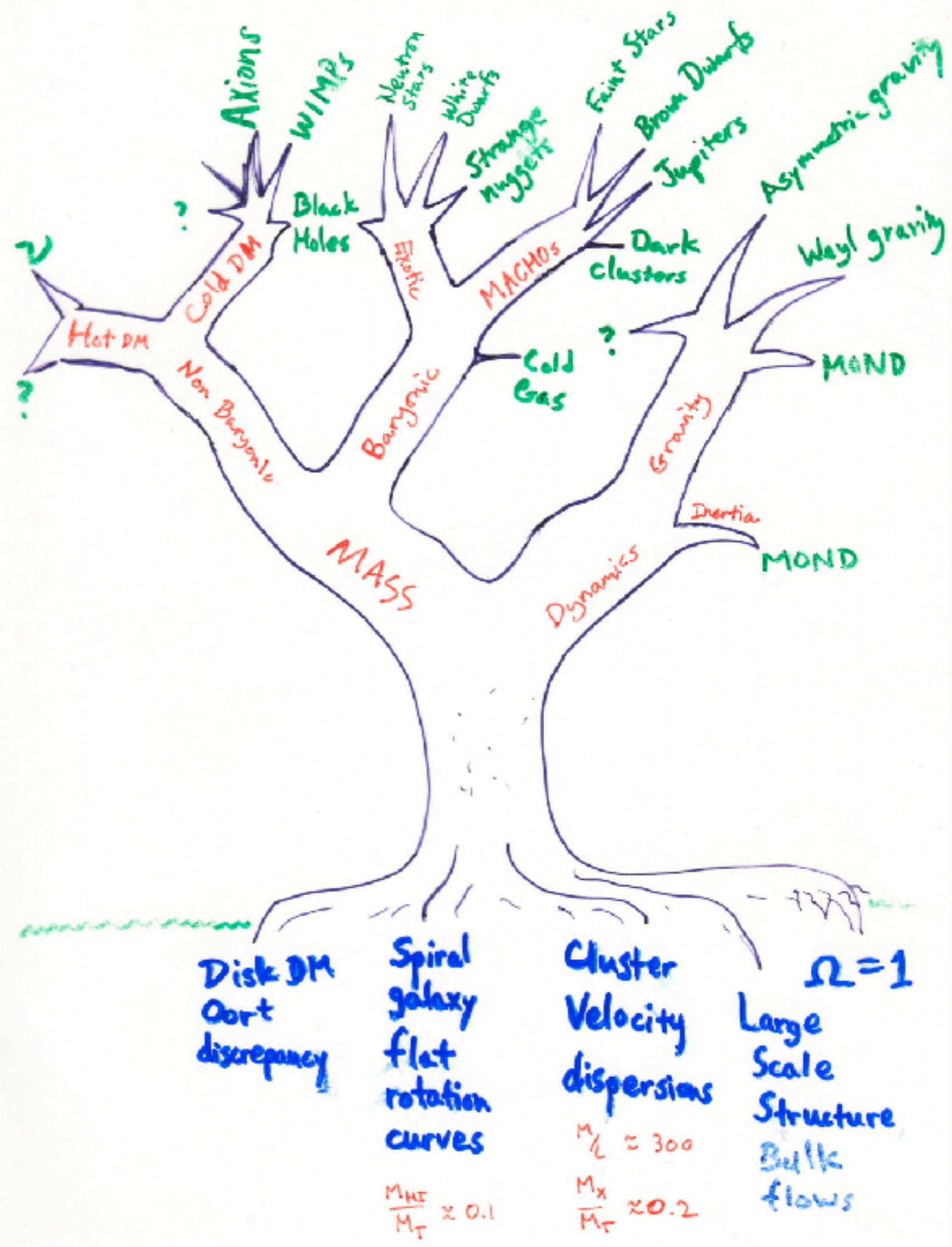


DARK MATTER

ASTR 333/433

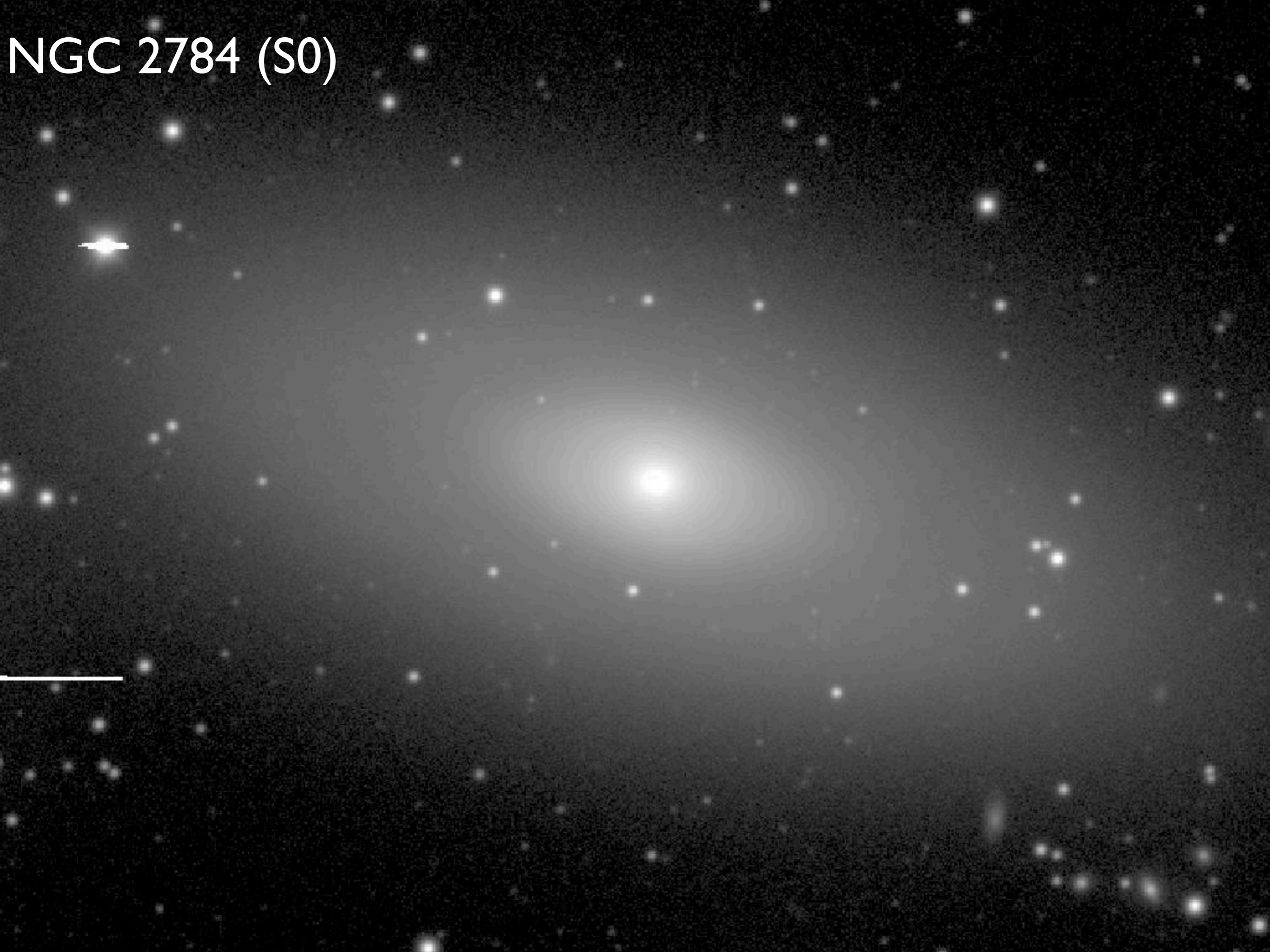
TODAY
COSMOLOGICAL FRAMEWORK
GALAXY FORMATION



M87 in Virgo (E)



NGC 2784 (S0)



NGC 474
shell galaxy

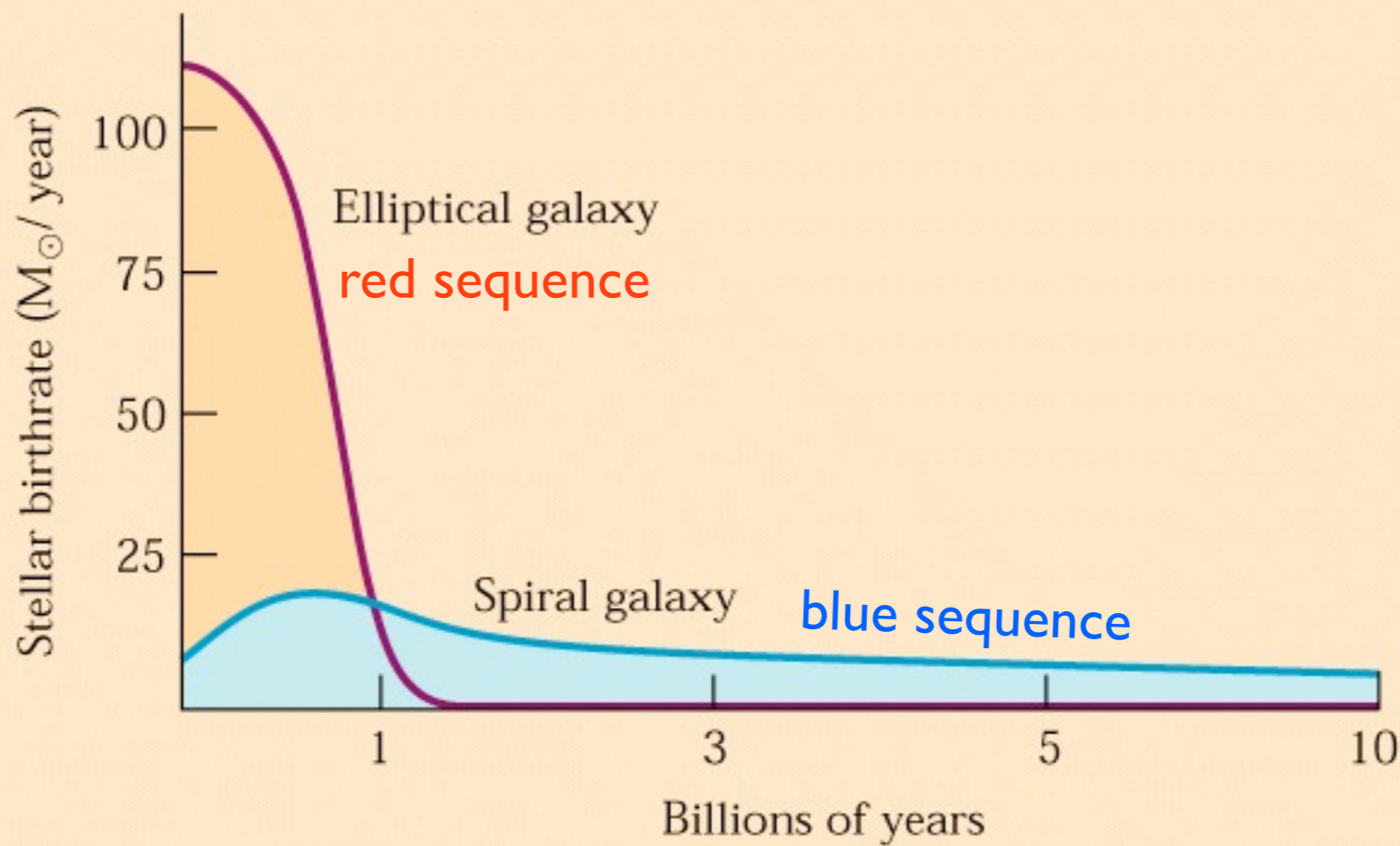


Generic Star Formation History

Elliptical



old stars

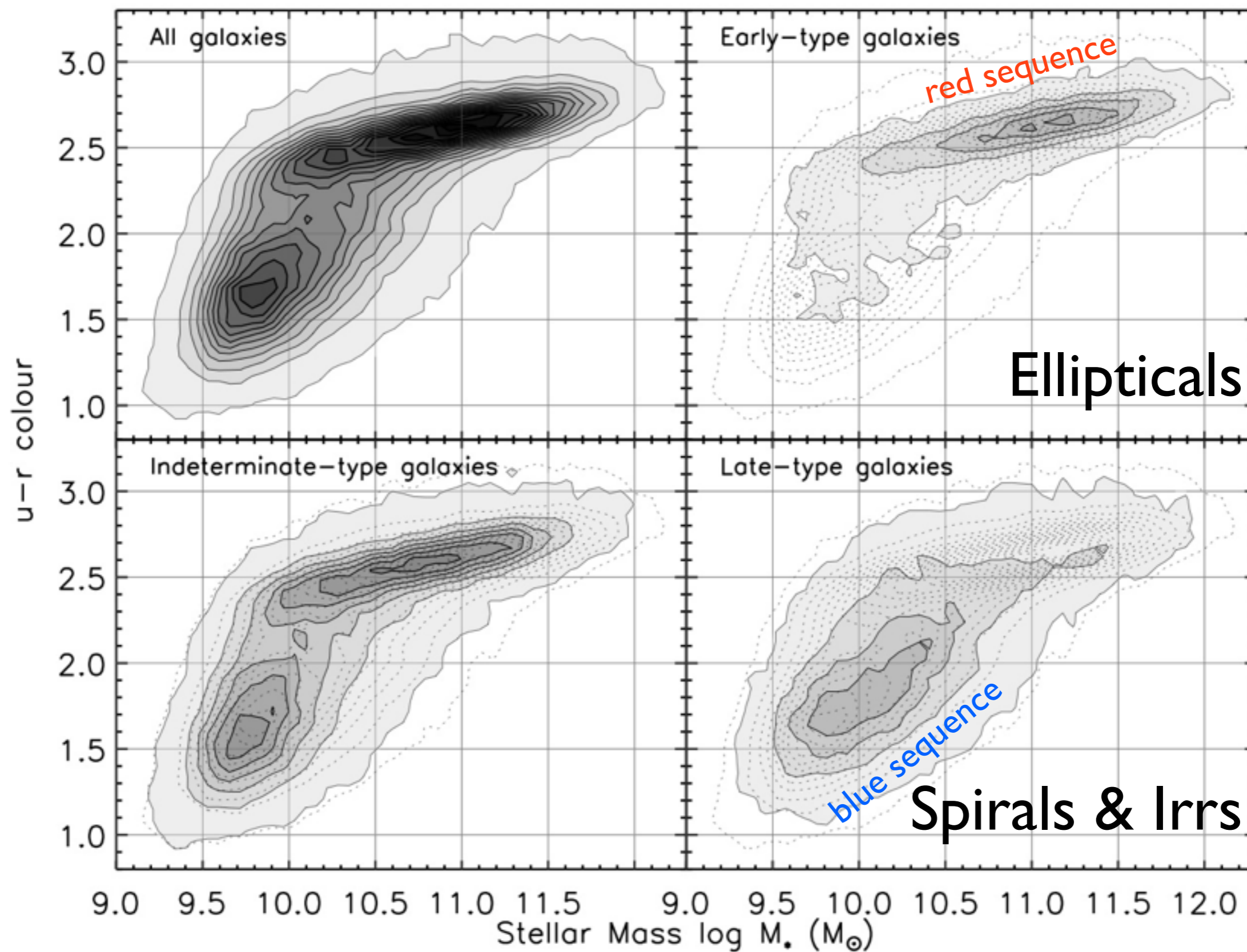


Spiral

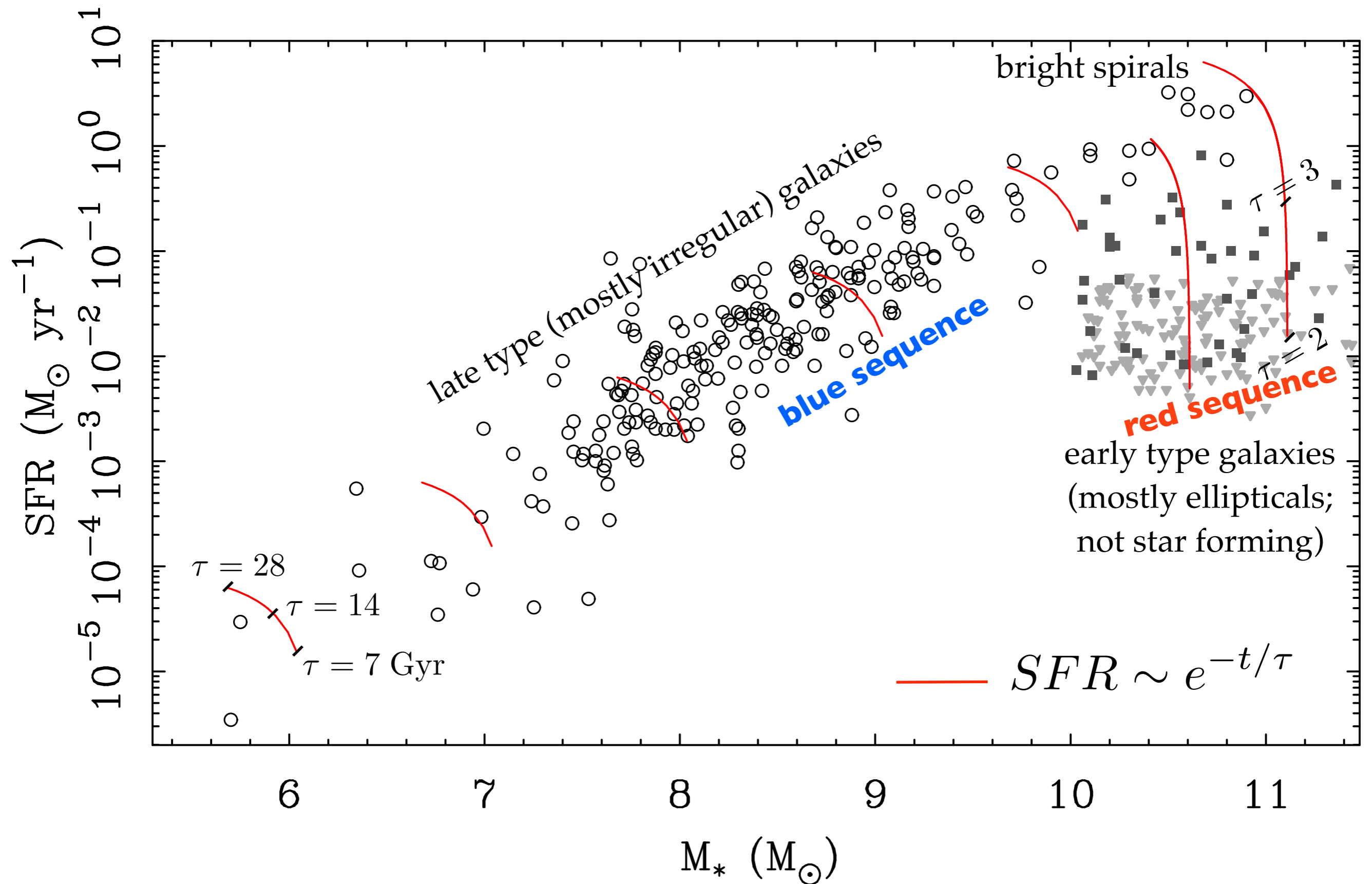


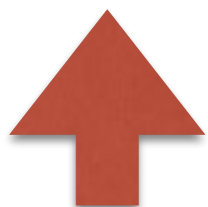
old stars
young stars
cold gas

color-magnitude relation for galaxies



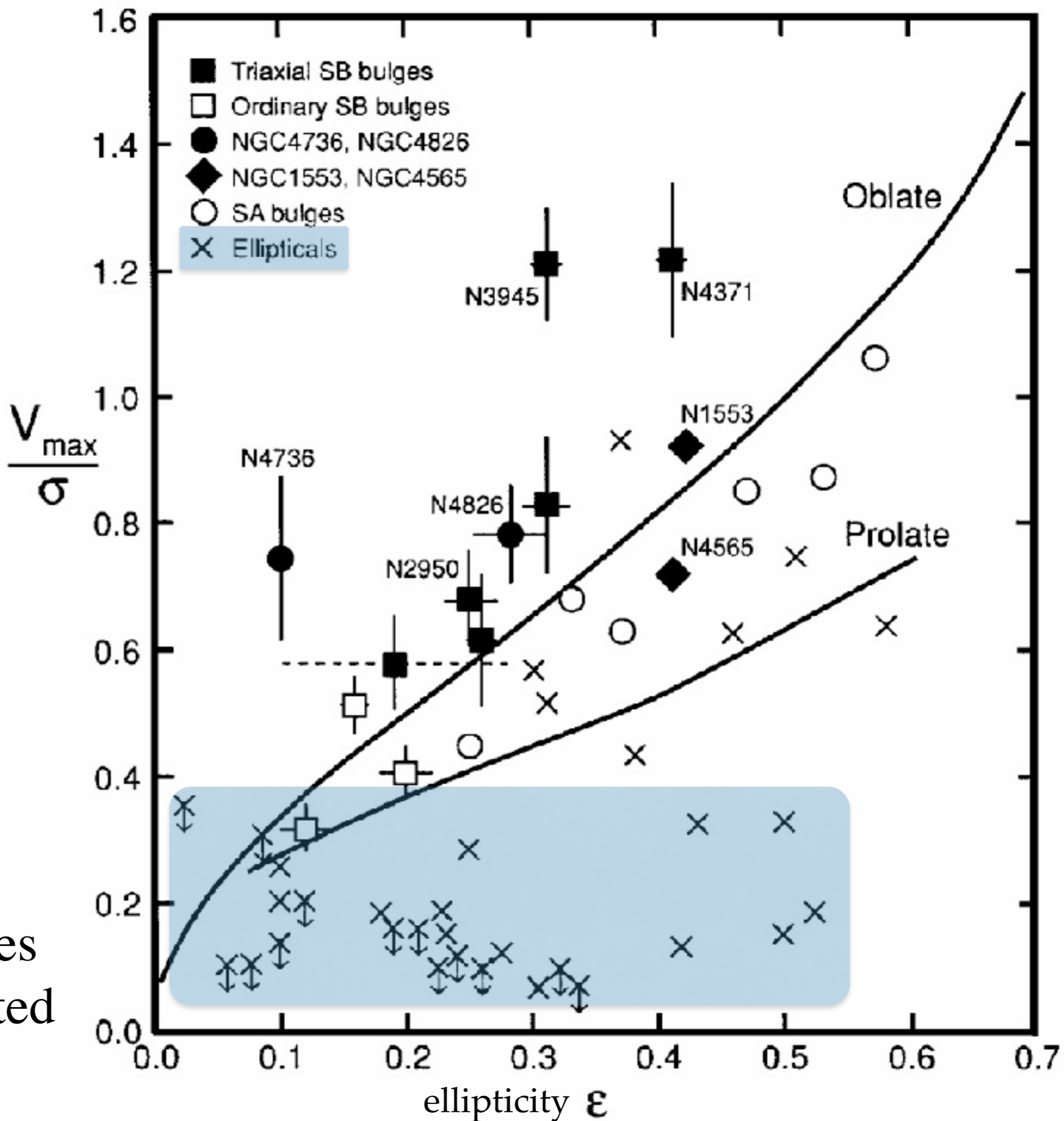
“Main Sequence of Star Forming Galaxies”





Spiral galaxies
rotationally supported
way off scale

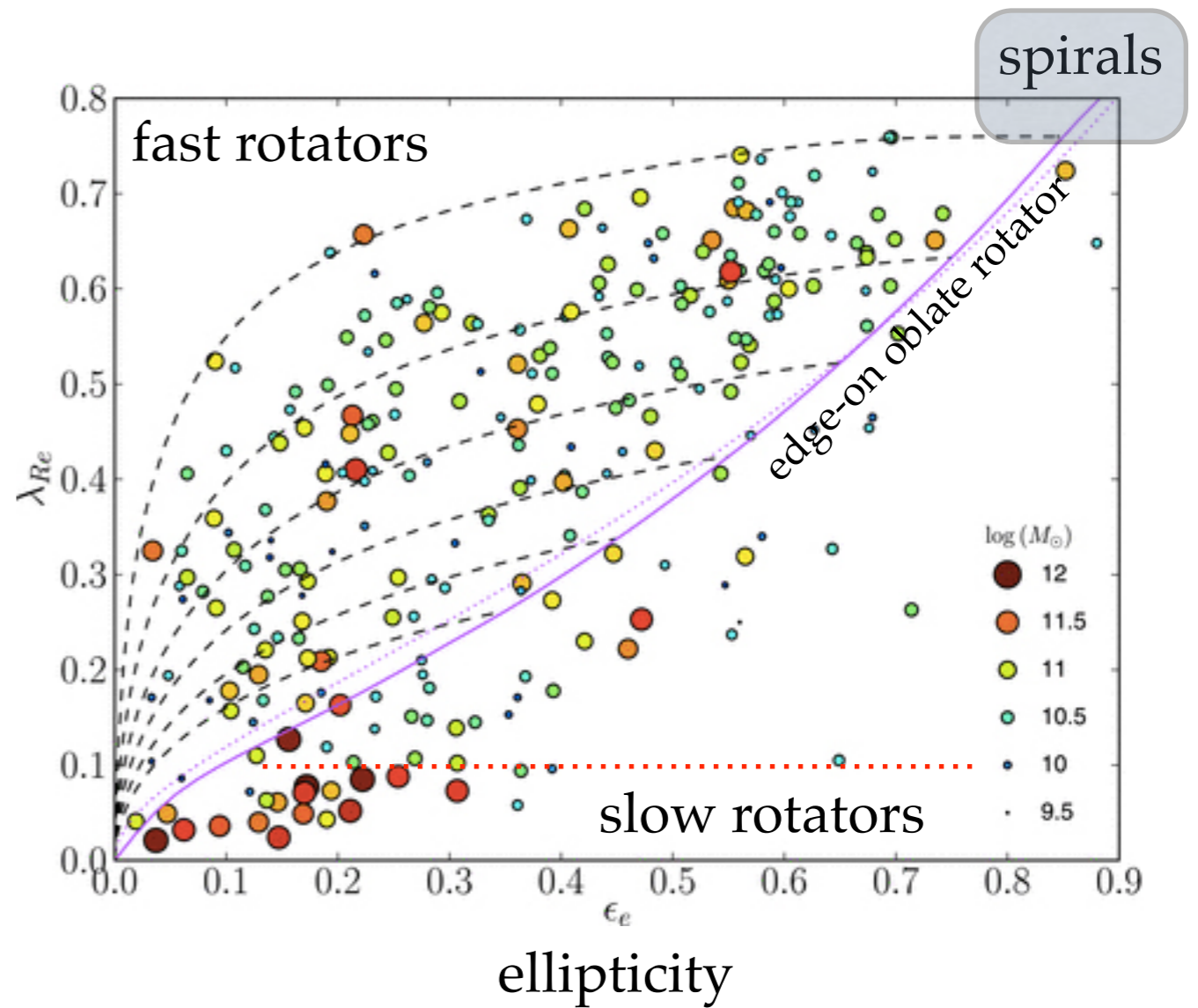
Elliptical galaxies
pressure supported



$$\lambda_R = \frac{\langle R|V| \rangle}{\langle R\sqrt{V^2 + \sigma^2} \rangle}$$

specific angular momentum

Massive ellipticals mostly pressure supported (slow rotators) while many (not all) lower mass ellipticals are fast rotators. These are often S0 galaxies.



Dashed lines represent different inclinations for different intrinsic ellipticities

Galaxy Formation

A many faceted problem

(sort of like Cthulhu being a multi-tentacled nightmare cult god)

Competition between gas accretion (to form disks)
and lumpy fragments (forms spheroids, substructure)



Monolithic galaxy formation collapse of one big gas cloud

(e.g., Eggen, Lynden-Bell, & Sandage 1962)

Hierarchical galaxy formation

“bottom up” formation from sequence of mergers

(big galaxies are built by piling up small galaxies - happens with cold dark matter)

Searle-Zinn (1978) fragments:

“...halo [globular] clusters originated within transient protogalactic fragments that gradually lost gas while undergoing chemical evolution and continued to fall into the Galaxy after the collapse of its central regions had been completed.”