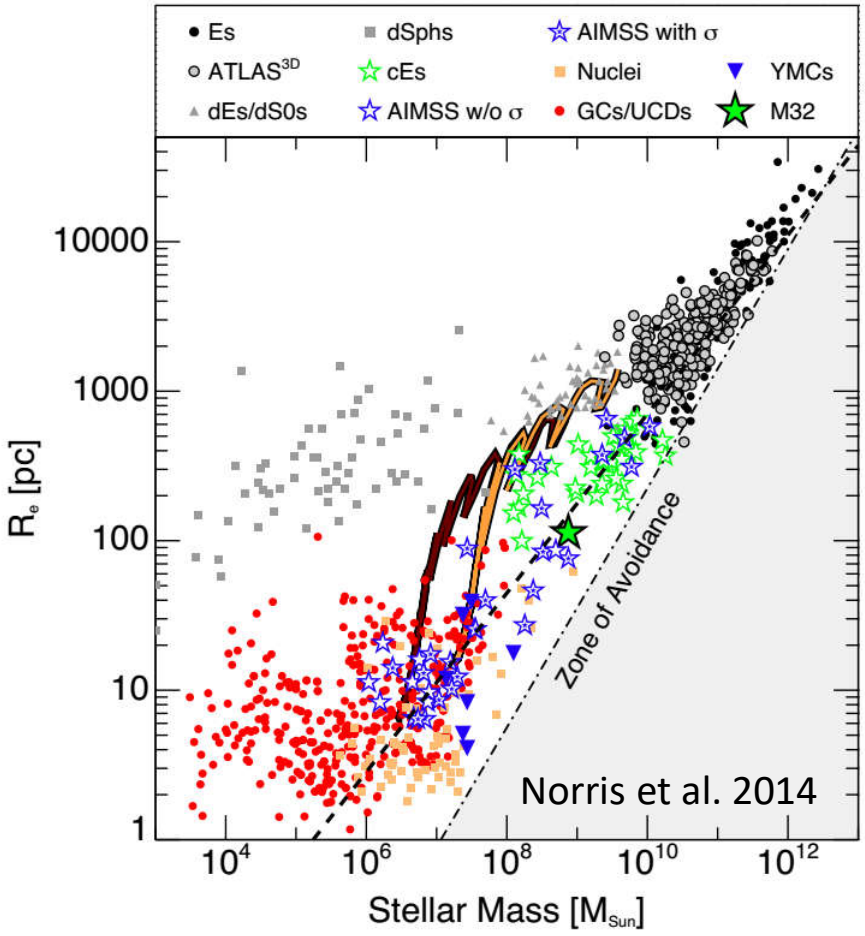
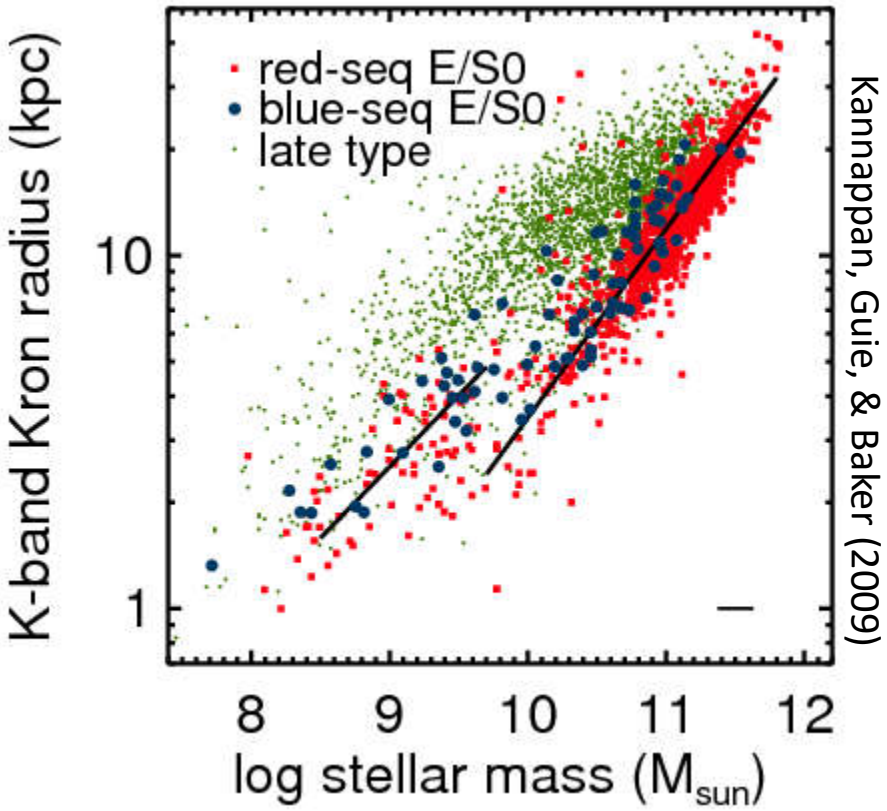
Galaxies as a Population IV

ASTR 503/703

The Mass-Radius Relation

dE/cE split at threshold scale?

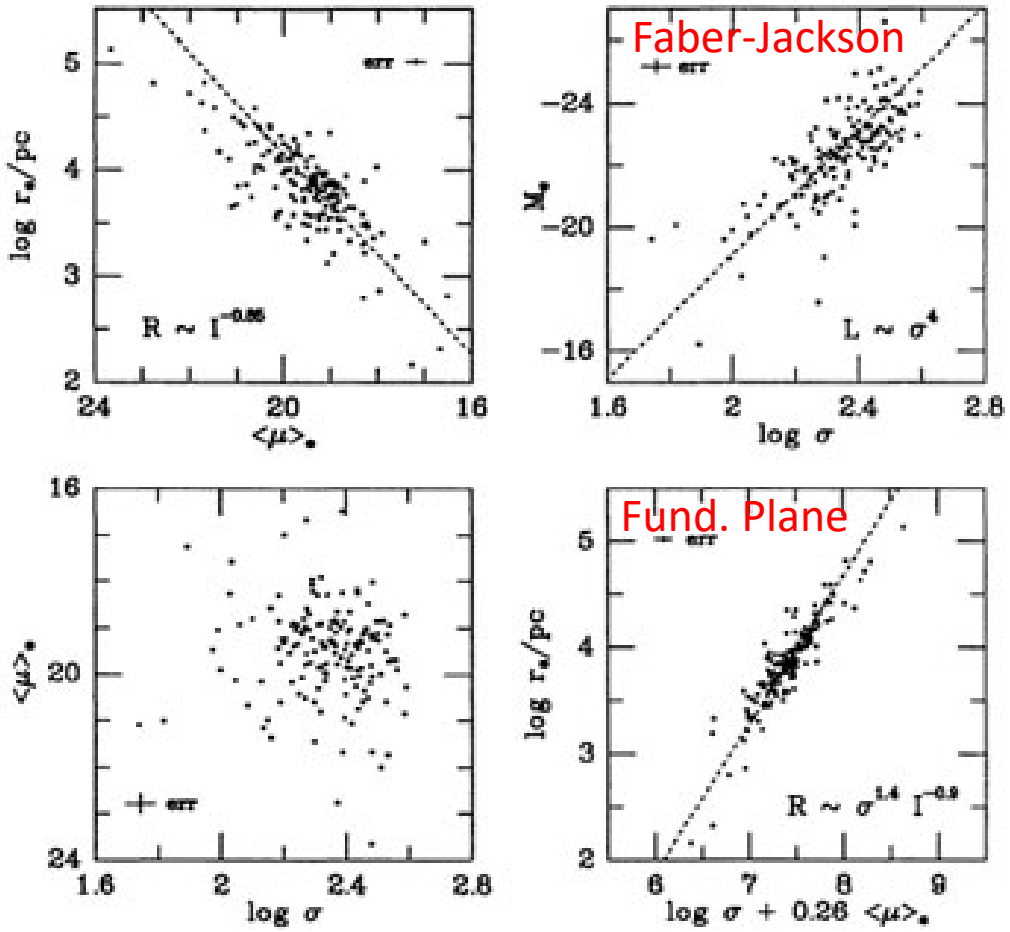




blue E/S0s like dEs?
catalog K-band radii not reliable, revisit

The Faber-Jackson Relation & the Fundamental Plane

(not Fundamental Metallicity Relation of class I)



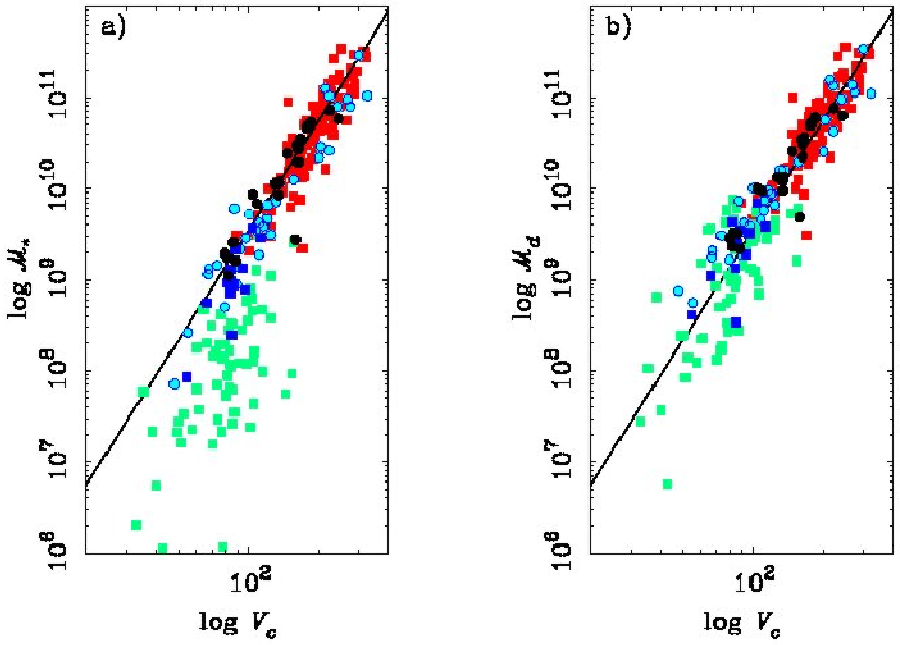
Kormendy ARAA 1989: data from Djorgovski & Davis 1987

- To first order get Faber-Jackson from Virial Theorem (prove it, assuming homology)
- Fundamental plane combines surface brightness μ, half-light radius r_e, and velocity dispersion σ (luminosity L is related to μ and r_e)

The Tully Fisher Relation

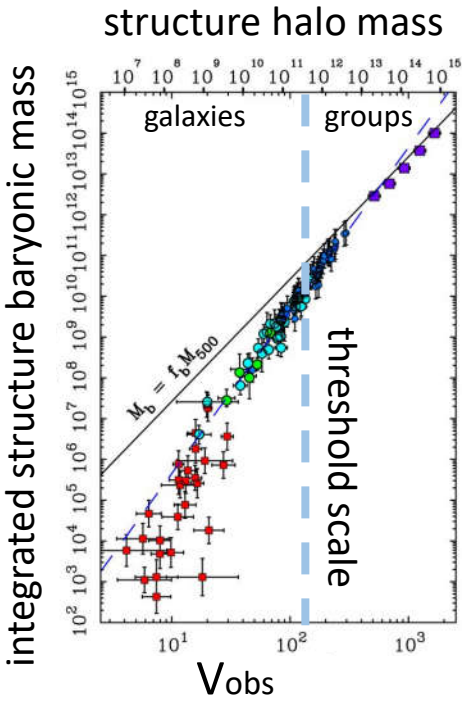
Baryonic Tully-Fisher Relation

(McGaugh et al. 1999)



Extended to larger structures

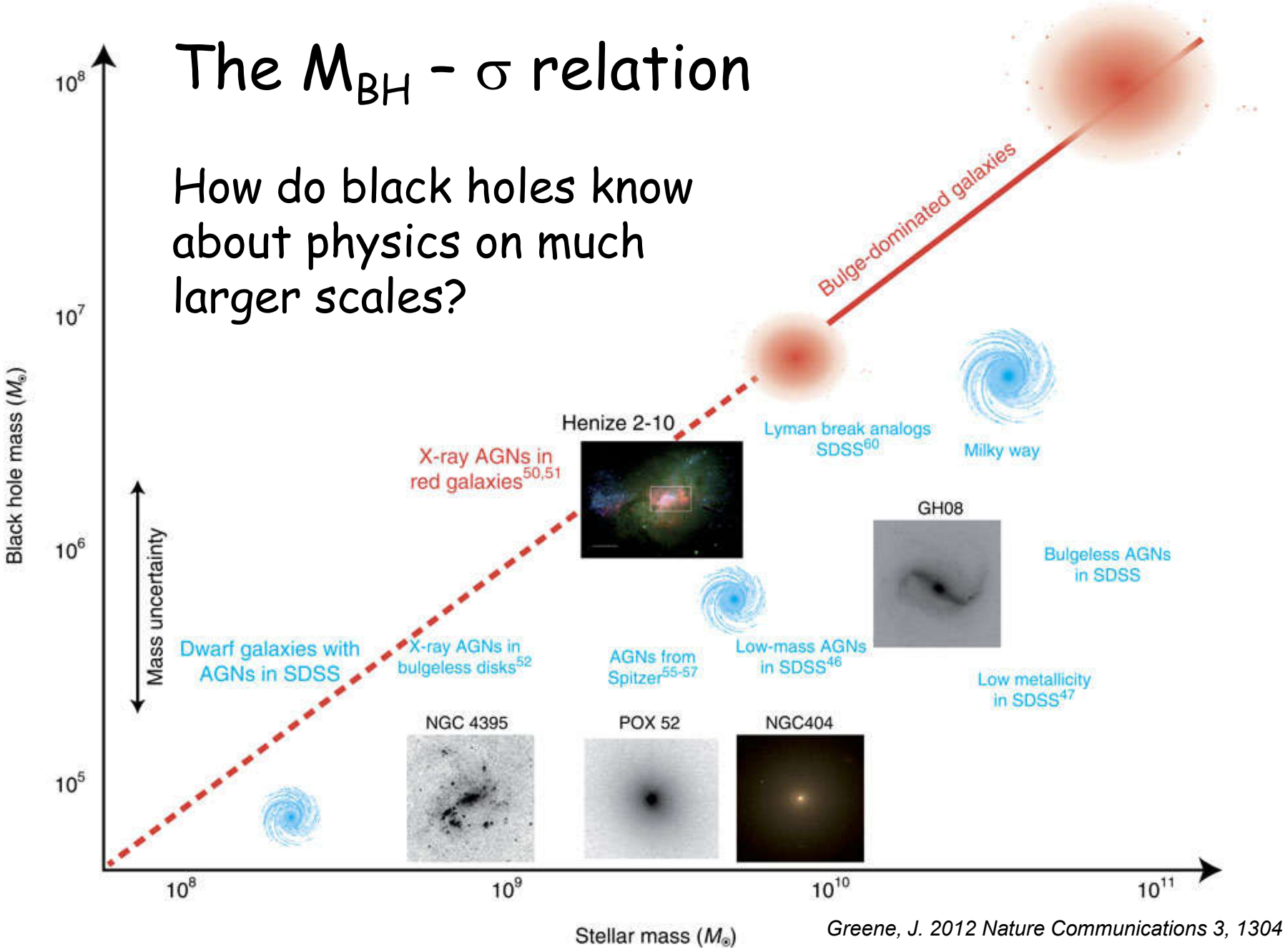
(McGaugh+ 2010)



- Intensifies puzzle of original Tully-Fisher relation (L-Vrot relation): why no surface brightness dependence?
- Also ties in w/ Missing Baryons Problem – why is gas missing in precisely the "gas rich" regime?

The M_{BH} – σ relation

How do black holes know about physics on much larger scales?



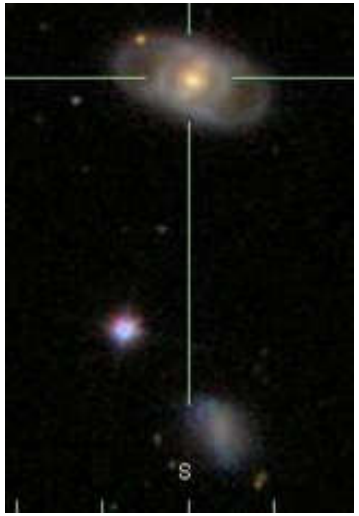
Greene, J. 2012 Nature Communications 3, 1304

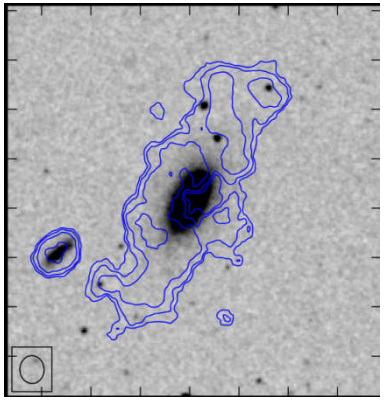
Outliers are interesting!

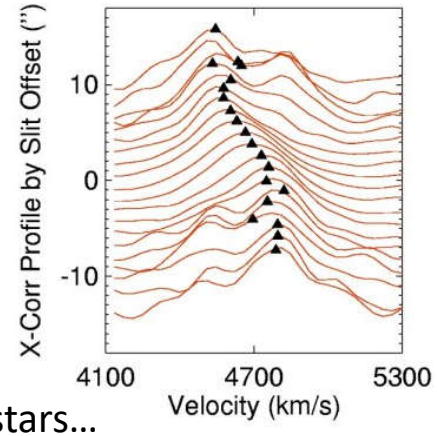
Why should we pay attention to rare phenomena?

- We see "stills" in the cosmic movie. We can't readily distinguish unusual phenomena from brief phenomena every galaxy experiences.
- Apparently rare phenomena may be the tip of an iceberg that has escaped detection (selection bias again).
- Rare cases can yield insights that "normal" cases do not.

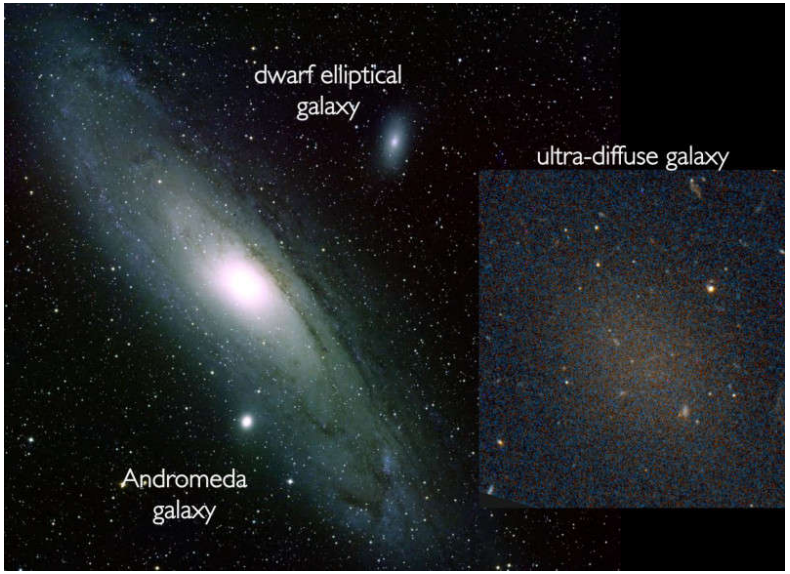
The *ACG*
(Amazingly Cool Galaxy)







pathological refusal to form stars…



van Dokkum et al. 2016

hiding in plain sight: ultra compact dwarfs

hiding in plain sight: ultra compact dwarfs