A survey of globular cluster kinematics in early-type galaxies

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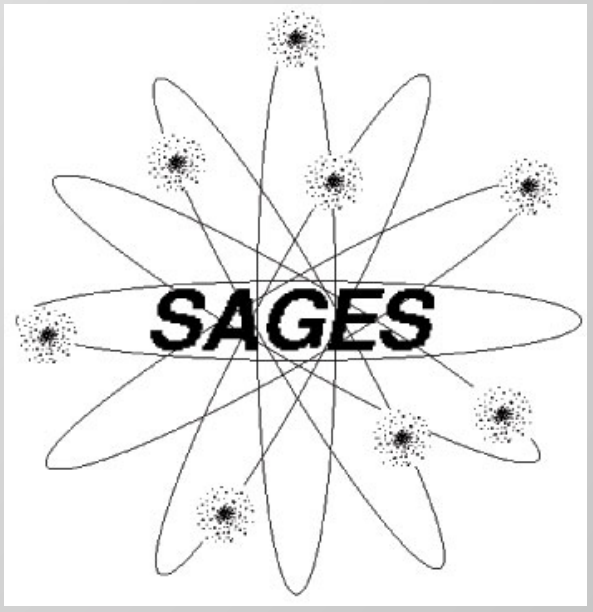


Outline

- Globular clusters kinematics

- Galaxy sample

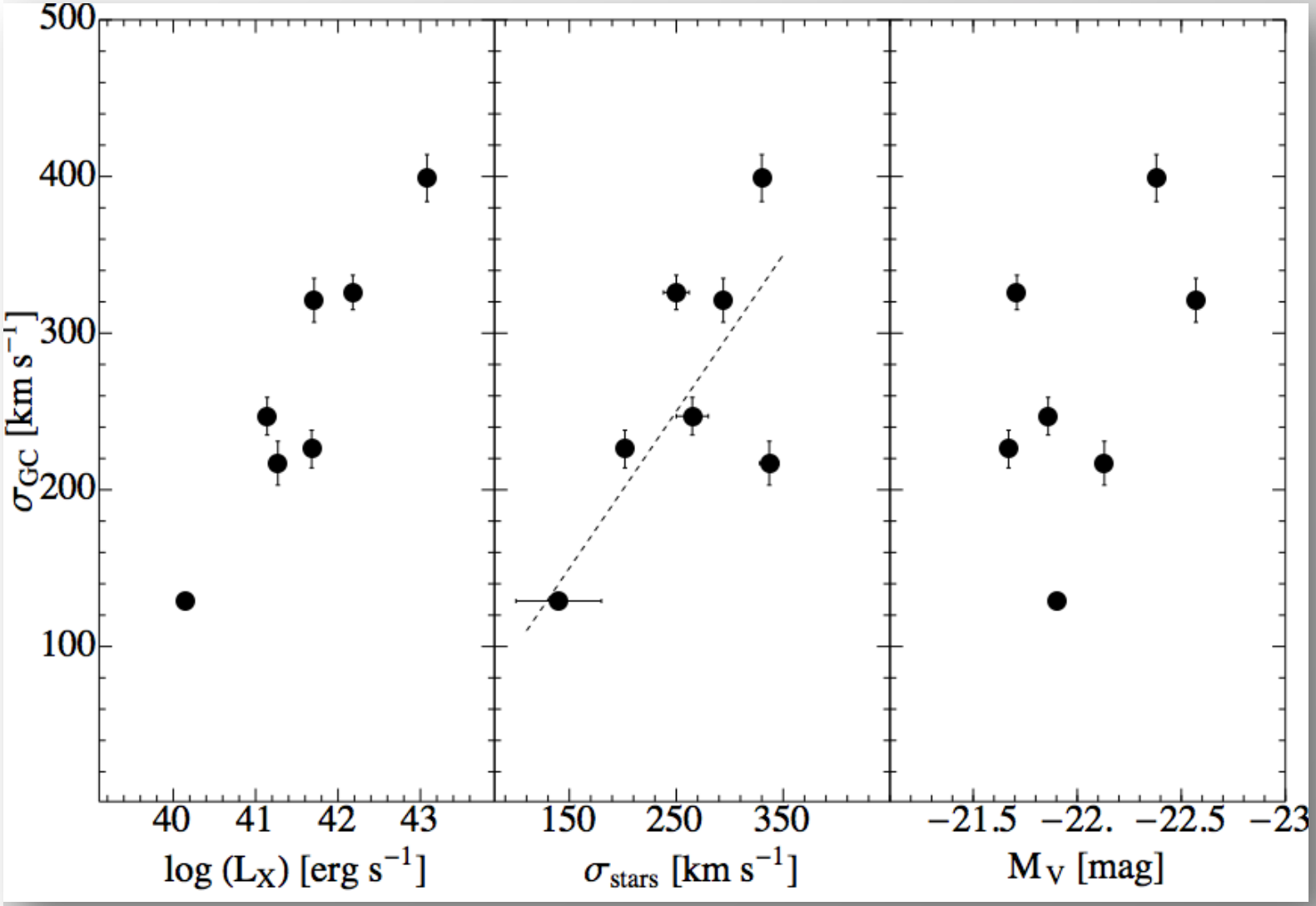
- Results

-Conclusions

State of the art of the globular cluster kinematics

NGC 1407, Romanowsky+09
NGC 4636, Lee+10
NGC 1399, Richtler+04
NGC 5128, Woodley+07

M60, Lee+08
M87, Côté+01
M49, Côté+03



Observations come from different instruments with an heterogeneous method of analysis.

Poor model predictions (mostly qualitative).

Major merger scenario (Ashman & Zepf 1992)

The angular momentum would be transported to the outer regions during the merger. Blue GCs are expected to rotate faster then red GCs in the external regions.
The velocity dispersion for both the blue and the red decreases with the galactocentric radius (Bekki et al. 2005).

Multiphase dissipational collapse scenario (Forbes et al 1997)

Blue GCs show no rotation and a high-velocity dispersion, while the red GCs show some rotation depending on the degree of dissipation in the collapse.

Accretion scenario (Côté et al. 1998)

The blue GCs are expected to have radially biased orbits rather than isotropic or tangentially biased orbits, and are also expected to show no rotation (Richtler et al. 2004).

High resolution N-body simulations + semi-analytic models (Bekki et al. 2008).

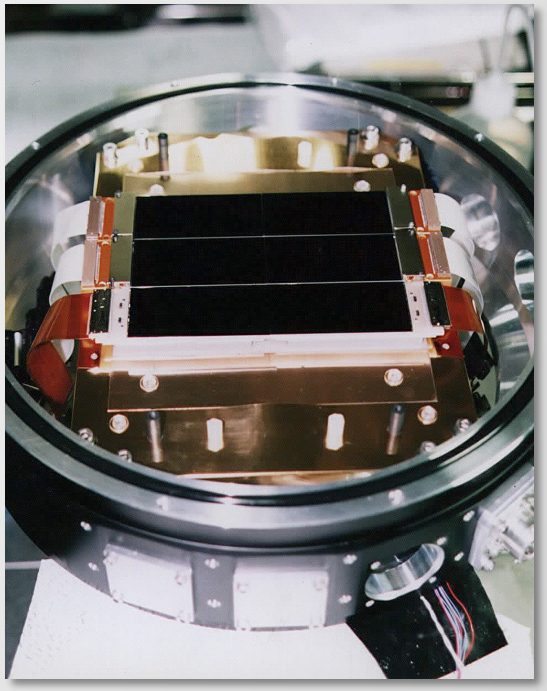
σ_{Blue} , σ_{Red} increase with galaxy luminosity

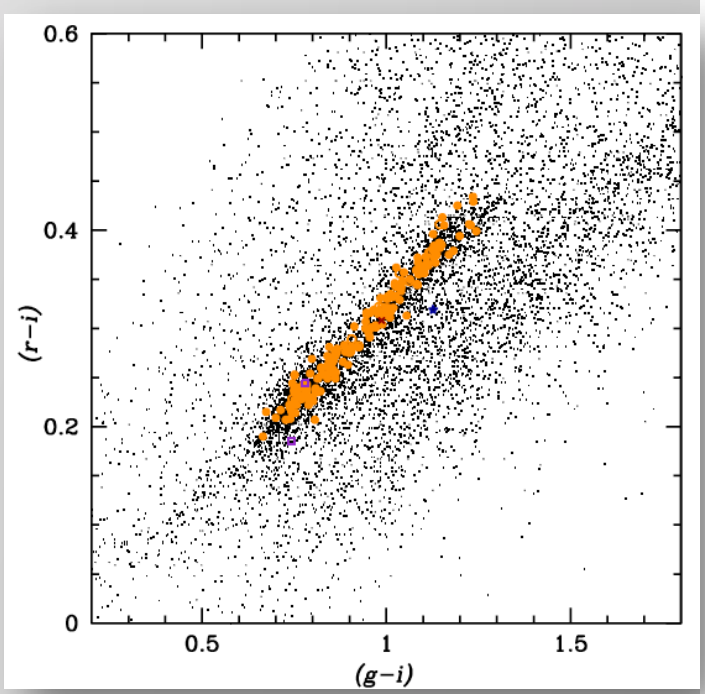
$\sigma_{\mathrm{Blue}} / \sigma_{\mathrm{Red}} \sim 1$

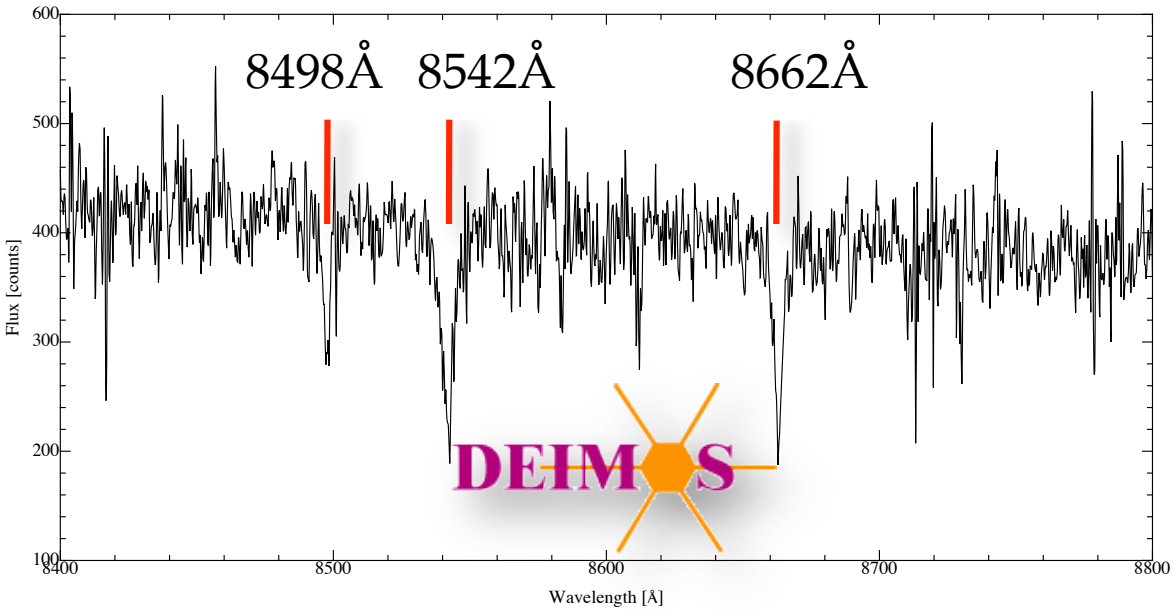
$V_{\mathrm{rot}} / \sigma < 0.3$

Subaru/Suprime-Cam

Field of view ~ 34′ × 27′





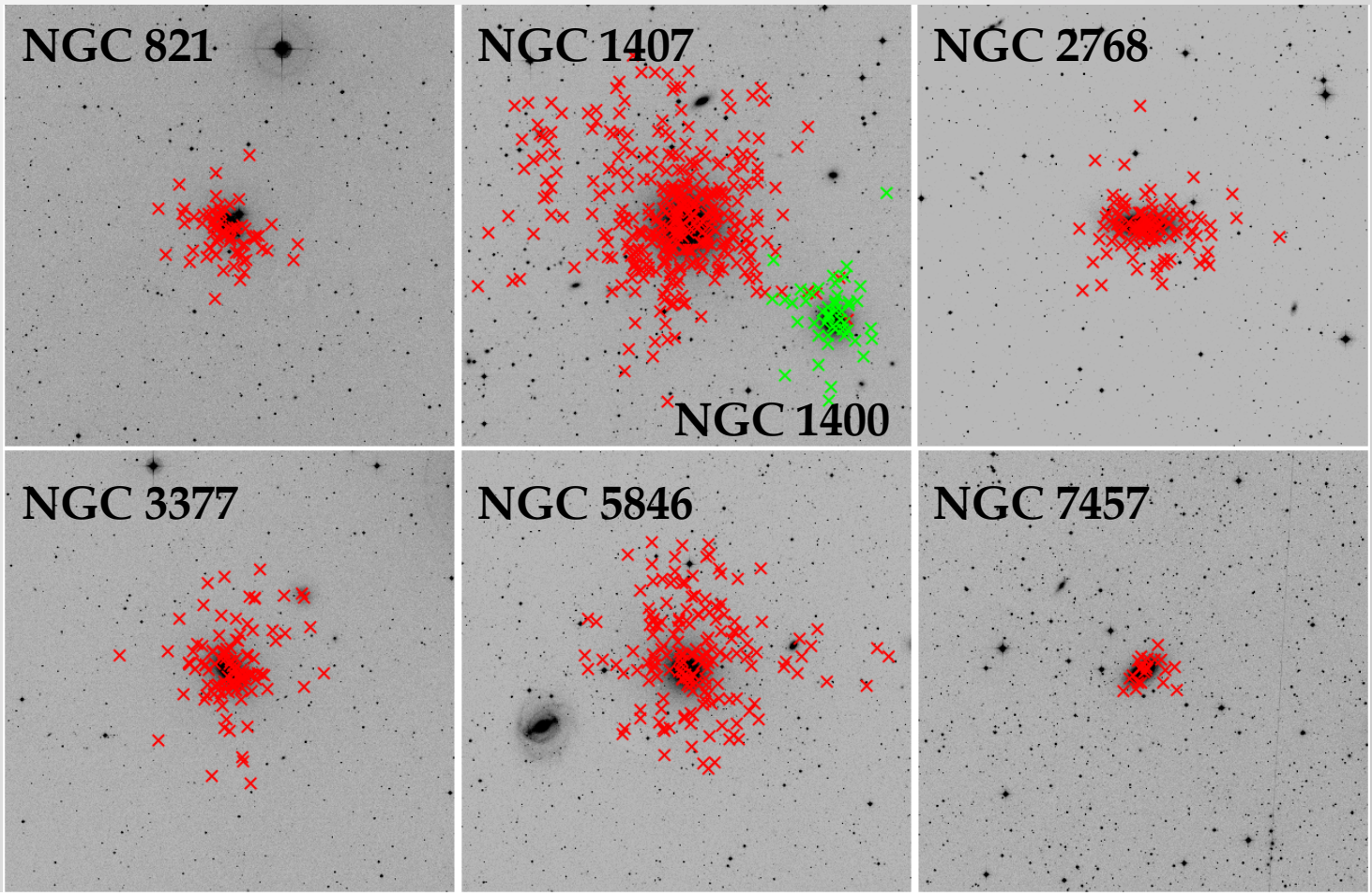


Keck/DEIMOS

Field of view of ~ 16′ × 5′ with ~0.5 Å/px

Accuracy of 5-10 km s^{-1}

Galaxy ID	Hubble Type	V_{sys} [km s^{-1}]	R_{eff} [arcsec]	D [Mpc]	$(m-M)$	M_K [mag]	PA_{phot} [degree]	$(b/a)_K$	N_{GC}
NGC 0821	E6	1735	50	23.9	31.9	-24.5	30	0.62	68
NGC 1400	E0	558	29	26.4	32.1	-24.6	35	0.90	50
NGC 1407	E0	1779	70	28.8	32.3	-25.7	60	0.95	346
NGC 2768	S0	1373	64	22.4	31.7	-25.3	93	0.46	107
NGC 3377	E6	665	34	4.7	28.3	-24.6	47	0.58	110
NGC 5846	E0	1714	63	24.9	32.0	-25.5	35	0.92	195
NGC 7457	S0	812	32	13.2	30.6	-24.1	125	0.54	21

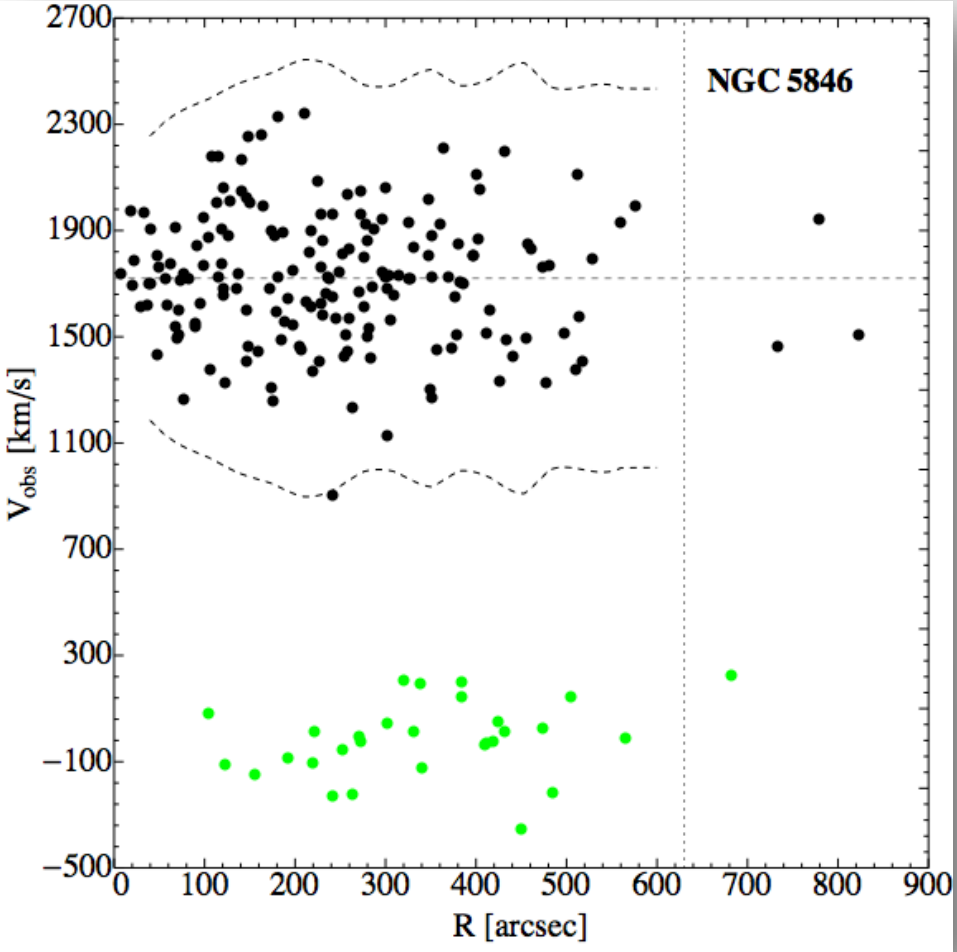


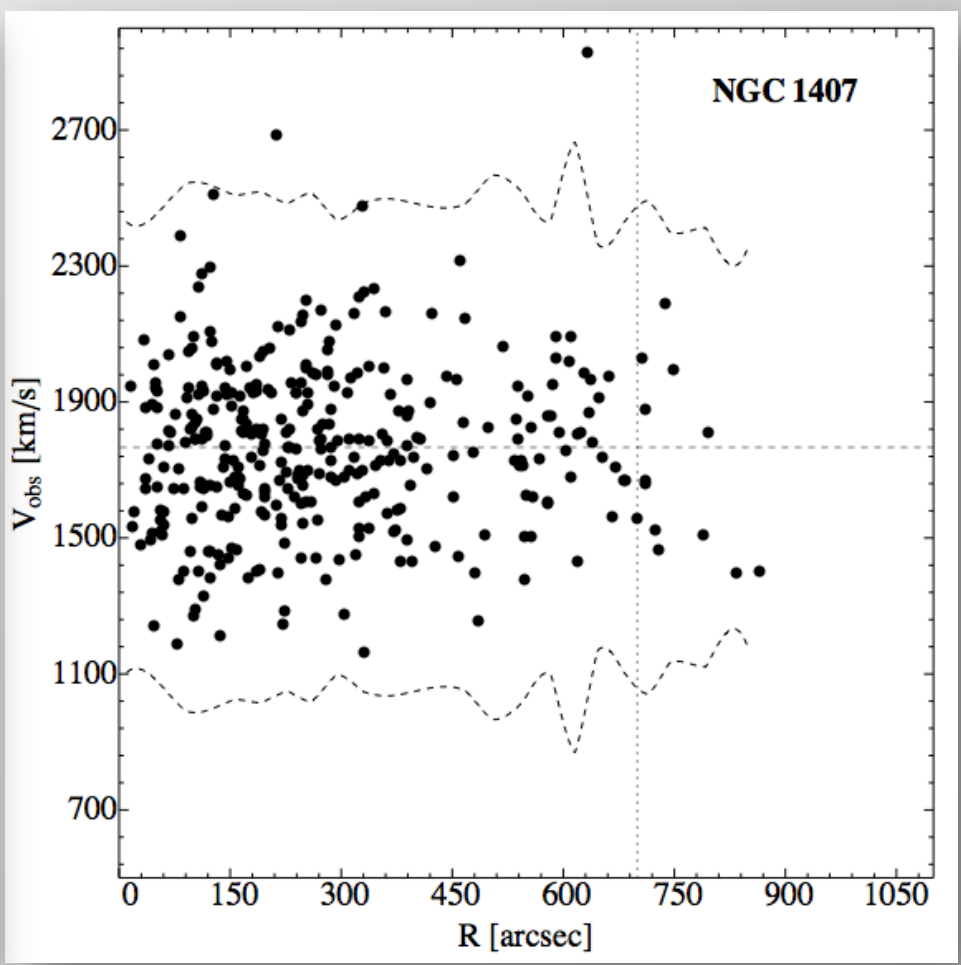
30 DEIMOS masks

50 hours of Keck time

30 hours of Subaru time

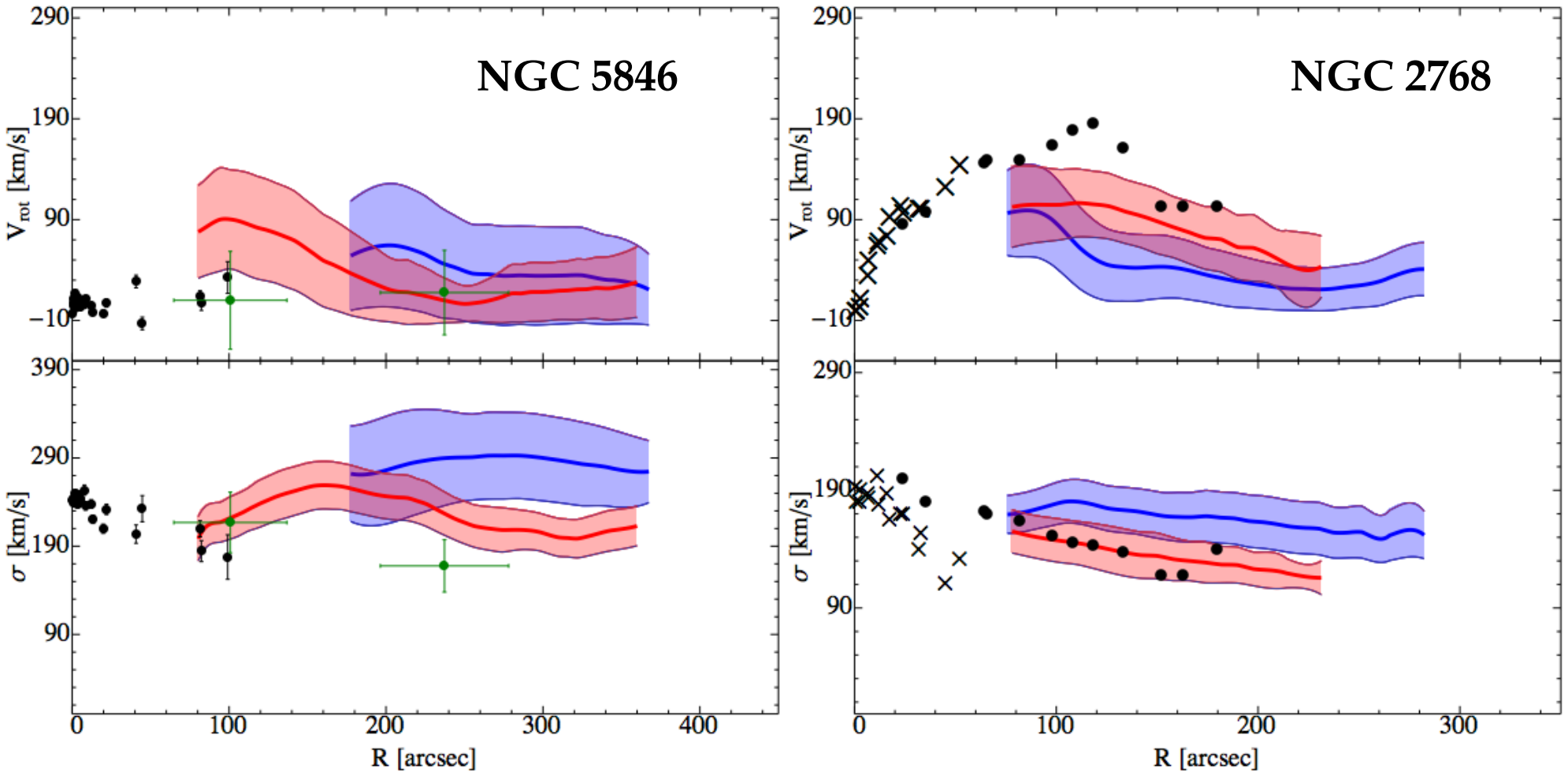
RESULTS: Velocity vs Radius



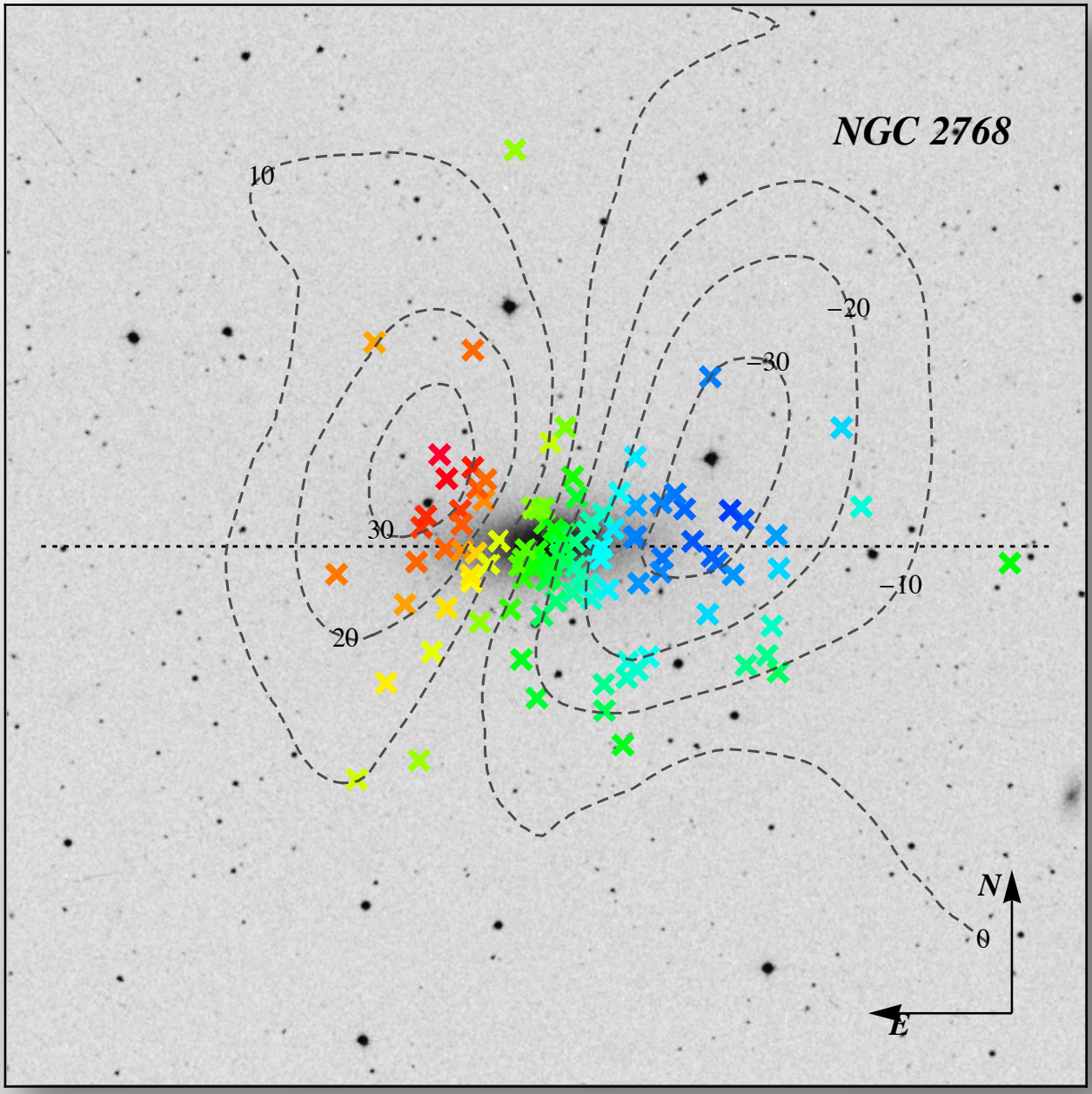


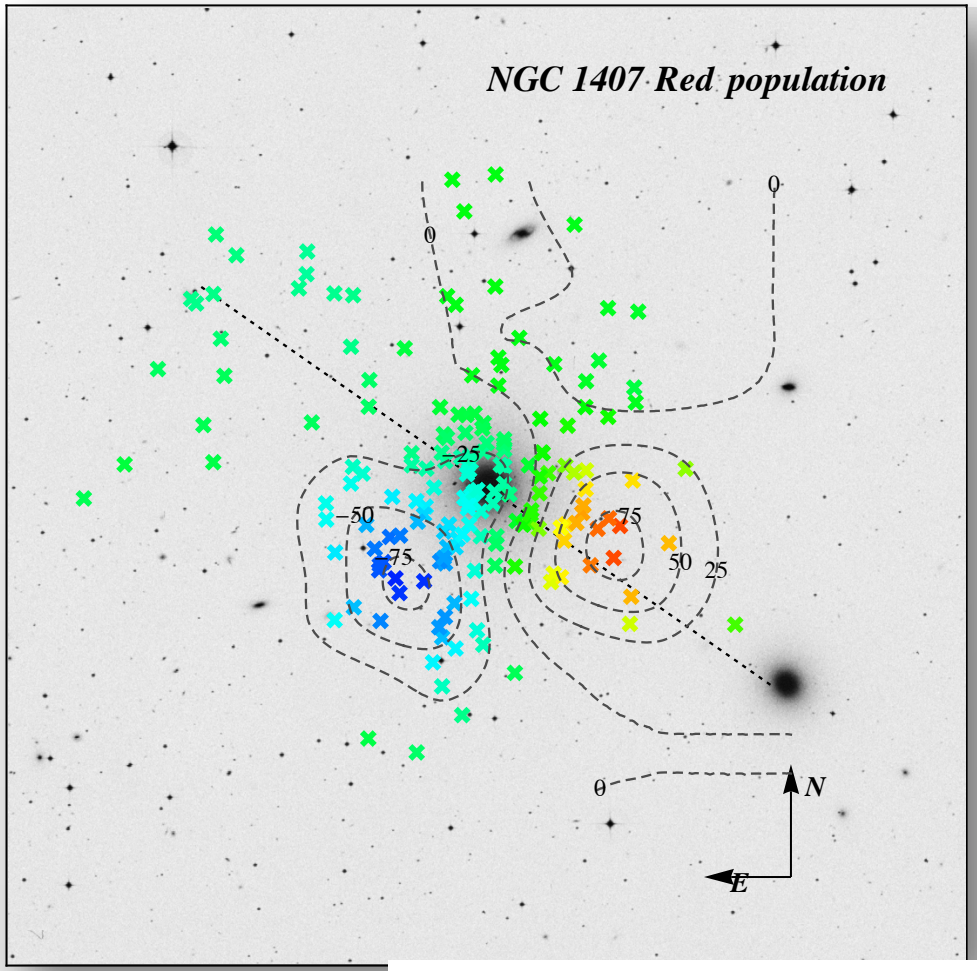
Coverage at large radii for all the galaxies $5 < R_{eff} < 12$

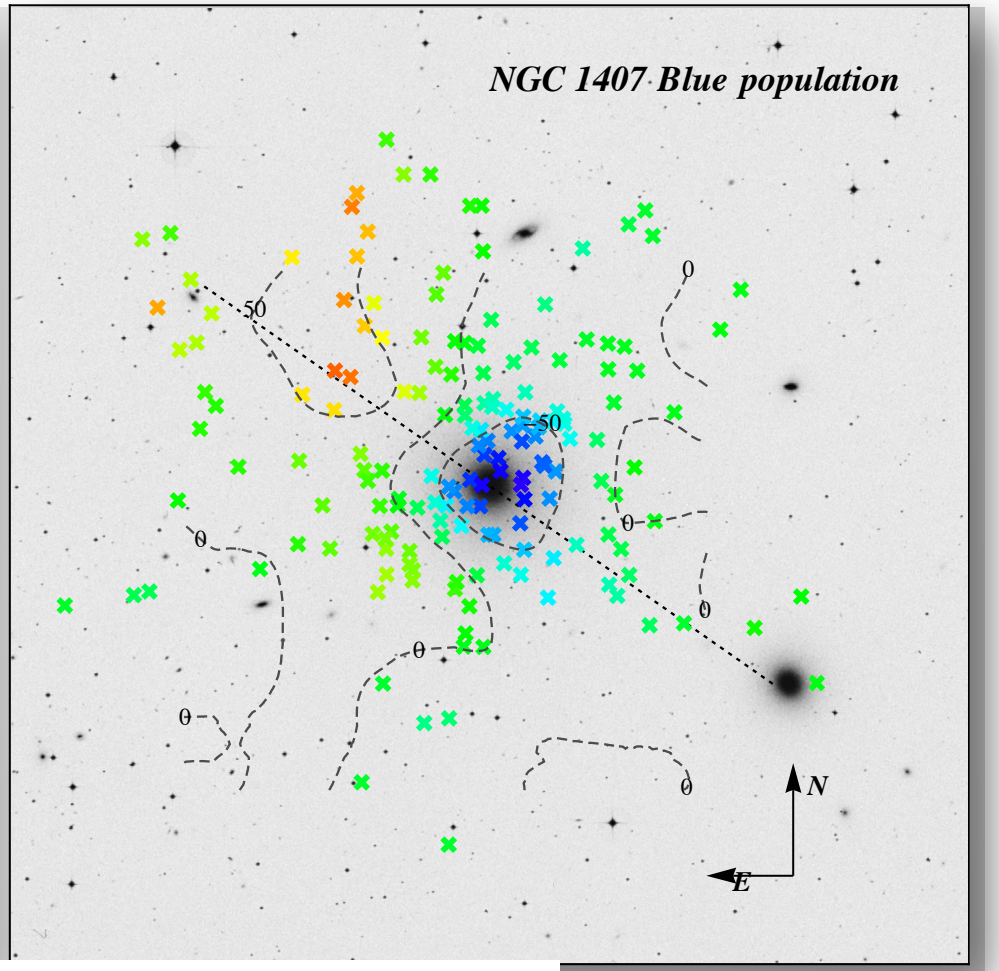
RESULTS: Kinematic radial profiles

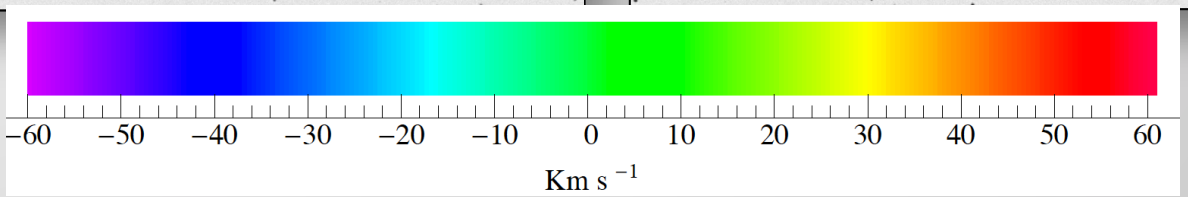


RESULTS: 2D Smoothed Velocity profiles









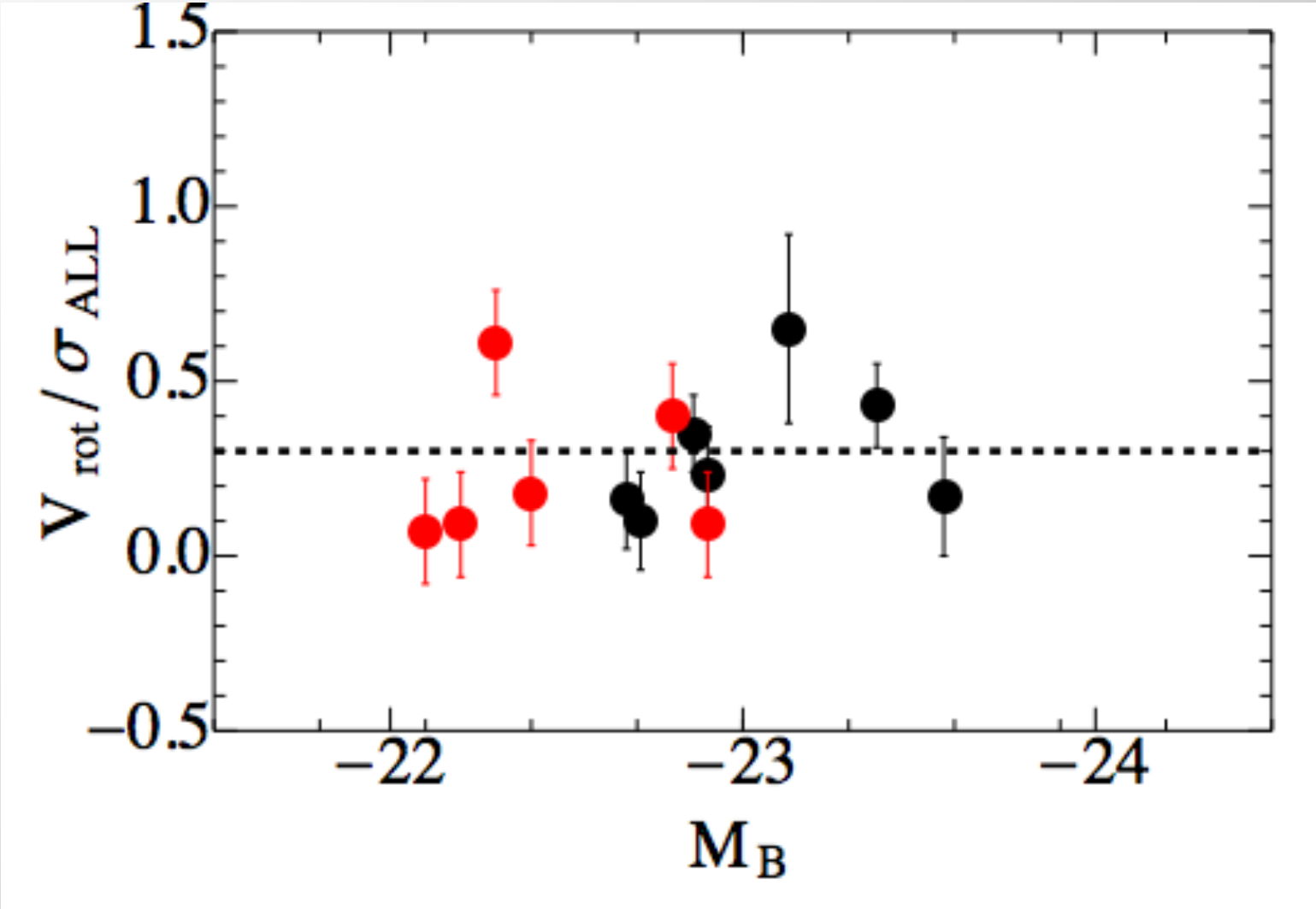
NGC 1407. Rotation produced by the metal-rich GCs close the major axis.

No clear rotation at large radii.

Evidence for a cold moving group of metal-poor (Romanowsky et al. 2009). Signature of a recent disruption of a disk galaxy?

RESULTS: GC kinematics vs. galaxy global properties II

Comparison with Bekki et al. 2008 (cosmological simulation) shows a good agreement but poor coverage at low masses.



Conclusions

• We doubled the GC kinematic sample in literature and new data are coming soon.

• Hint of rotation in the inner regions but NO rotation in the outskirt.

• We confirm the strong correlations of the host galaxy quantities (L_X, σ and M_V) with the velocity dispersion of all the GCs showing that it is an excellent tracer of the galaxy (and DM) halo.