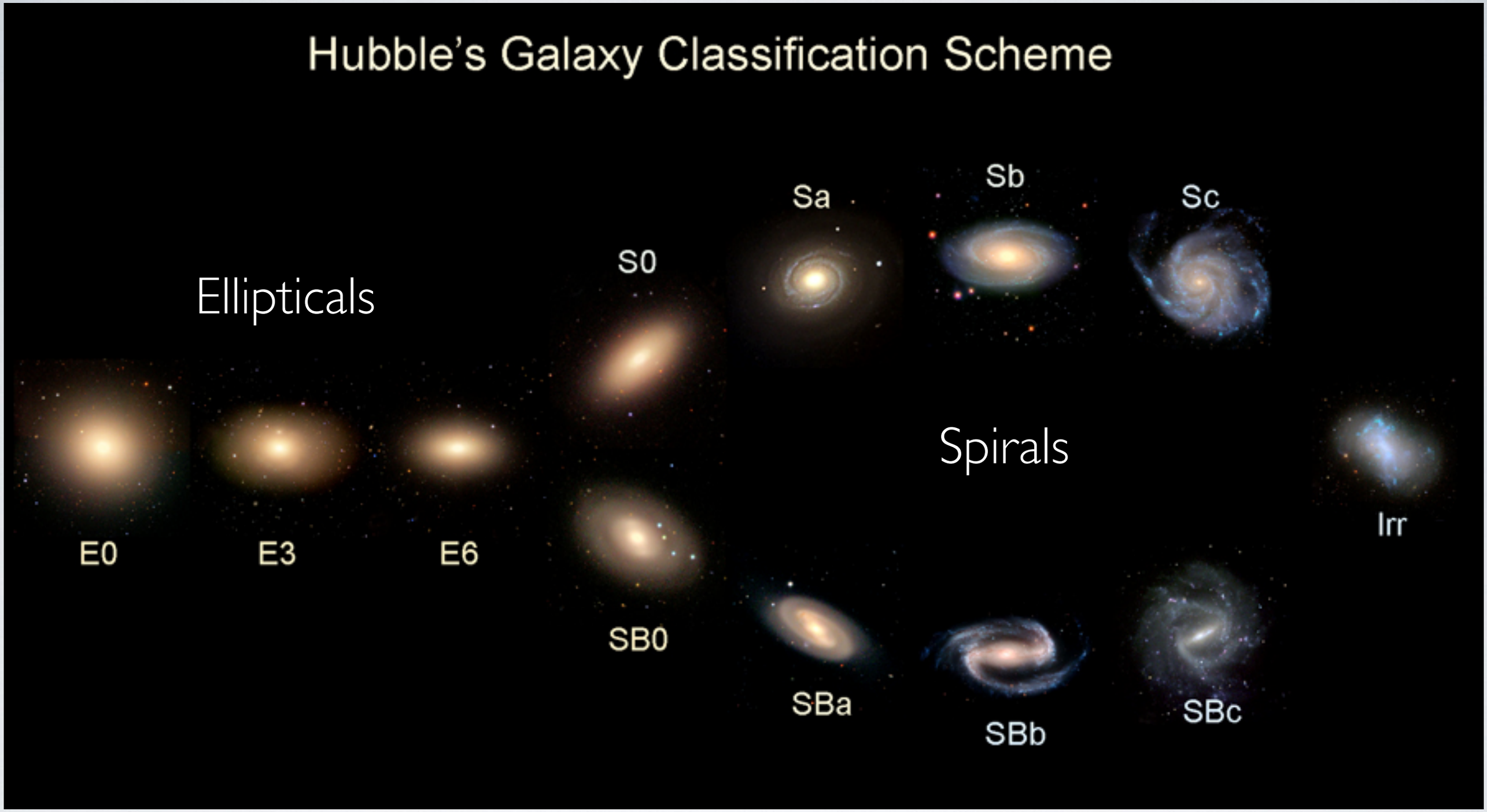
MORPHOLOGICAL CLASSIFICATION OF GALAXIES

Data Science Project

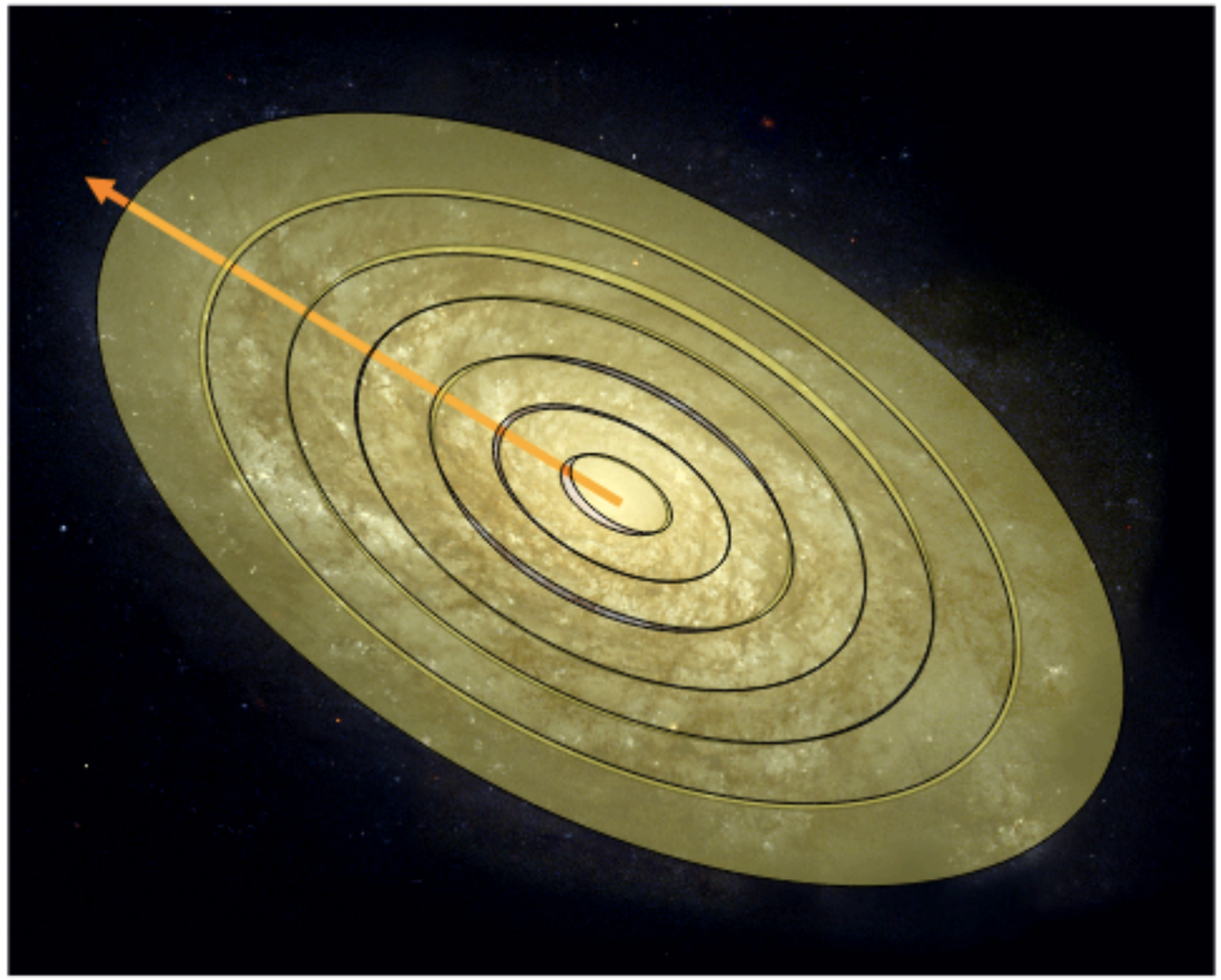
Helena Domínguez Sánchez
helenado@sas.upenn.edu

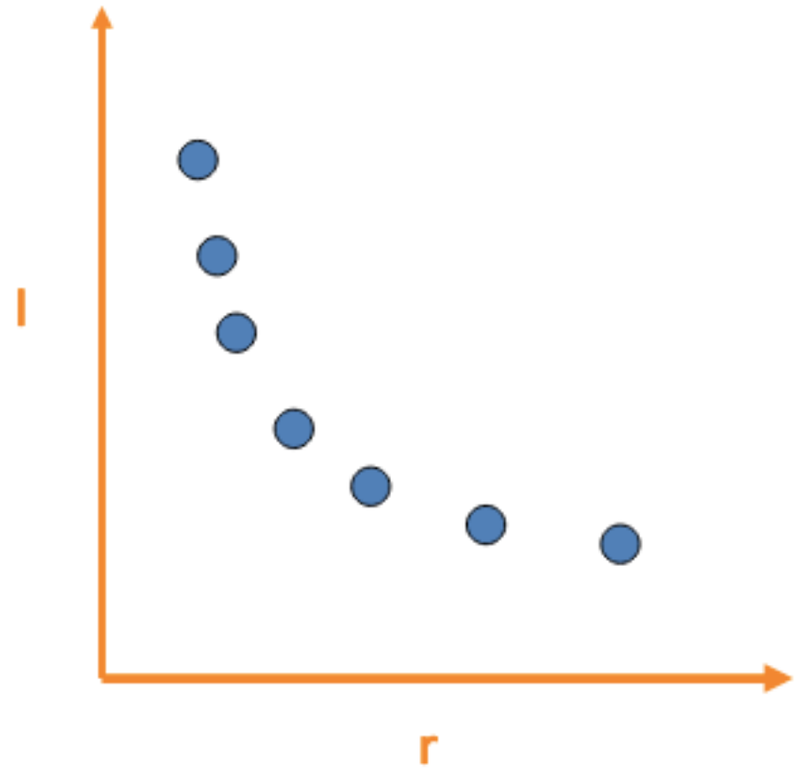


-3 -2 -1 0 2 4 6 10

T-Type

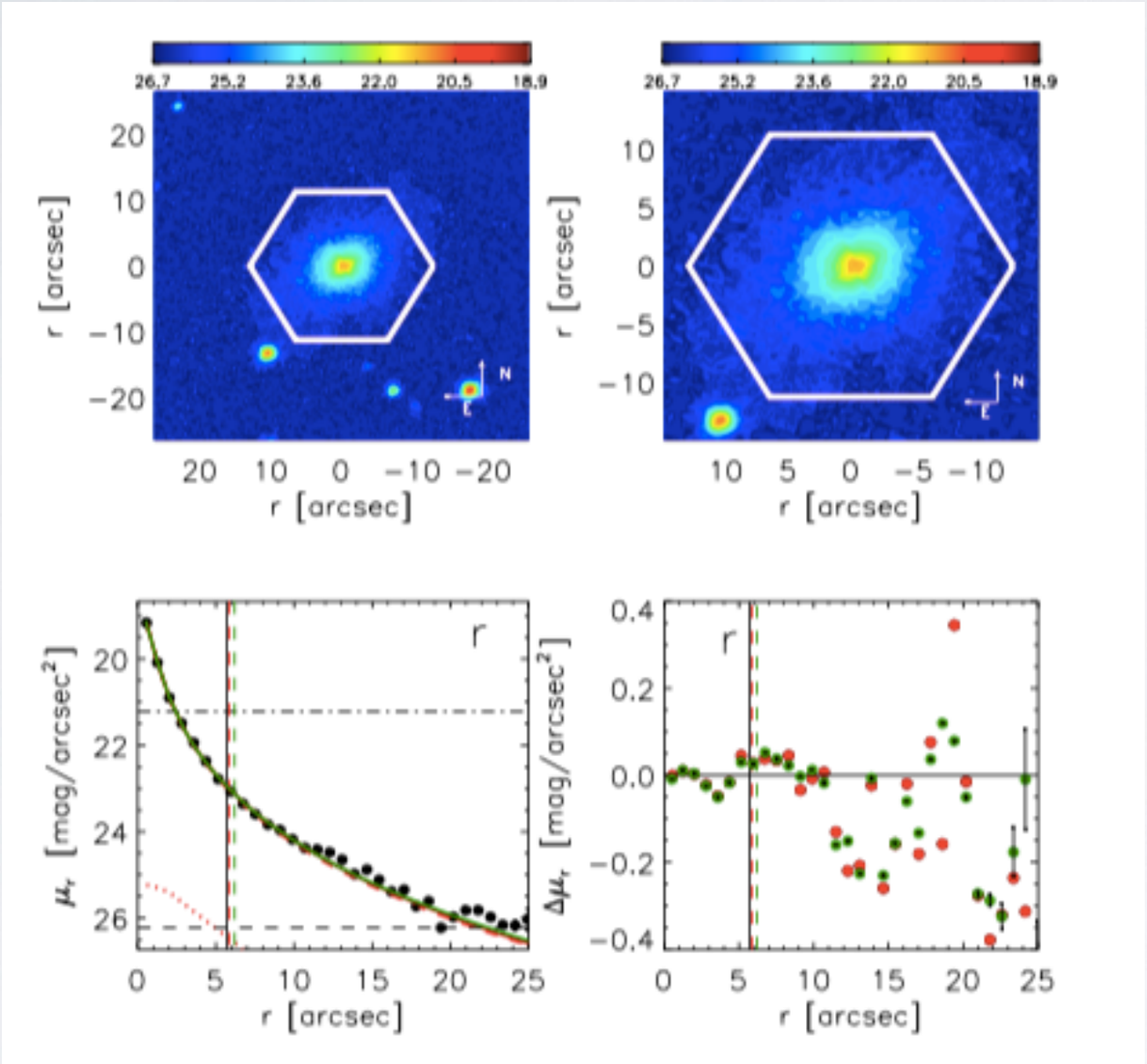
Galaxy Light Profiles





Fit ellipses and then average radially

Galaxy Light Profiles



Fit ellipses and then average radially

Galaxy Light Profiles

$$I(r) = I_0 \exp\left(-r/r_0\right)$$

Disk galaxies are usually well described by an exponential function: its light fall off slowly with radial distance.

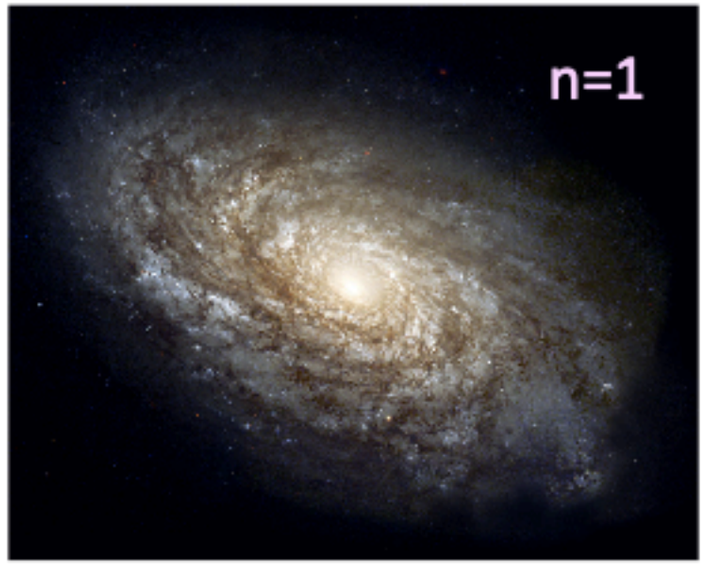
Galaxy Light Profiles

$$I(r) = I_0 \exp\left(-\left(r/r_0 \right)^{\frac{1}{4}} \right)$$

Elliptical galaxies are very concentrated in the centre and their light profiles declines fast with radius.

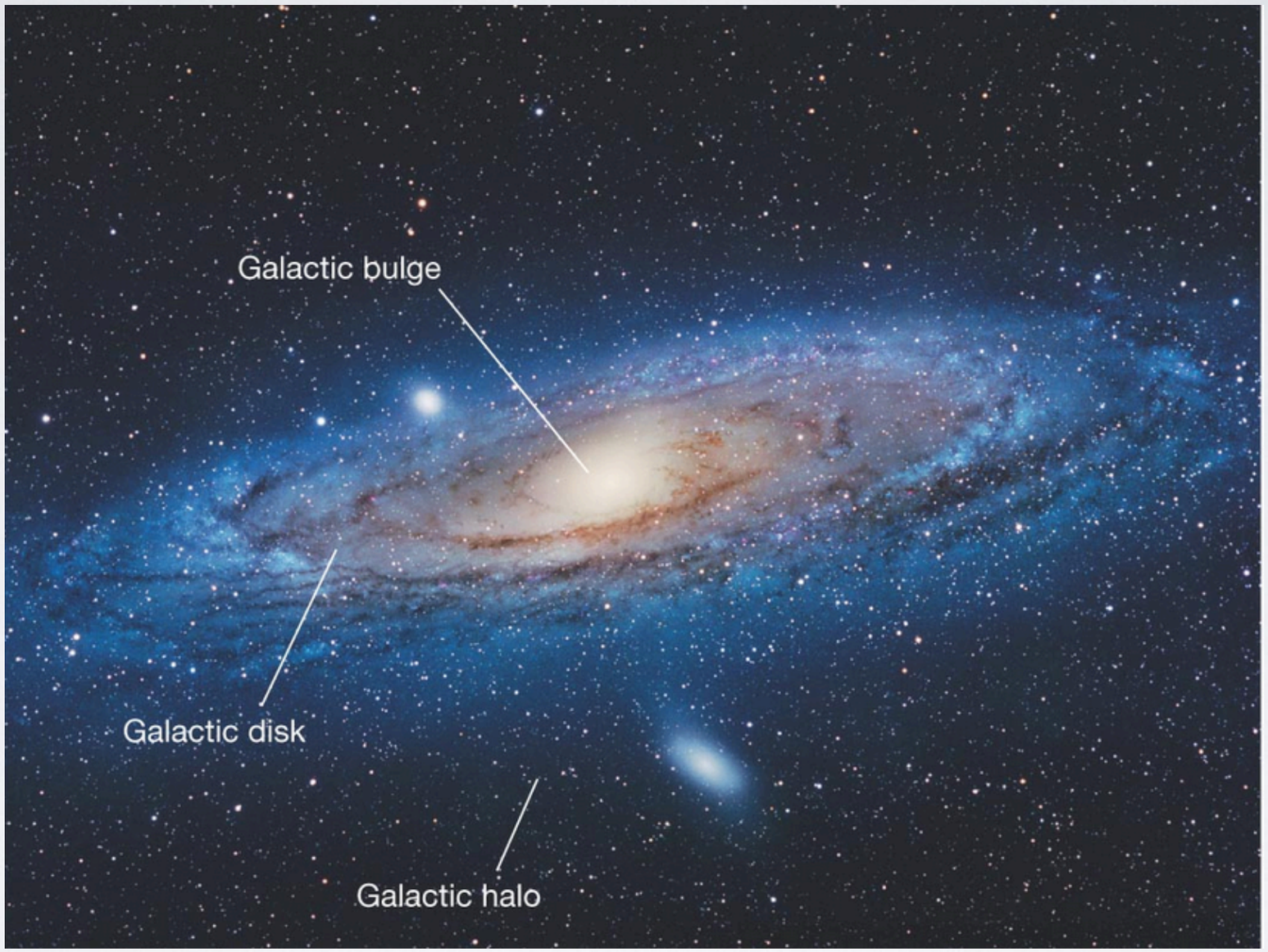
Galaxy Light Profiles

$$I(r) = I_0 \exp\left(-\left(r/r_0\right)^{\frac{1}{n}}\right)$$



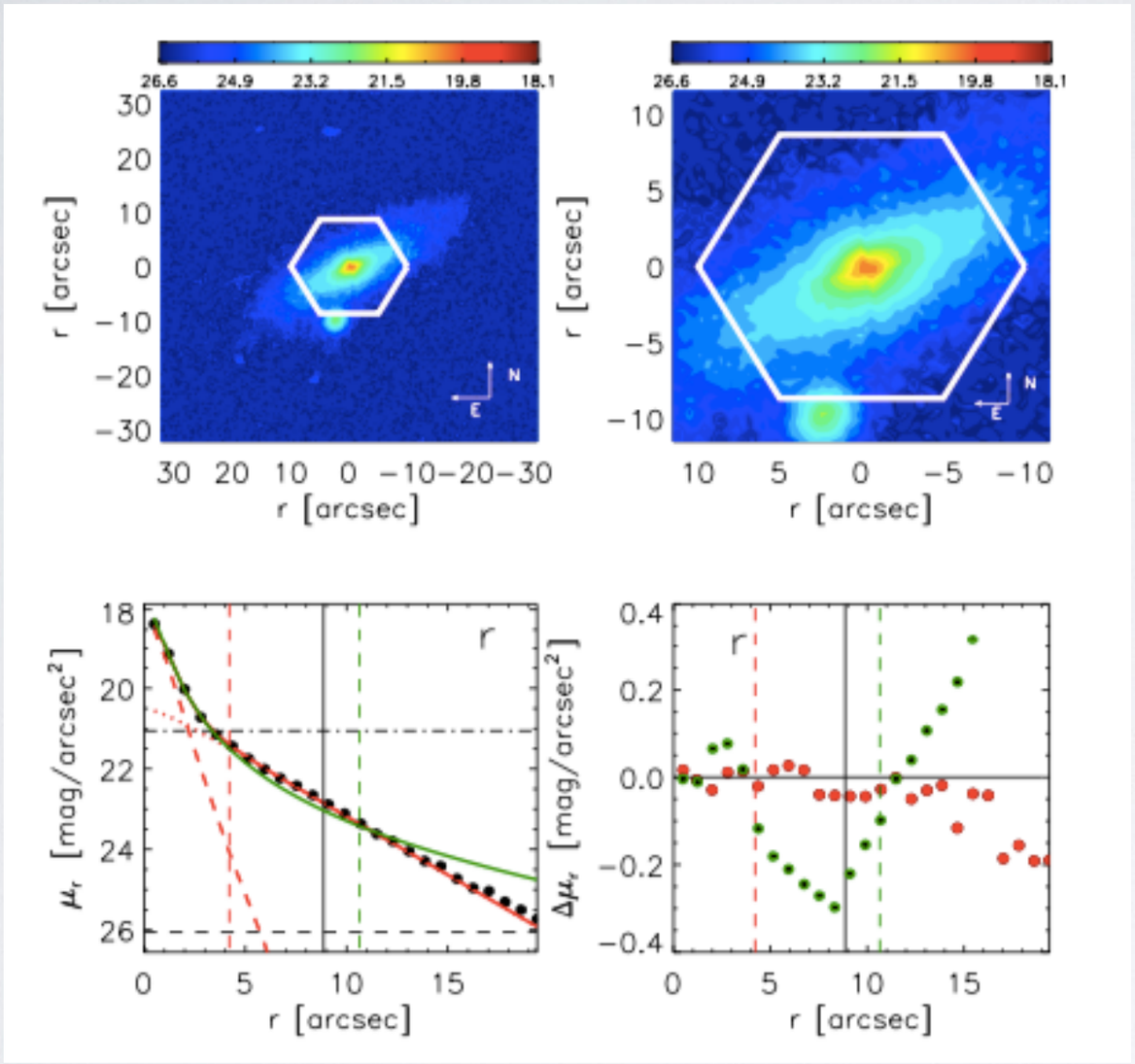
Generalization is known as Sersic function: it reduces to an exponential if n =1 and fits well ellipticals with n > 4.

Galaxy Light Profiles



Some galaxies have two components: bulge + disk

Galaxy Light Profiles



$$I_{deV+exp}(r;\ I_e, I_0, R_e, R_0) = I_e \exp\left(-7.67\left[\left(\frac{r}{R_e}\right)^{\frac{1}{4}} - 1\right]\right) + I_0 \exp\left(-\frac{r}{R_0}\right)$$

Galaxy Colors

- Astronomers refer to 'colors' as the ratio in brightness between different bands (e.g., Lg/Lr)

- Galaxies with on-going star formation are blue.

- Galaxies can be red because:
  - they are old
  - they have large amounts of dust
  - they have more heavy elements

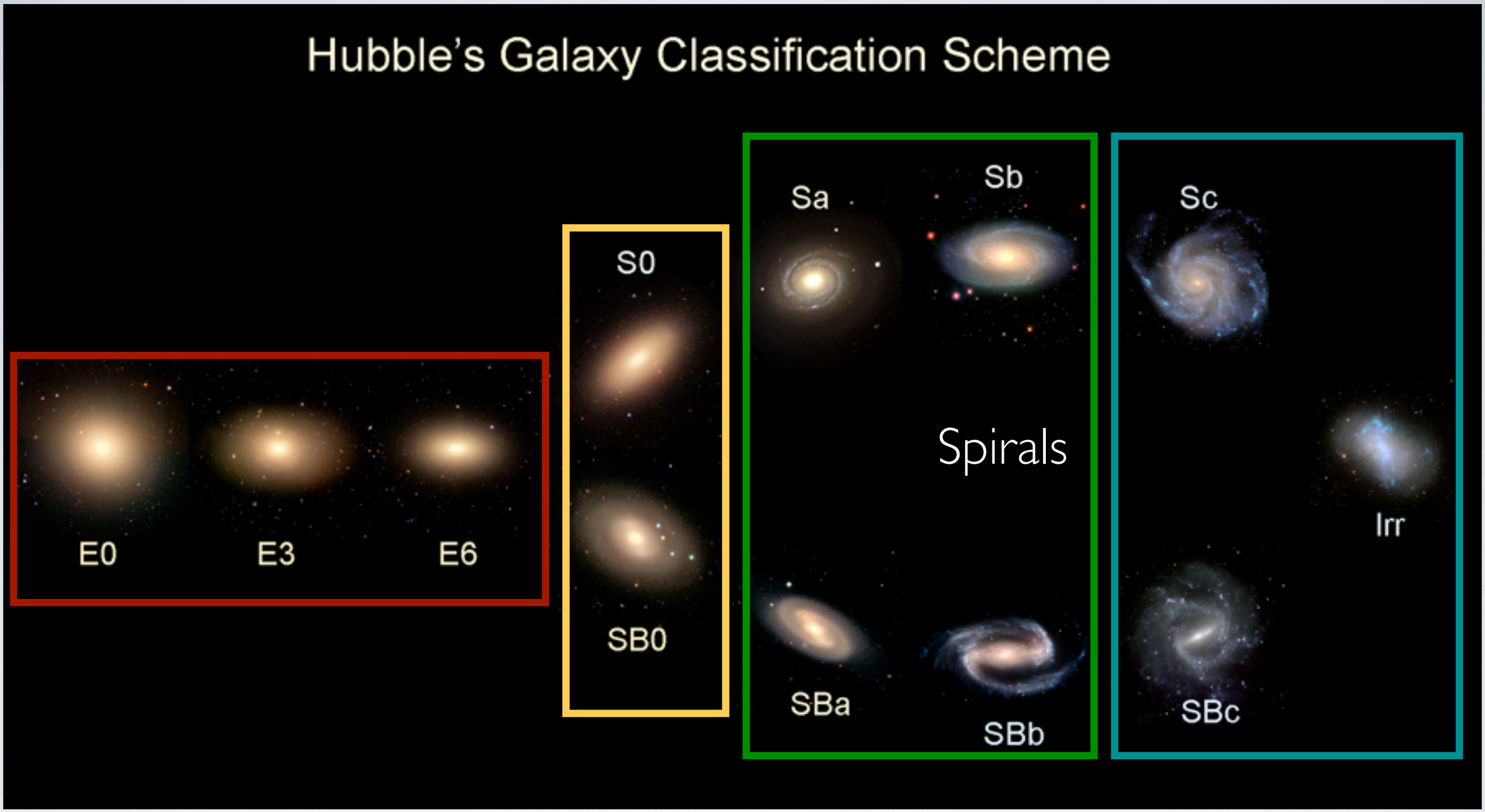
See Fig. 23 from Fischer et al. 2018

Catalog Content

4672 galaxies

- ID
- ra, dec
- redshift
- Lr
- C=Lr/Lg
- Re
- PA
- b/a
- B/T
- $Re_{,disk}$
- $Re_{,bulge}$
- $n_{,bulge}$

See Table 2 from Fischer et al. 2018



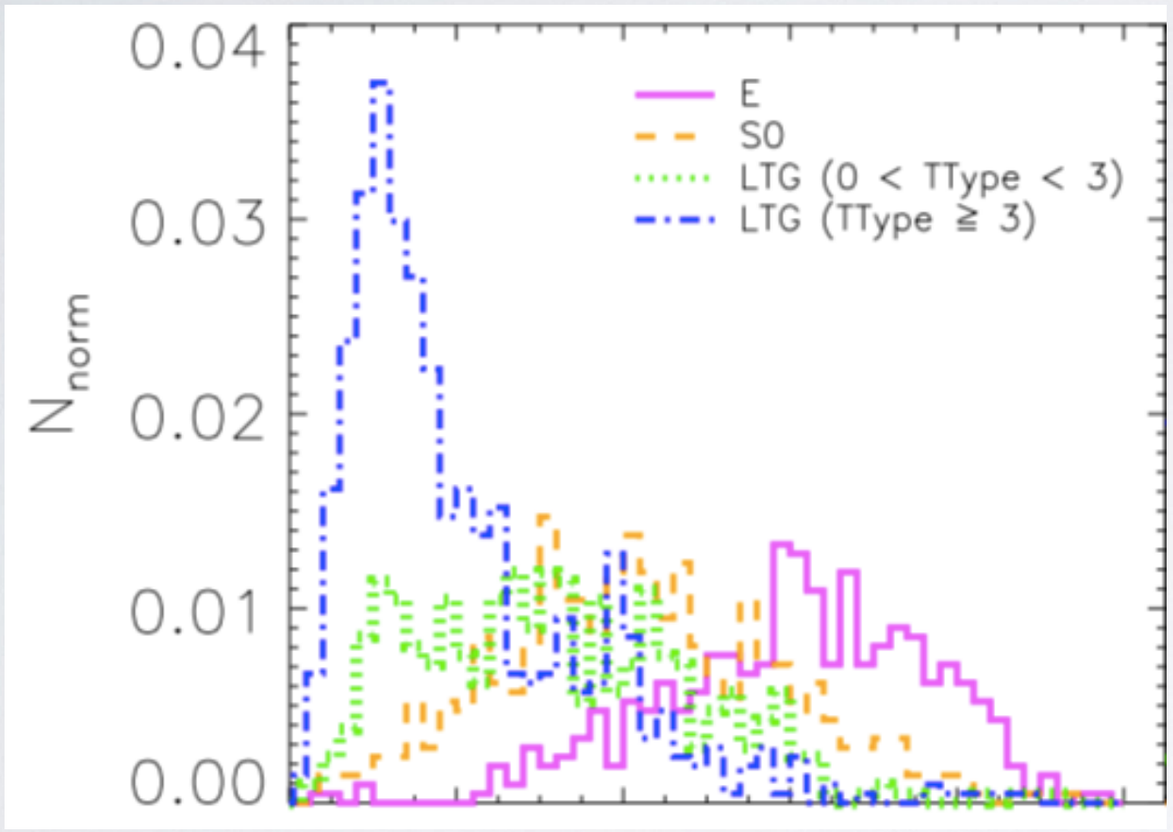
EII = I

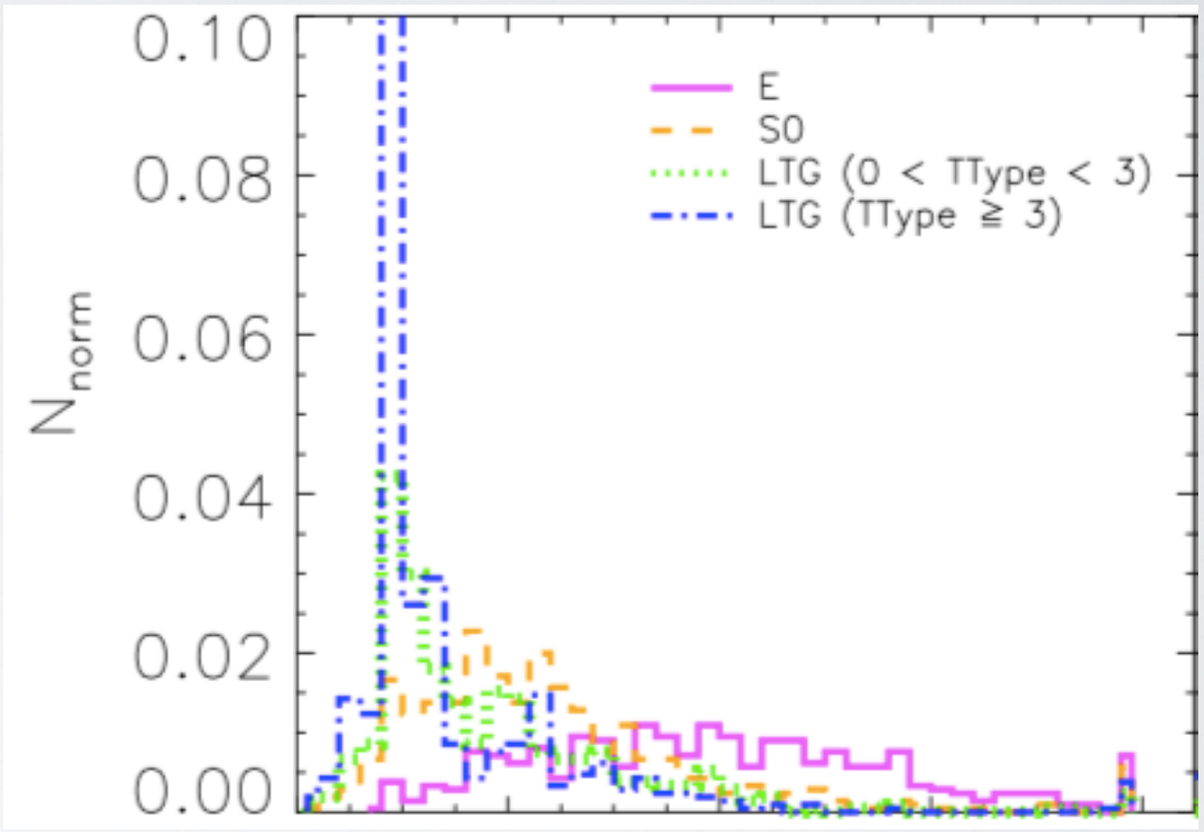
S0 = 2

S I = 3

S2 = 4

Correlation between light profiles and morphology





See Table Fischer et al. 2018