



Compact groups of galaxies: small, dense, elusive



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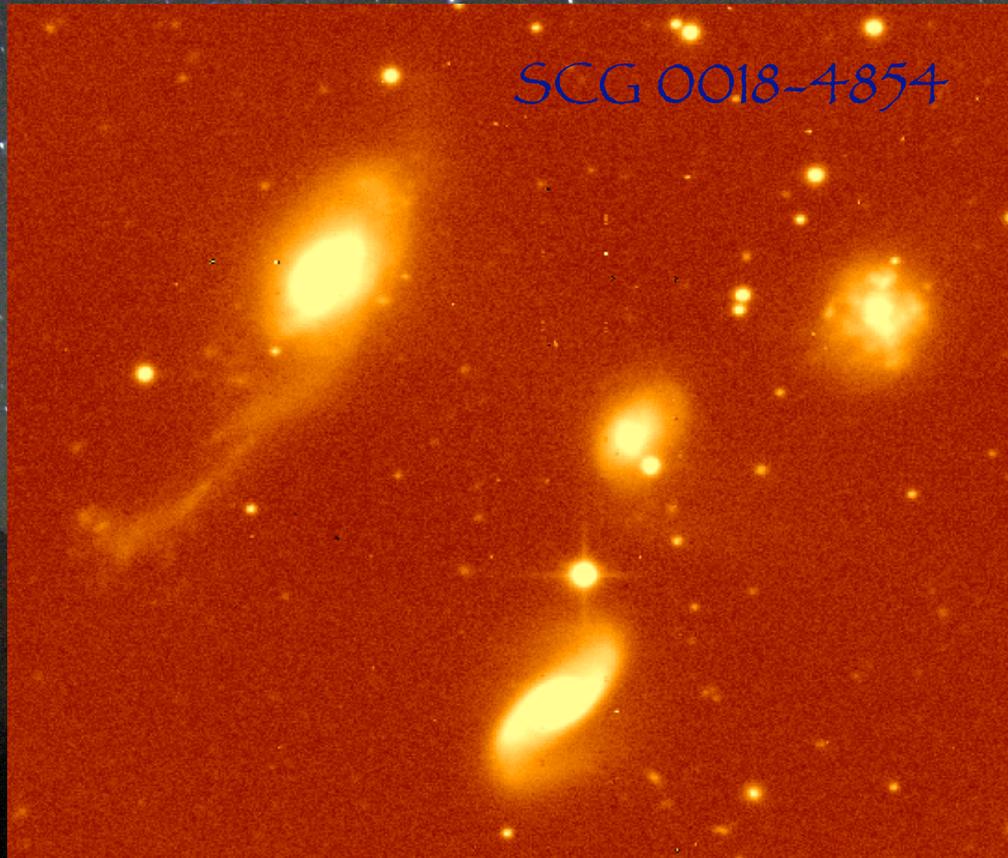
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Compact groups: what are they?



SCG 0018-4854

"The criteria" (HCGs)

Richness: $n \geq 4$

Isolation: $R_{\text{isol}} > 3 \times R_{\text{group}}$
no galaxy in isolation ring

Compactness: $\mu_G < 26$

Compact groups: open questions



What is their origin?
What is their evolution?
What is their relation with clusters?

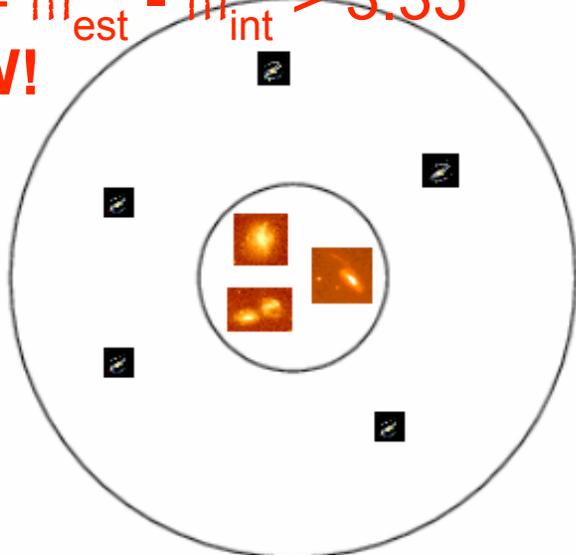


Compact groups at low z : the Southern Compact Group survey

* Southern Compact Groups (SCGs): nearby ($z < 0.03$) compact groups. Imaging and spectroscopic follow-up, groups with high percentage of spirals

$$\Delta m = m_{\text{est}} - m_{\text{int}} > 3.35$$

NEW!

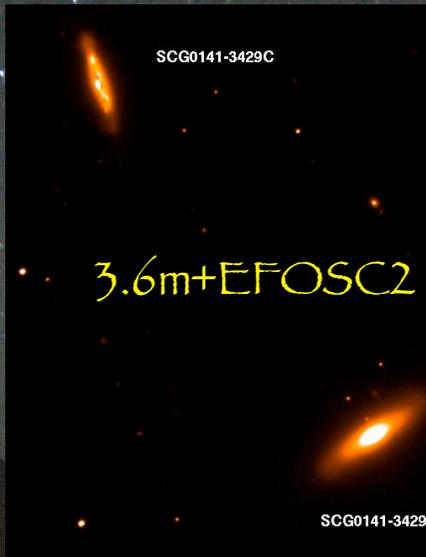
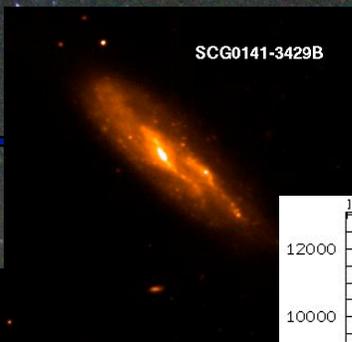


Fore/background galaxies allowed in the isolation ring if $m_{\text{isol}} > m_f$



120 groups over 5200 sq. deg.
60 groups with $b_j \leq 14.5$

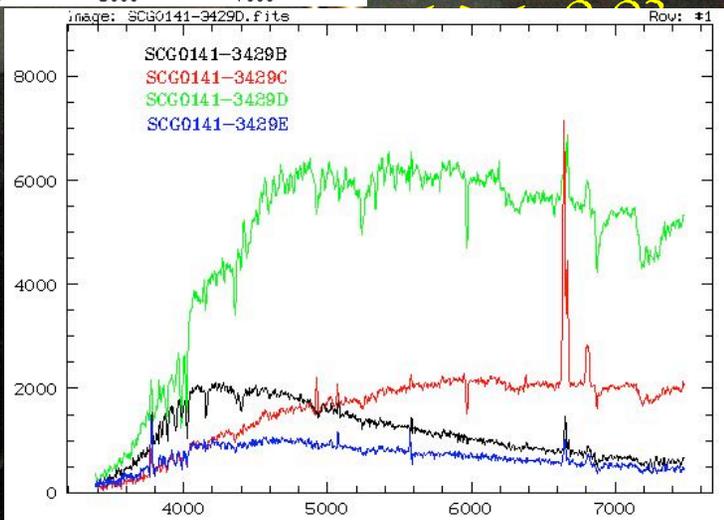
Southern Compact Groups at low z: observations and results



3.6m+EFOSC2



$\langle t_c \rangle \approx 0.051 H_0^{-1}$
 $\sigma_{3D} = 330 \text{ km/s}$
 $f_s = 0.69$
 $\delta\rho/\rho \sim 80$
 $R_c \sim 50 \text{ Kpc}$
 $\langle M \rangle = 7.7 \times 10^{12} M_\odot$
 $\langle M/L_B \rangle = 207$



Southern Compact Groups at low z: 3D-NTT

SCG0141-3429C

SCG0141-3429B

SCG0141-3429A

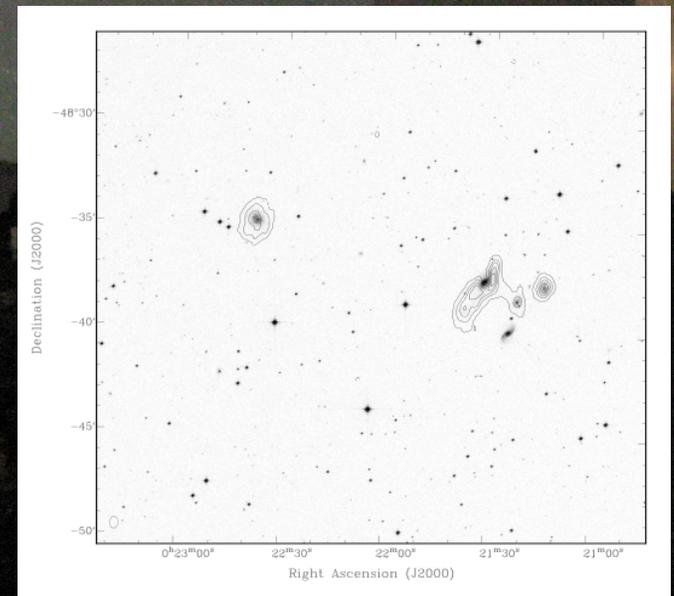
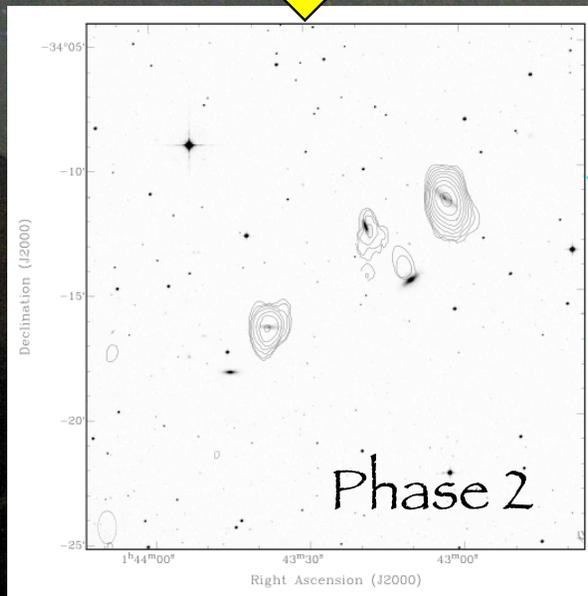
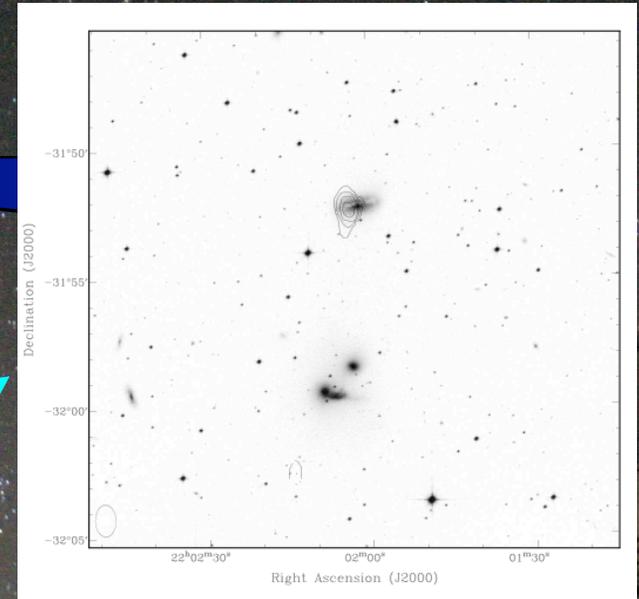
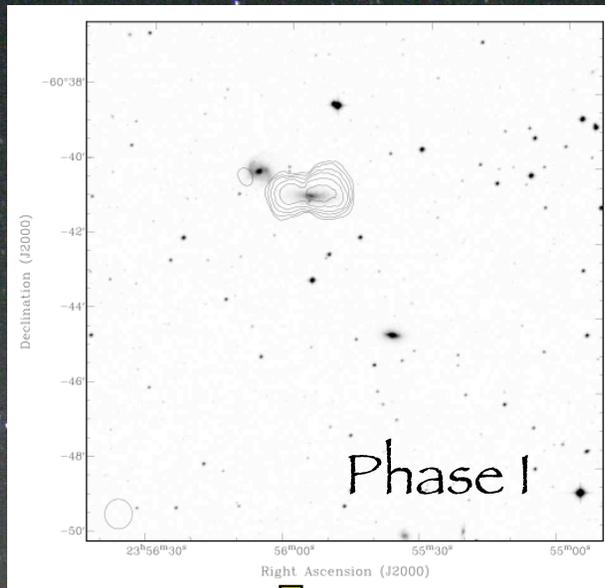
SCG0141-3429E

SCG0141-3429D

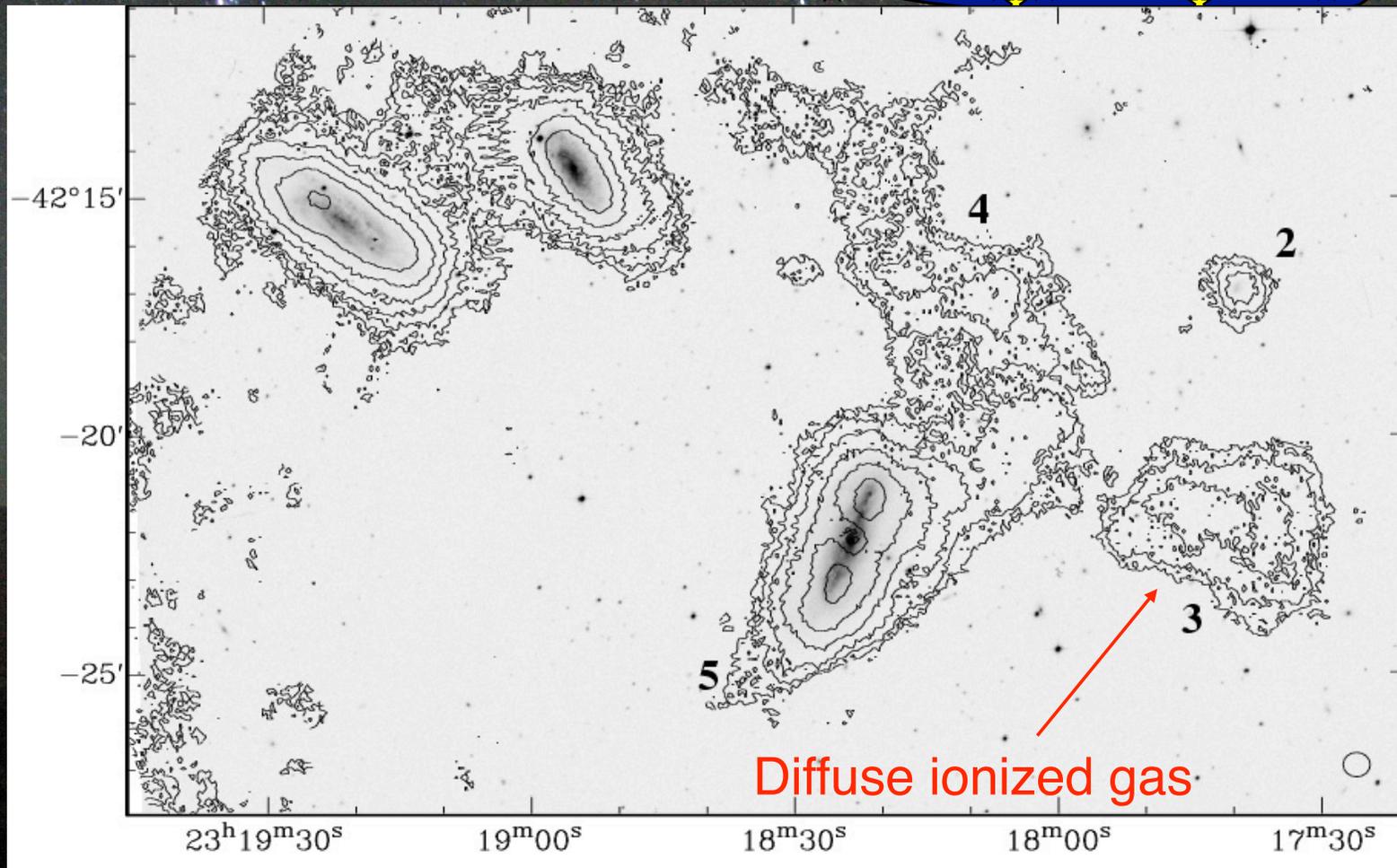
Gas kinematics vs ...



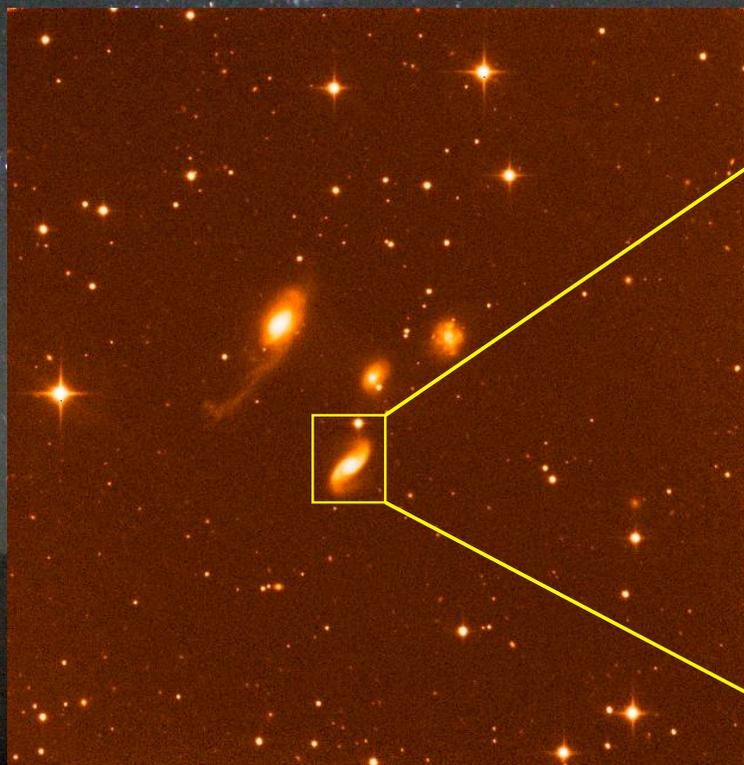
HI (ATCA)



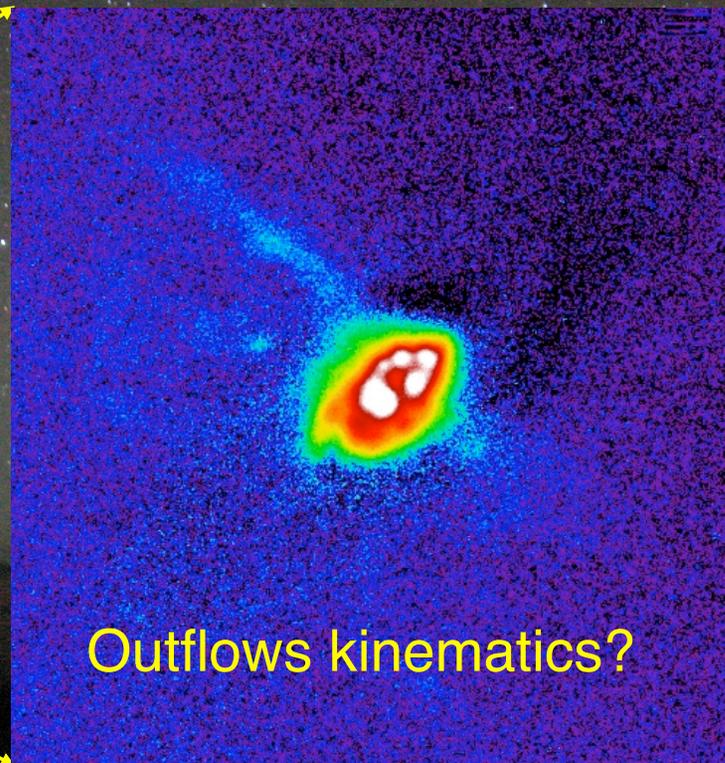
Southern Compact Groups at low z: 3D-NTT



Southern Compact Groups at low z: 3D-NTT

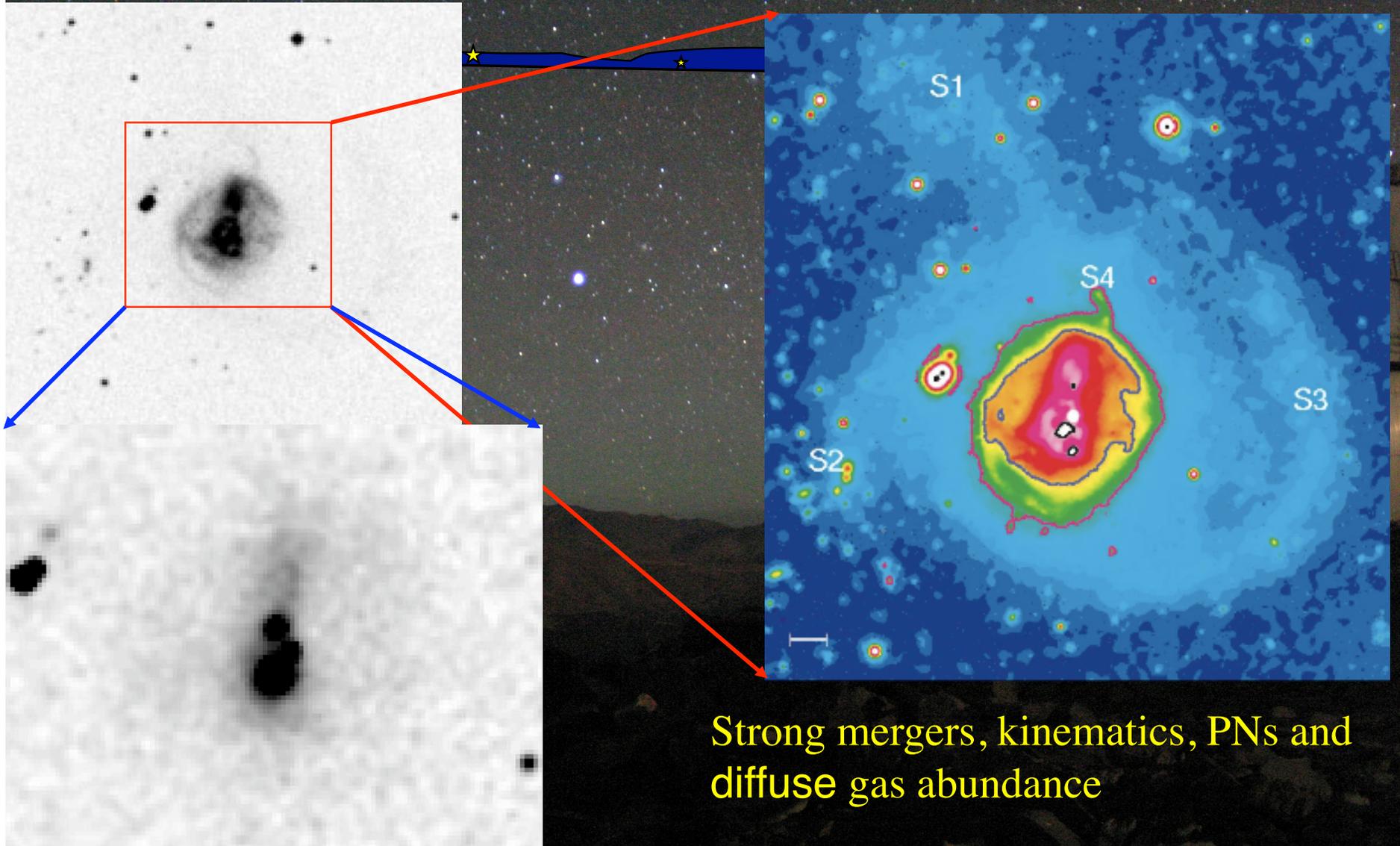


Danish 1.54m+DFOSC
Image (Pompei et al.,
2007)



VLT+FOR2 H α image
(Temporin et al., 2005;
Temporin et al., in prep.)

Southern Compact Groups at low z: 3D-NTT



Strong mergers, kinematics, PNs and diffuse gas abundance

Group lifetime:



$$\langle t_c \rangle (\text{SCGs}) = 0.051 H_0^{-1} \longleftrightarrow \sim 0.76 \text{ Gyr}$$

$$\langle z \rangle (\text{SCGs}) = 0.03 \longleftrightarrow \sim 0.43 \text{ Gyr}$$

Groups are still evolving!



So, let's go back in time...

Compact groups at high z : what's going on

★ Four main surveys: Las Campanas, 2dF, SLOAN and DPOSS II

★ Las Campanas: 76 compact groups from redshift survey, $\langle z \rangle \sim 0.08$

★ 2dF compact group survey: compact group catalog from redshift survey. $\langle z \rangle = 0.11$

★ SDSS compact group survey: compact group catalog from imaging and spectroscopic survey. $r_{\text{lim}}^* \approx 21$, $14 \leq r_{\text{brightest}}^* \leq 18$, $\langle z \rangle = 0.126$

★ DPOSS II compact group survey: 459 compact groups from a search on digitized DPOSS plates. $r \sim 21$, $16 \leq r_{\text{brightest}} \leq 17$, $\langle z \rangle = 0.13$ Spectroscopic follow-up in progress.

Compact groups at high z : DPOSS II survey

* Automated search of ~ 6200 sq. degrees of DPOSS II plates for small, high density groups

* Search criteria:

Richness: $n \geq 4$, with $\Delta \text{mag}_{\text{comp}} \leq 2$

Isolation: $R_{\text{isol}} \geq 3 \times R_{\text{gr}}$

Compactness: $\mu_{\text{gr}} < \mu_{\text{limit}}$; $\mu_{\text{limit}, r} = 24$

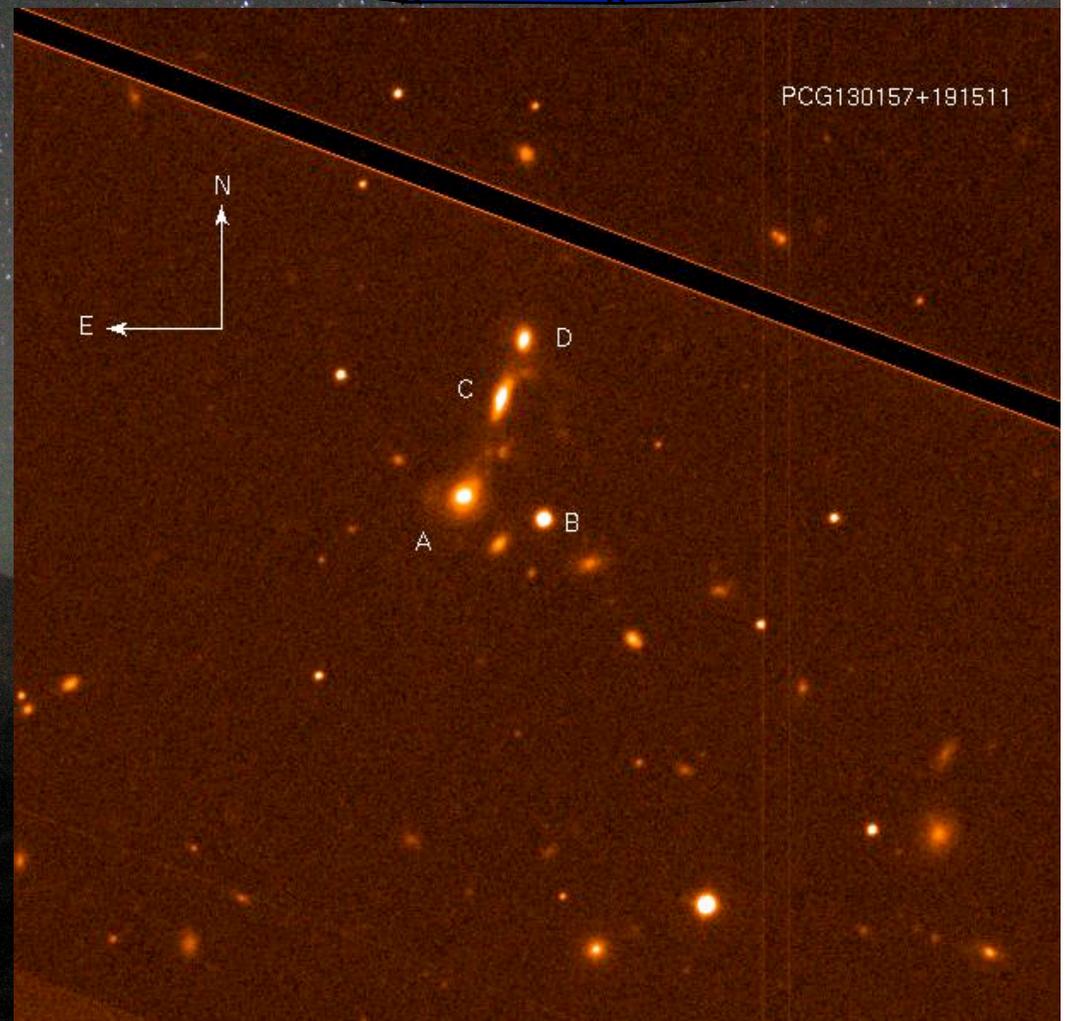
* Found:

459 candidates, with:

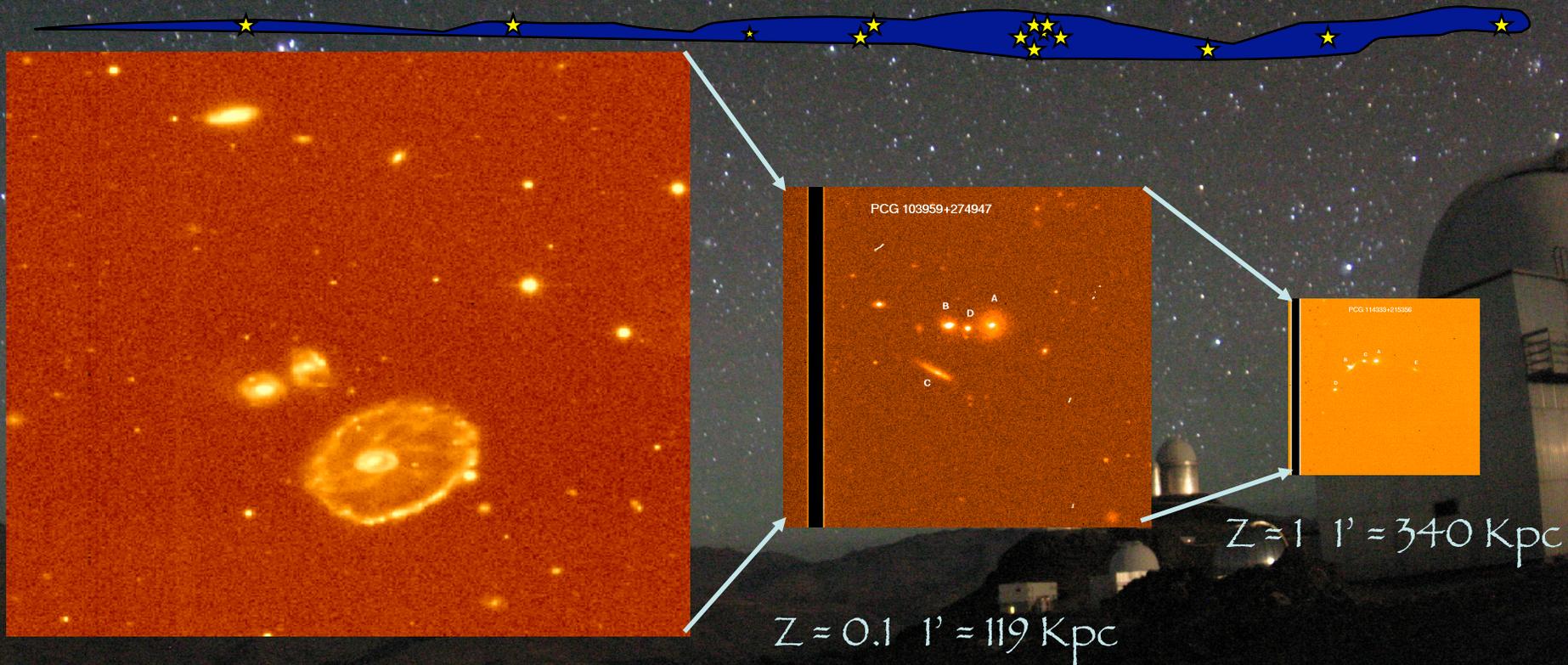
$\langle z \rangle \approx 0.13$, extending out to $z \sim 0.2$

and an expected contamination:

$N_{\text{random}}/N_{\text{real}} \approx 10\%$



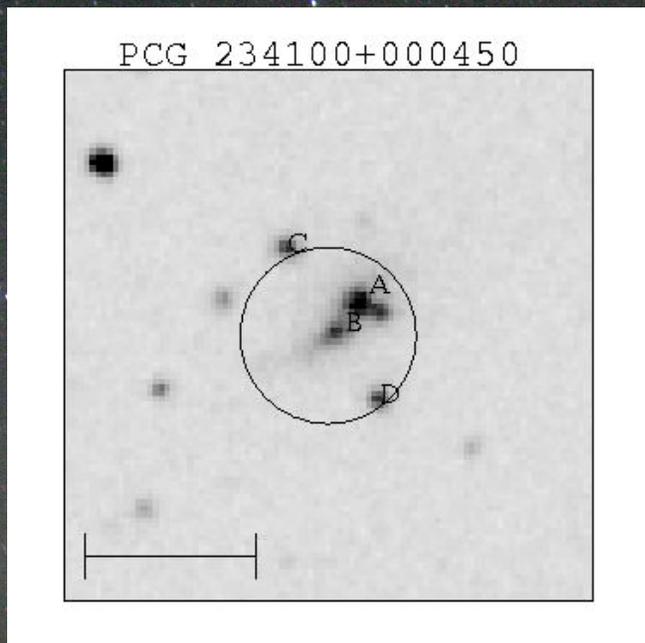
Compact groups at **high** z : $z \sim 0.2$ \longleftrightarrow 2.5 Gyr



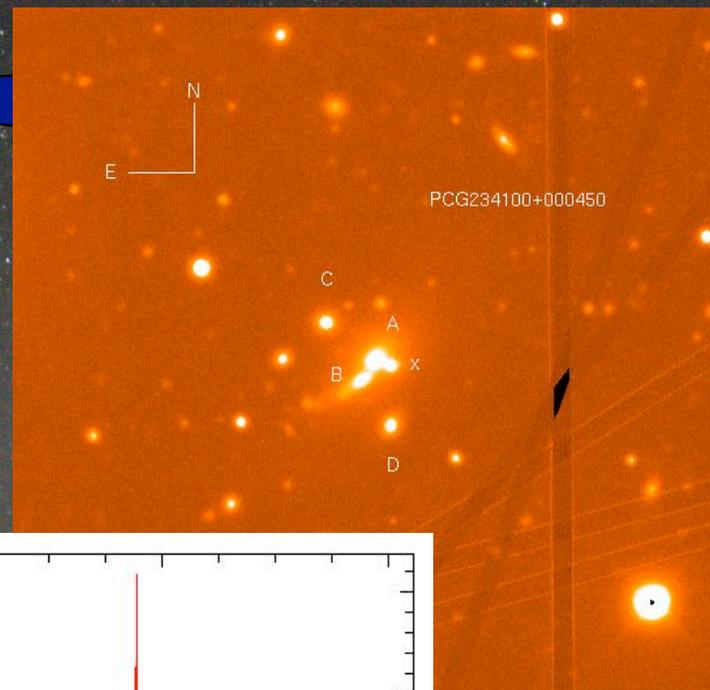
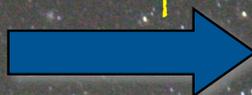
$Z = 0.01$ $1' = 13$ Kpc

$\langle R_{\text{group}} \rangle \div 50-70$ Kpc
IT'S DIFFICULT TO FIND COMPACT GROUPS!

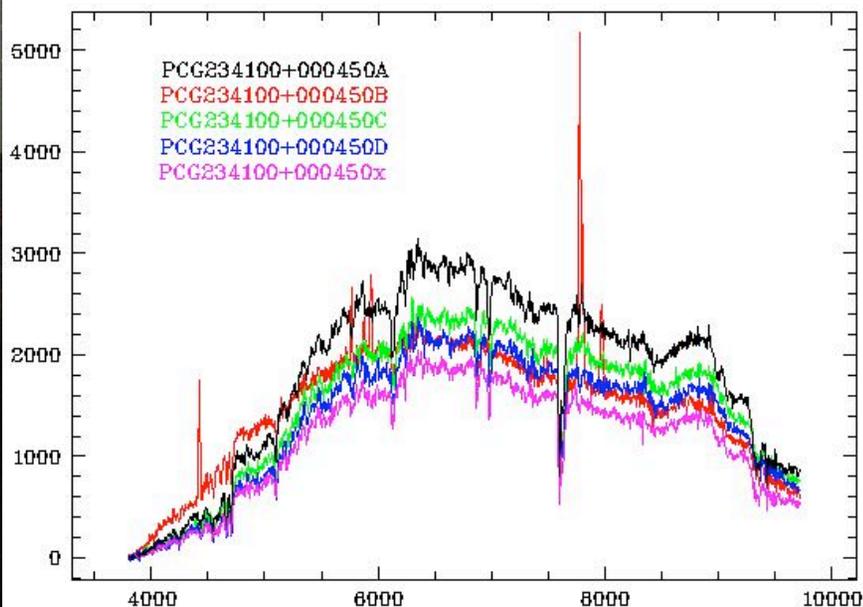
Compact groups at high z: the DPOSS II Compact Groups survey



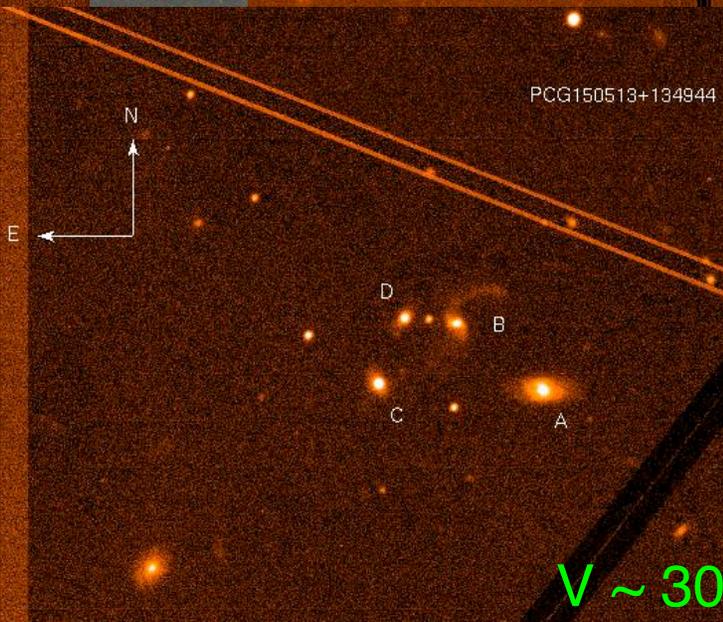
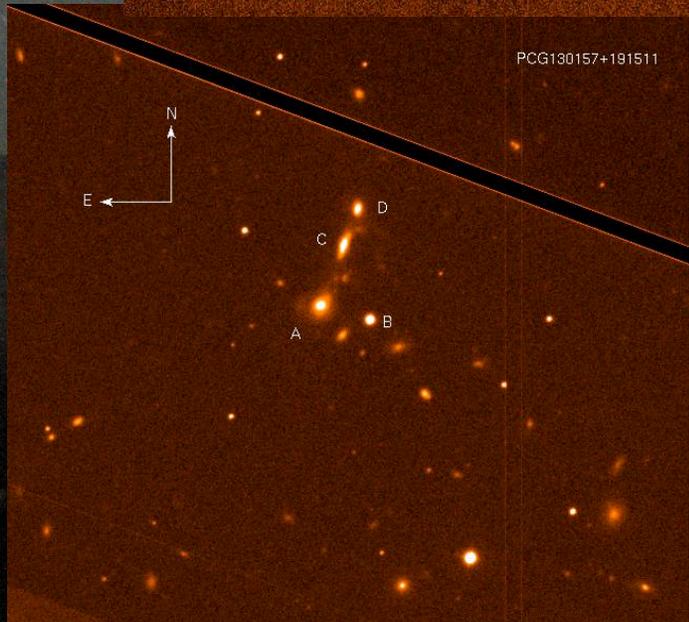
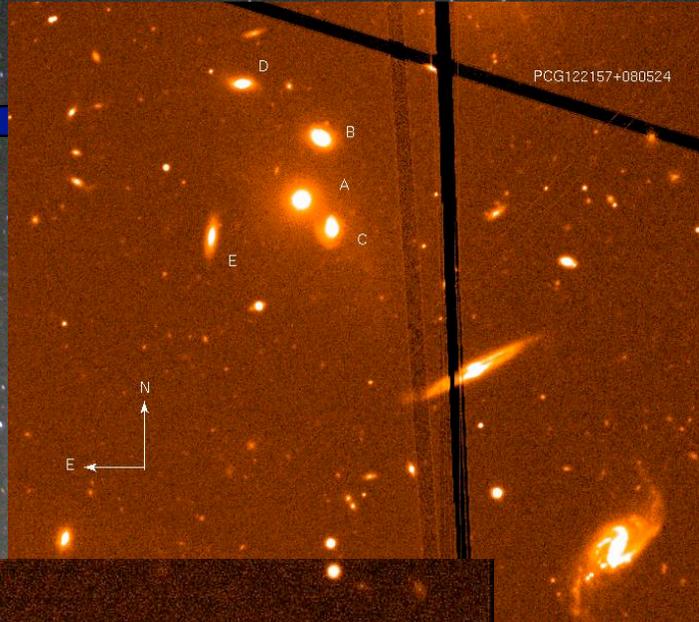
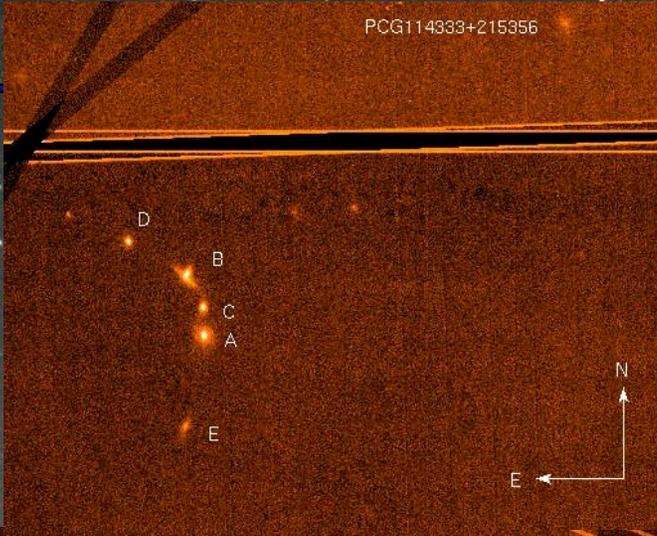
NTT+EMMI
spectroscopic
follow-up



65% concordant groups
 $\sigma_{3D} = 299 \text{ km/s}$
 $\langle t_c \rangle = 0.018 \text{ H}_0^{-1}$
 $\delta\rho/\rho \sim 80$
 $R_c \sim 50 \text{ Kpc}$
 $\langle M \rangle = 4.5 \times 10^{12} M_\odot$
 $\langle M/L_B \rangle = 92$
 $\langle z \rangle = 0.12 \pm 0.06$



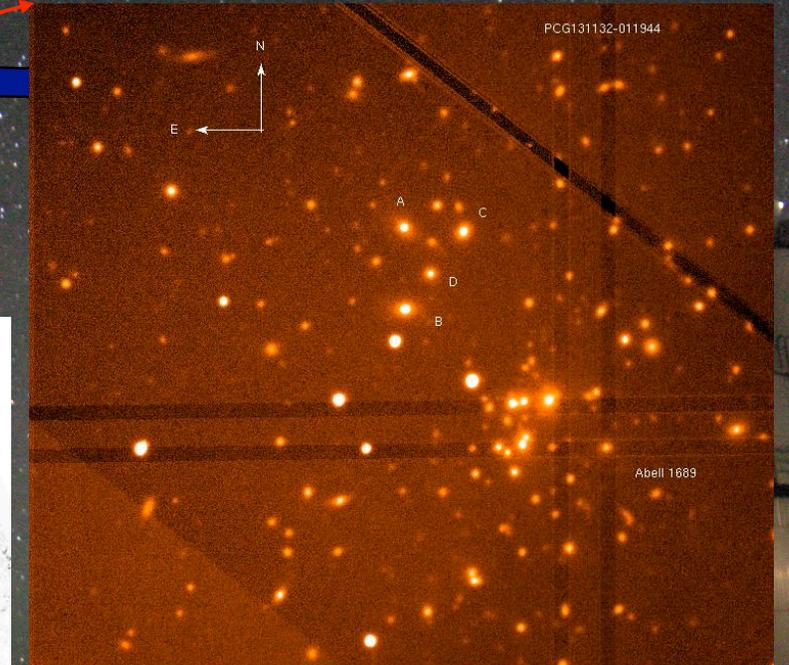
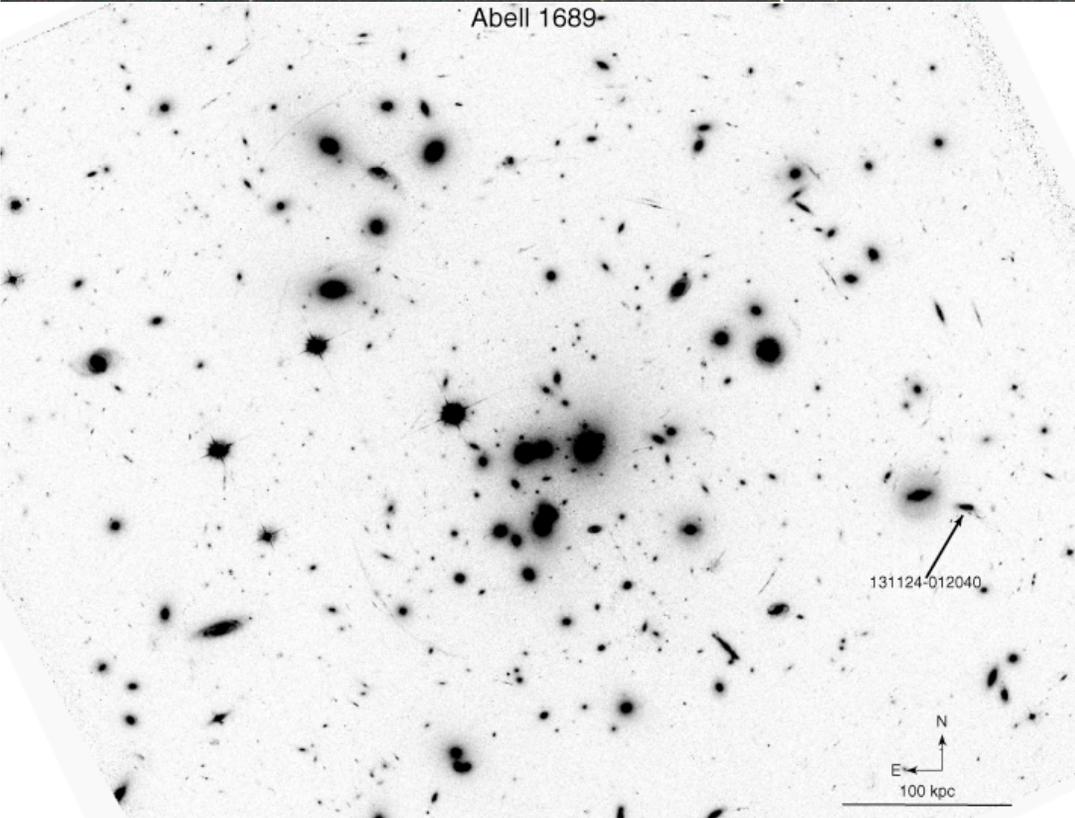
Distant compact groups: group kinematics and...



$V \sim 30000-45000$ km/s

..... the infall business

$Z=0.1832$



EMMI-DPOSS survey
(Pompei et al., 2008)

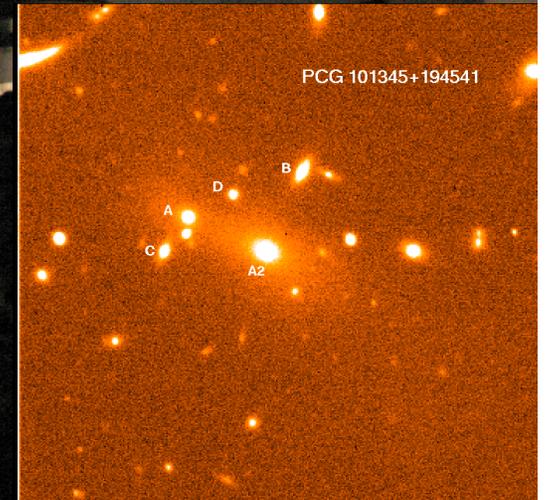
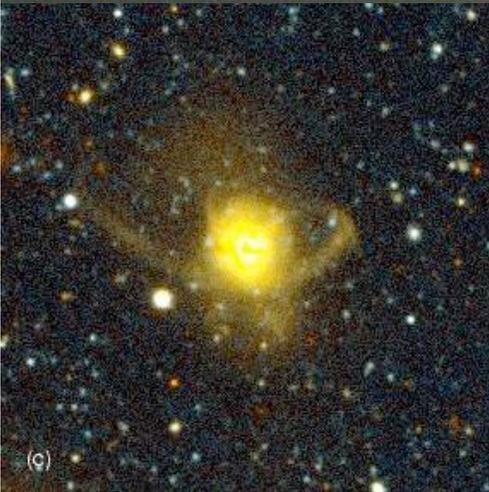
Abell 1689, Cortese et al, 2007)

Compact groups: final destiny (?)

Loose group of galaxies

Corethalo system

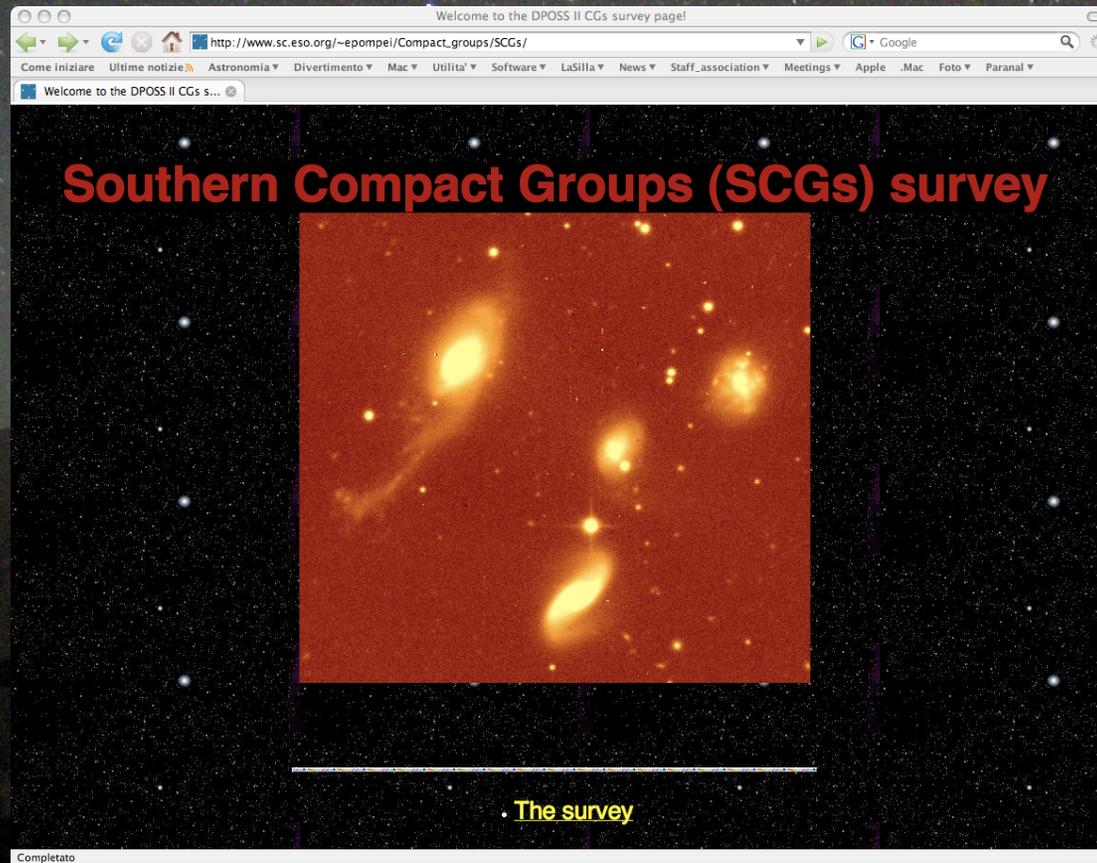
Compact group



Compact groups: **want to know more?**

http://www.sc.eso.org/~epompei/Compact_groups/SCGs

http://www.sc.eso.org/~epompei/Compact_groups/DPOSS/



1989 ~ 2009: 20 years of NTT

1979 ~ 2009: 30 years of 3.6m ★★



Celebrating half a century of
Astronomy in La Silla



conference

~ February 2009