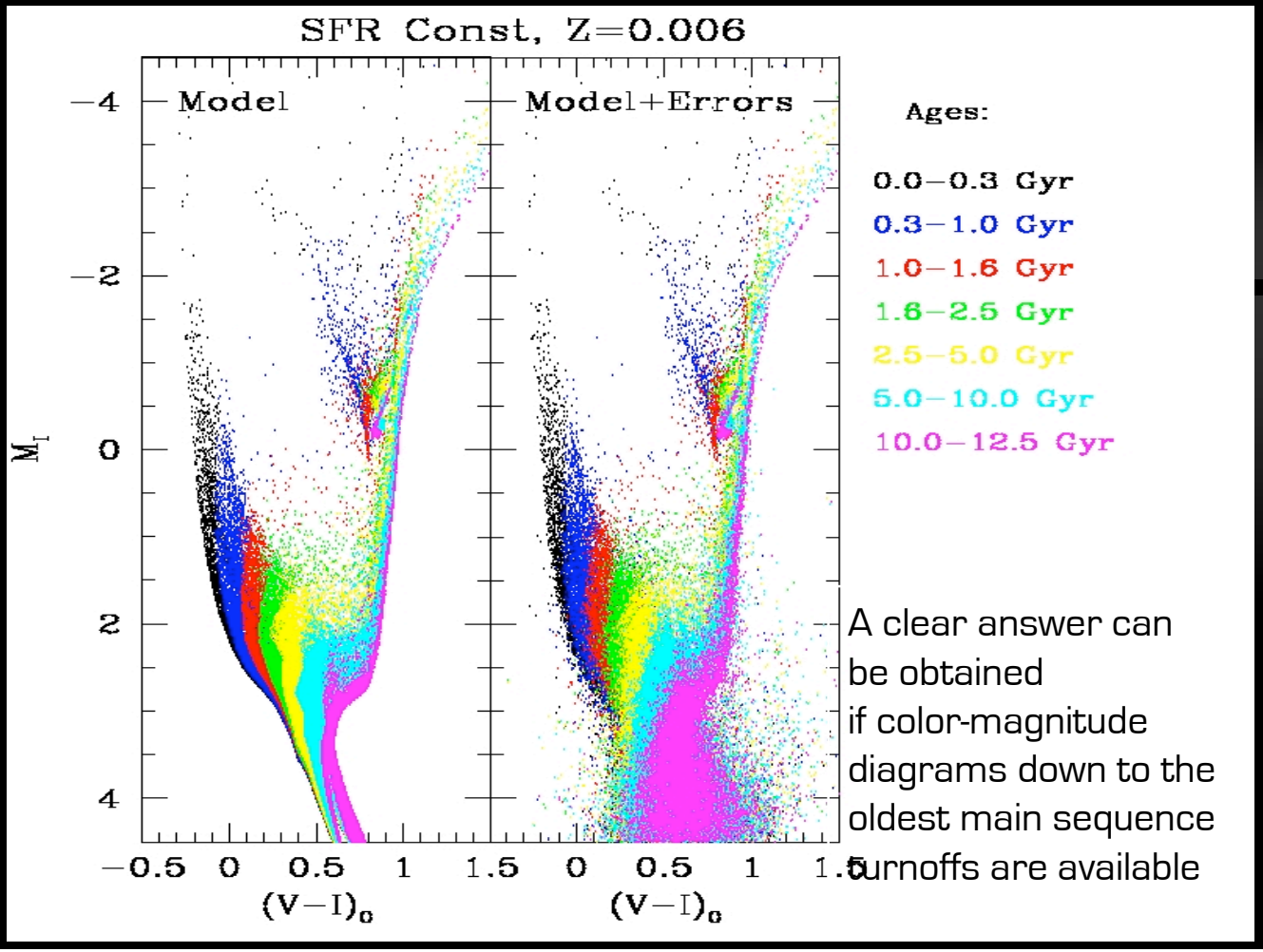


0.84 pc

Genzel et al. 2000

1. The M31 M33 science cases:

- ✓ Detailed and unambiguos star formation histories (C. Gallart, IAC)



A clear answer can be obtained if color-magnitude diagrams down to the oldest main sequence turnoffs are available

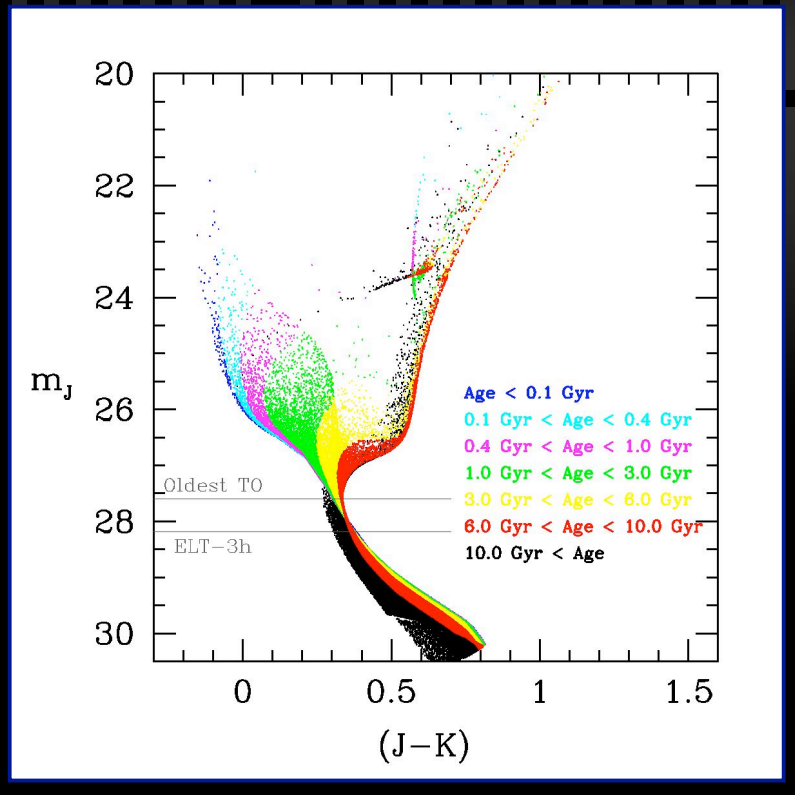
1. The M31 M33 science cases:

- ✓ Detailed and unambiguos star formation histories (C. Gallart, IAC)

It is possible to perform precision photometry over the whole M33 and the M31 disk. Even if small FOV (≈1 arcmin), enough stars due to the high stellar density

E-ELT: Assuming Laser Tomography Adaptive Optics

- Resolution: ~0.006''/pix (J-band)
- Lim. Mag.: J~27 in 1 hour



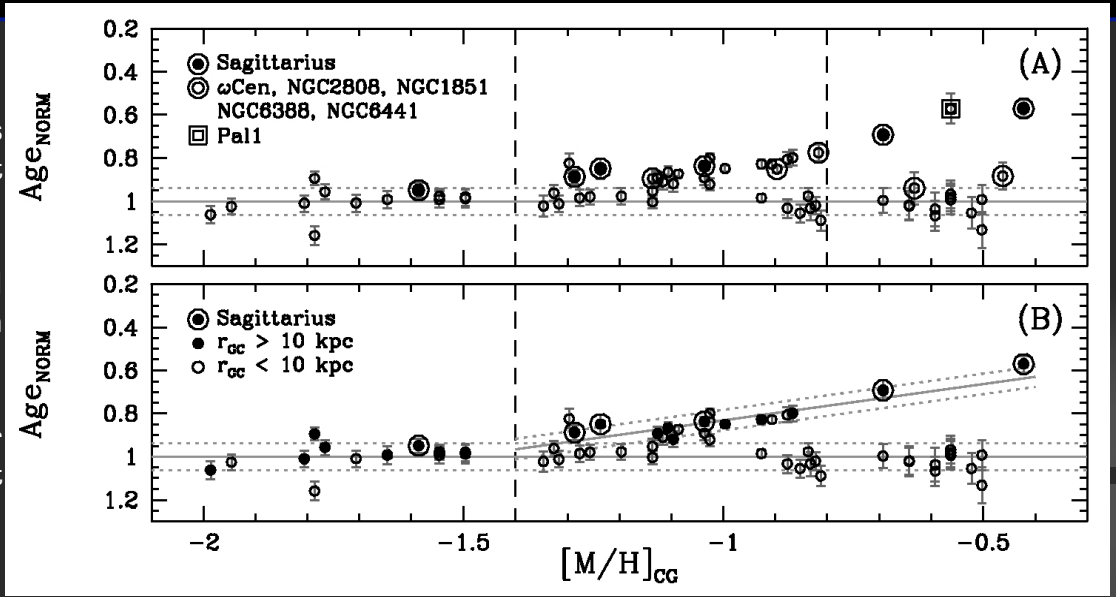
The stellar cluster system of M31 and M33: accurate ages. A. Marín-Franch (IAC)

Milky Way recent results:

Marín-Franch et al. (2009) found two distinct groups of GCs in the Milky Way halo, suggesting that it formed in two phases or processes:

- The first one would be compatible with a rapid (<0.8 Gyr) assembling process of the halo, in which the clusters in the old group were formed.

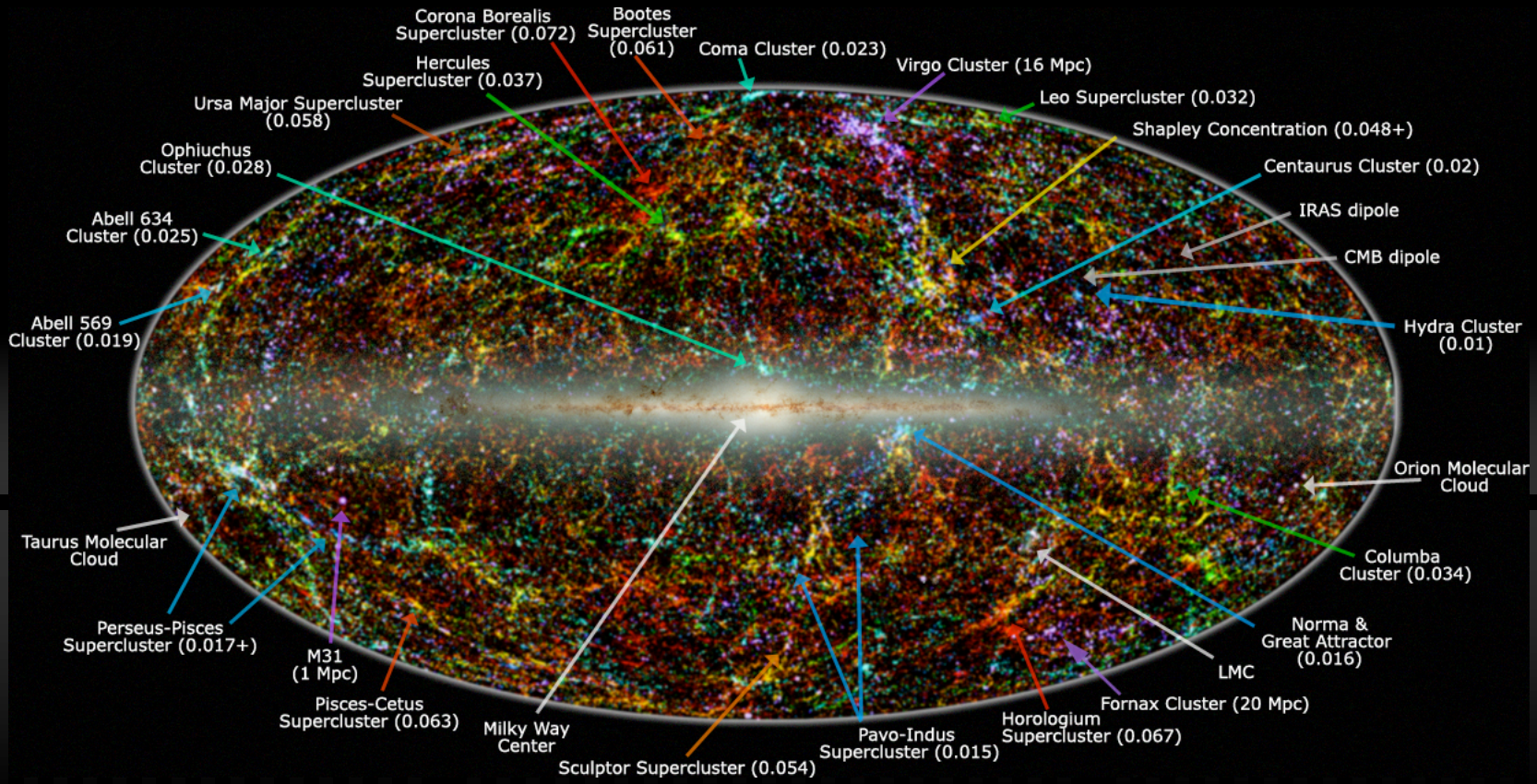
- origin the younger clusters, related to their formation within Milky Way satellite galaxies that were later accreted?



M31 has ≈ 450 GCs (Brodie & Strader 2006).
M33 has ≈ 1500 GCs (Zloczewski et al. 2008). Indication of several ages?

The study of GC ages in M31 & M33 will provide fundamental information about these galaxies formation and early evolution, to compare with the recent results obtained for the Milky Way.

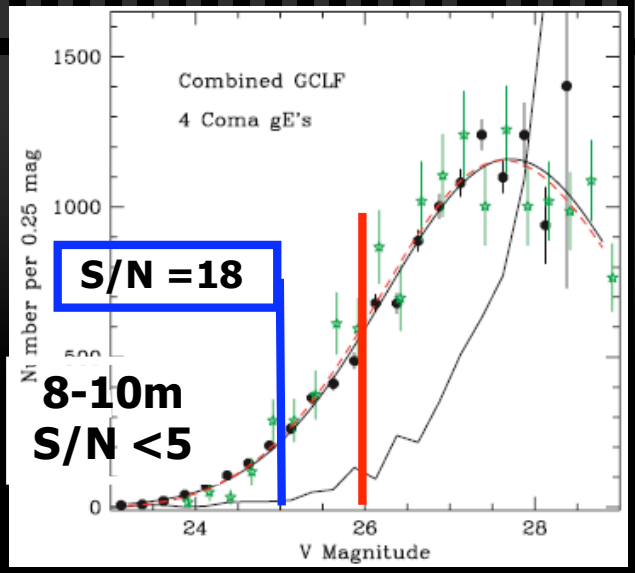
2. The Coma science cases:



- The most evolved galaxy cluster in the nearby Universe.
- Is located at high declination in the sky.
- It's very well studied in the literature.
- It does have dynamical structure and, therefore, allows to study the influence of both, global and local environment.

2. The Coma science cases:

- ✓ Kinematics and metallicity from PN in ellipticals covering wide range in masses (J.A Aguerri, P.Sanchez-Blazquez)
- ✓ Stellar populations and kinematics in clusters (J. Cenarro)



Kinematics:
down to V=26(<15 km/s)
30 GC/arcmin2
Stellar Populations:
down to V=25
10 GC/arcmin
Like doing GCs in Virgo/Fornax from 8-10m telescopes!!

ELT-ETC, (8 h) [seeing-limited; R=2500; λ 3500-5500 Å, 1.1 Å/pix]

- ✓ dE in Coma (J. Cenarro, J.Falcon)

3. Other E-ELT related science proposals

- ✓ ULXs. (J. Casares (IAC), I. Negueruela (U. Alicante), F. Vilardell (U. Alicante), A. Herrero (IAC), T. Shahbaz (IAC) Derive dynamical masses of the brightest ULXs to determine whether they contain IMBHs.

  The need for the E-ELT comes from the fact that they are found in very crowded fields contaminated by nebulosity.

- ✓ AGB stars in the Local Group Galaxies A. Garcia (IAC), A. Manchado (IAC), C. Abia (UGR)

  Determine s-process elements and CNO isoptopic abundance, investigating the correlation with other stellar parameters (e.g luminosity, stellar mass, and metallicity)

- ✓ Disk vertical structure. I. Pérez (UGR) , E[illegible]r Gallart (IAC)

  Kinematics and stellar populations of nearby edge-on galaxies to reconstruct disk formation

Link to the meeting report:

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