Observational Properties of Simulated Galaxies

Computational Cosmology as seen through a Telescope

CAASTRO: The Changing Face of Galaxies

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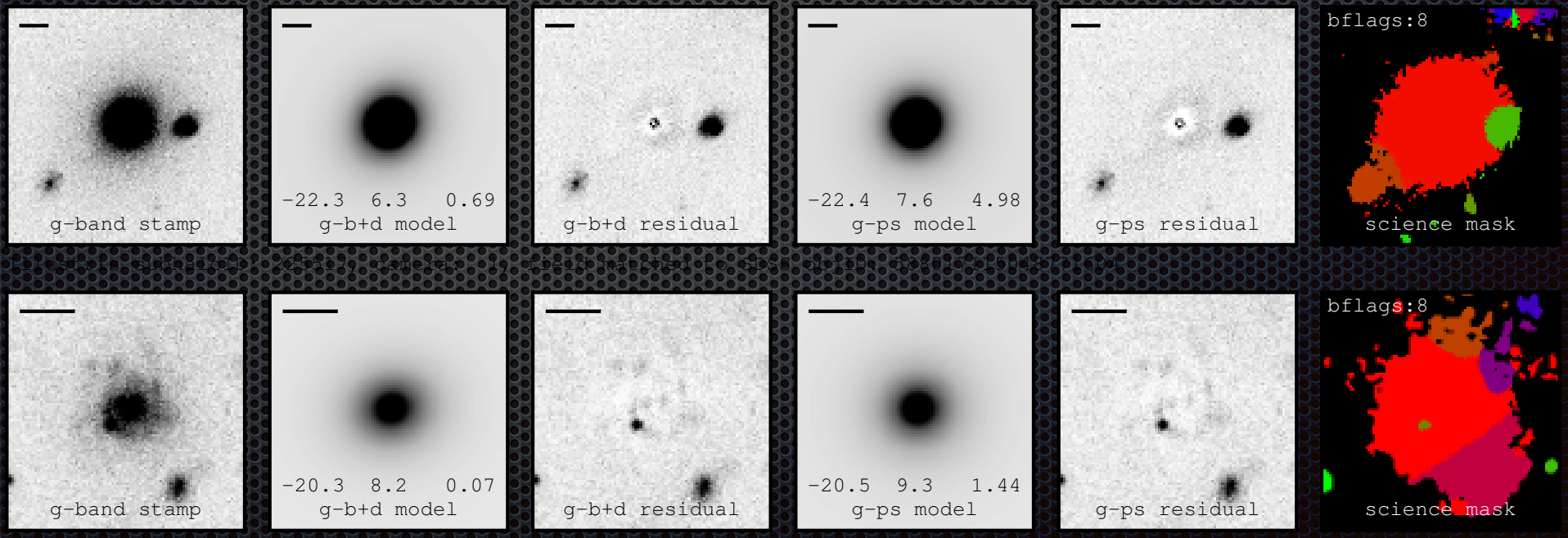
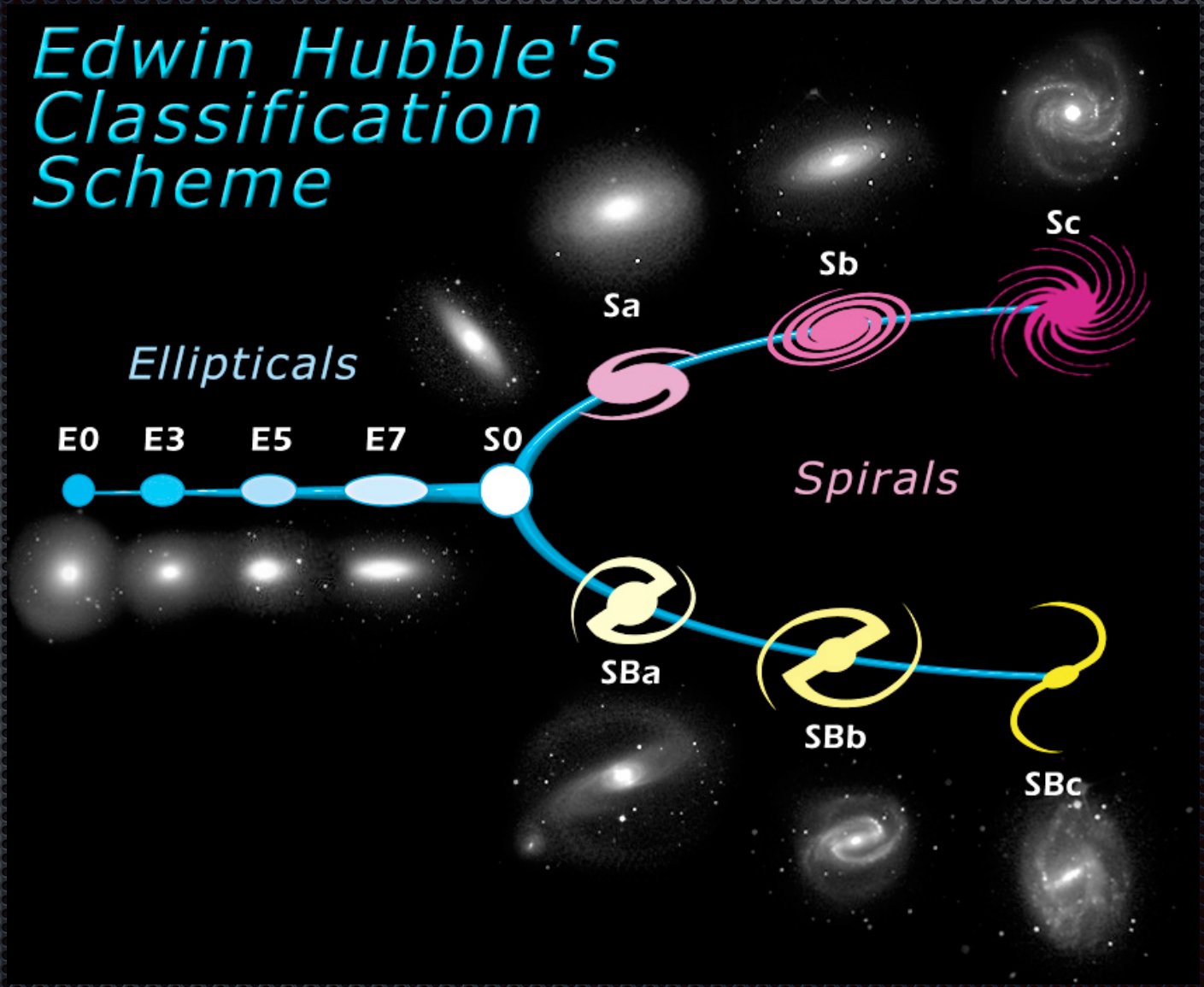


- **Introduction**

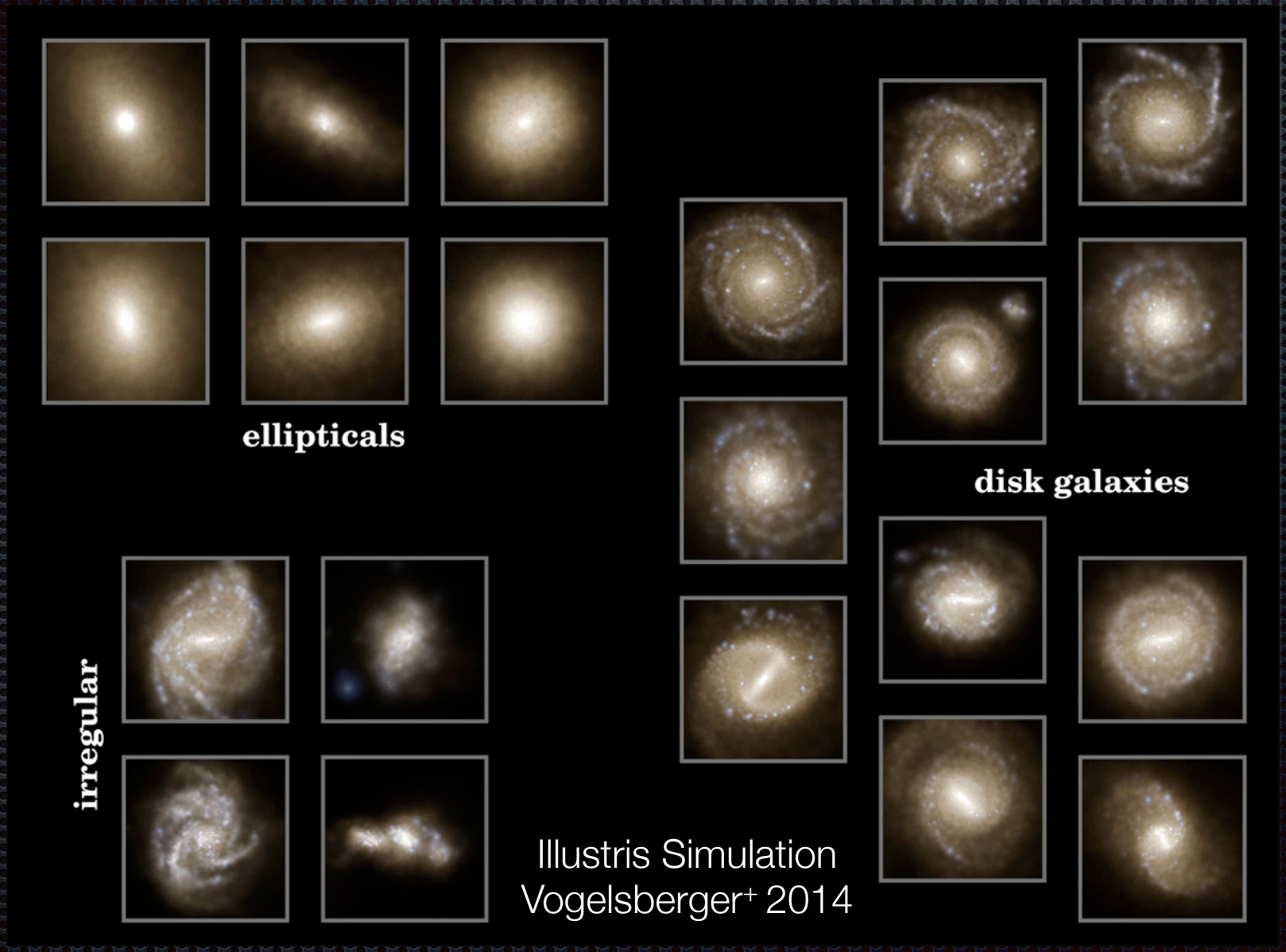
Galaxies demonstrate diverse morphological structures



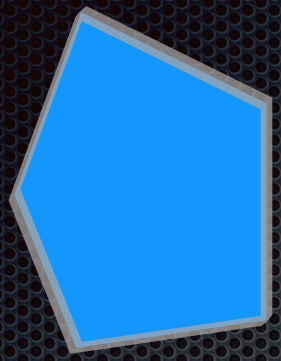
http://skyserver.sdss.org/dr1/en/proj/advanced/galaxies/tuningfork.asp

Introduction Hydrodynamical Simulations

Goal: reproduce the observed properties & morphologies of galaxies

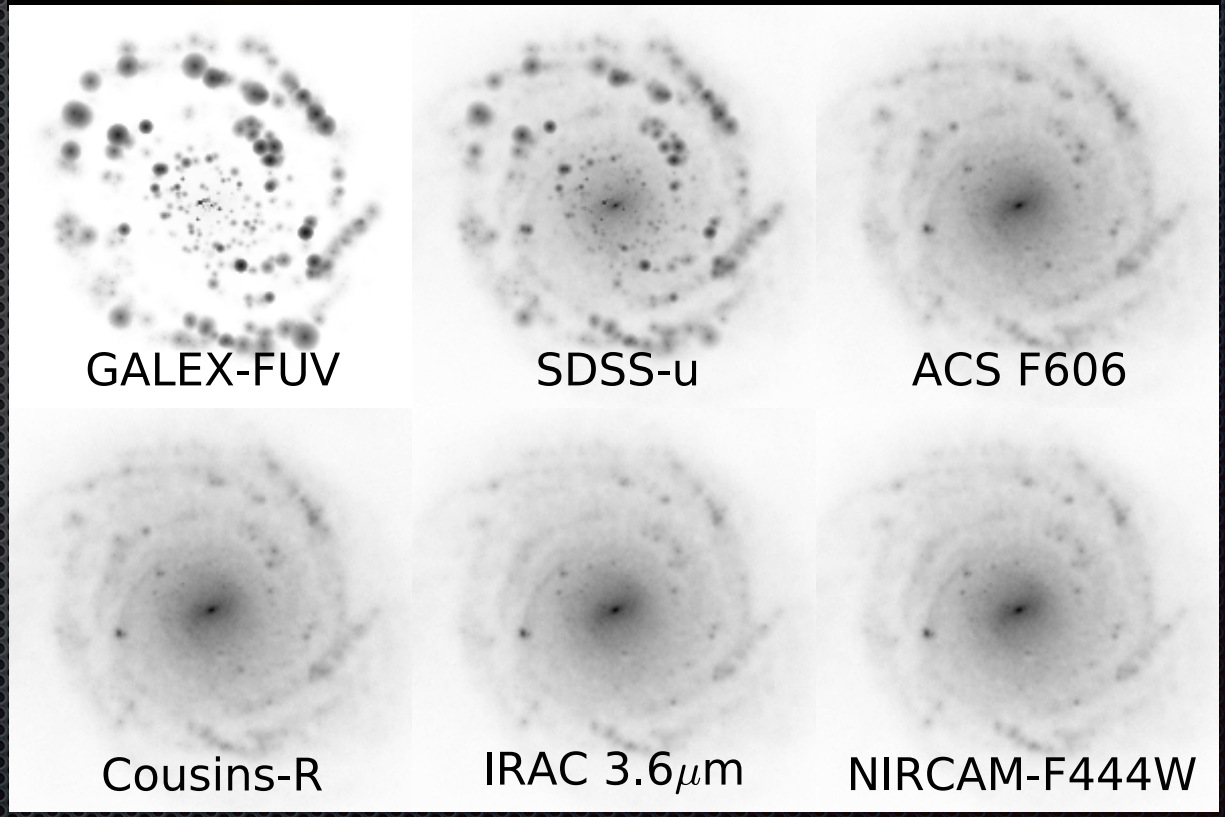


- **Introduction** Synthetic images



gas cell

star particle + SED



Torrey et al. 2015

- **Methods**

Galaxies from z=0 of the Illustris Simulation with SDSS Realism

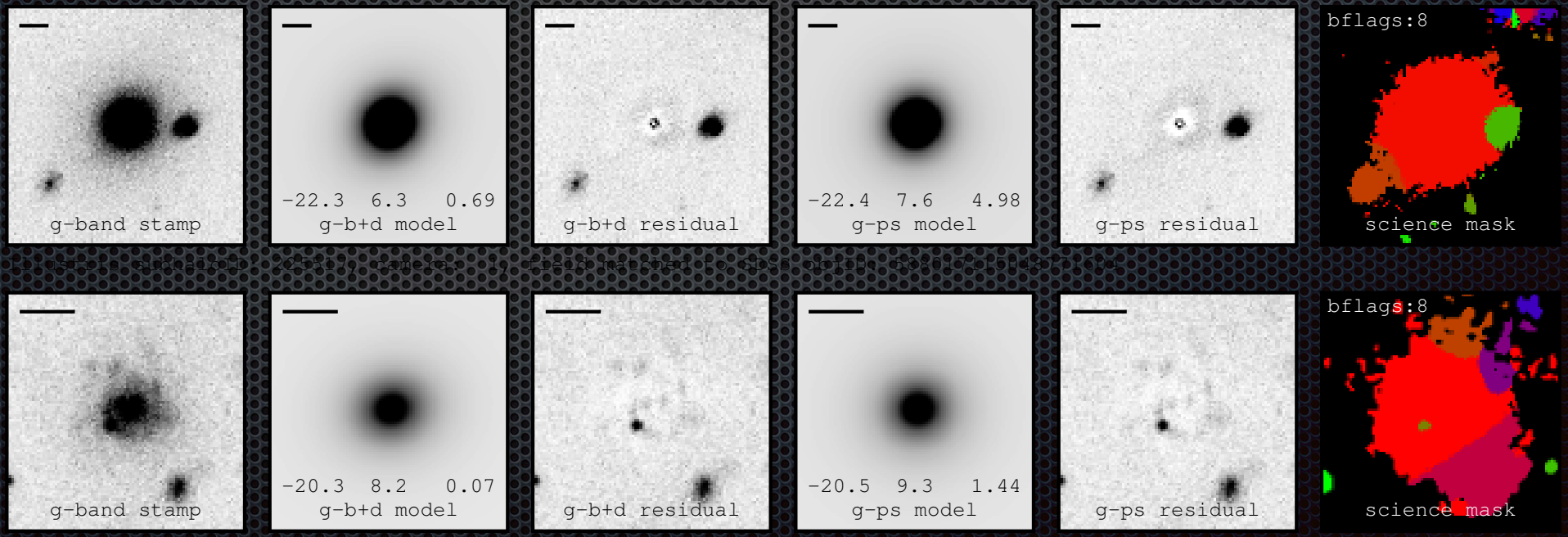
Key components:

Goal: derive galaxy properties consistently with observed galaxies

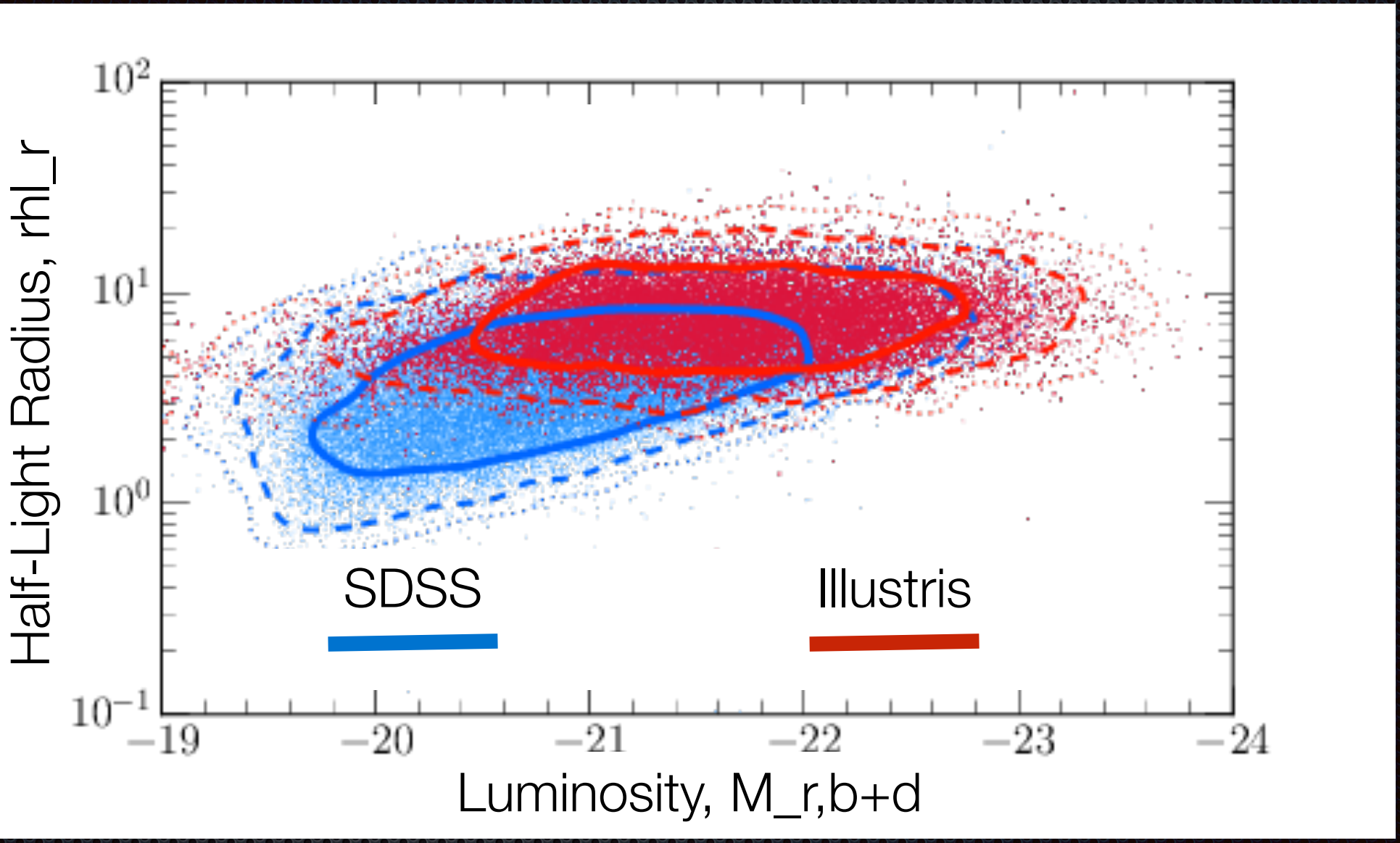
Bottrell et al. 2016, MNRAS submitted

(email connor.bottrell@gmail.com for early access to catalogs)

- Public catalogs of 2D parametric decompositions of Illustris galaxies with full SDSS realism (bulge+disc and pure sersic)
- Processed with the *same* decomposition pipeline as catalogs by Simard et al. 2011

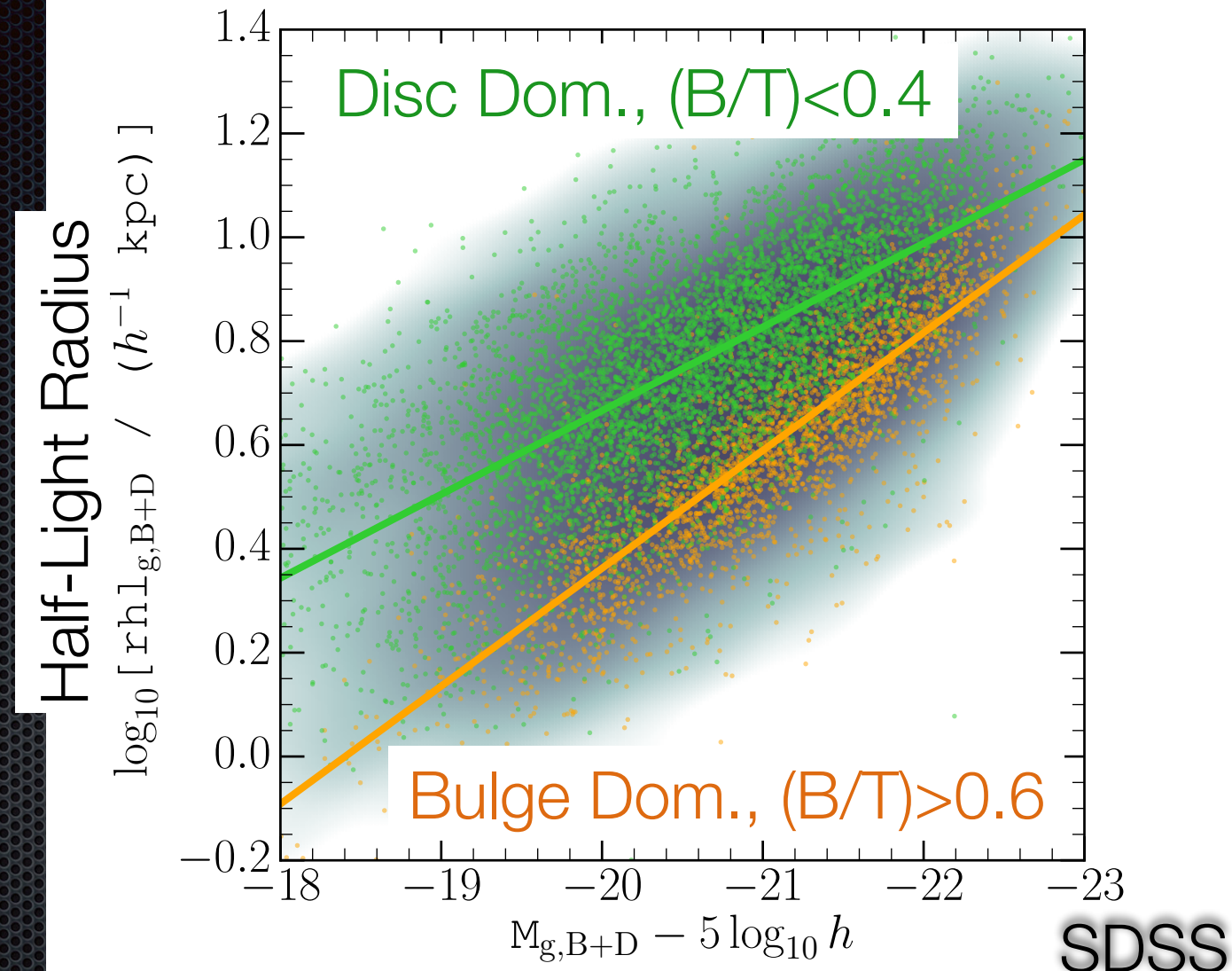


- **Size Luminosity Relation**



Illustris galaxies (red): larger, brighter, shallower slope for same masses

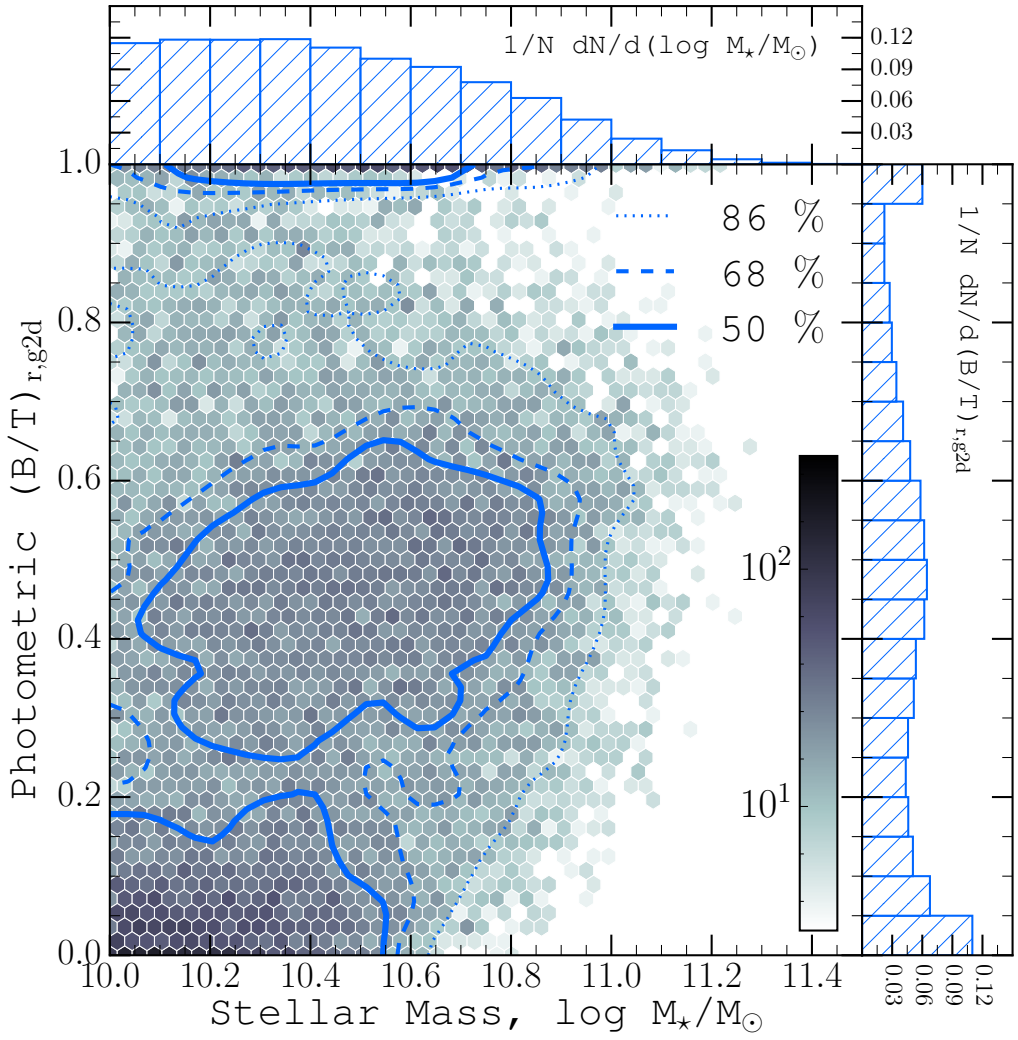
Size Luminosity Relations of Discs/Spheroids



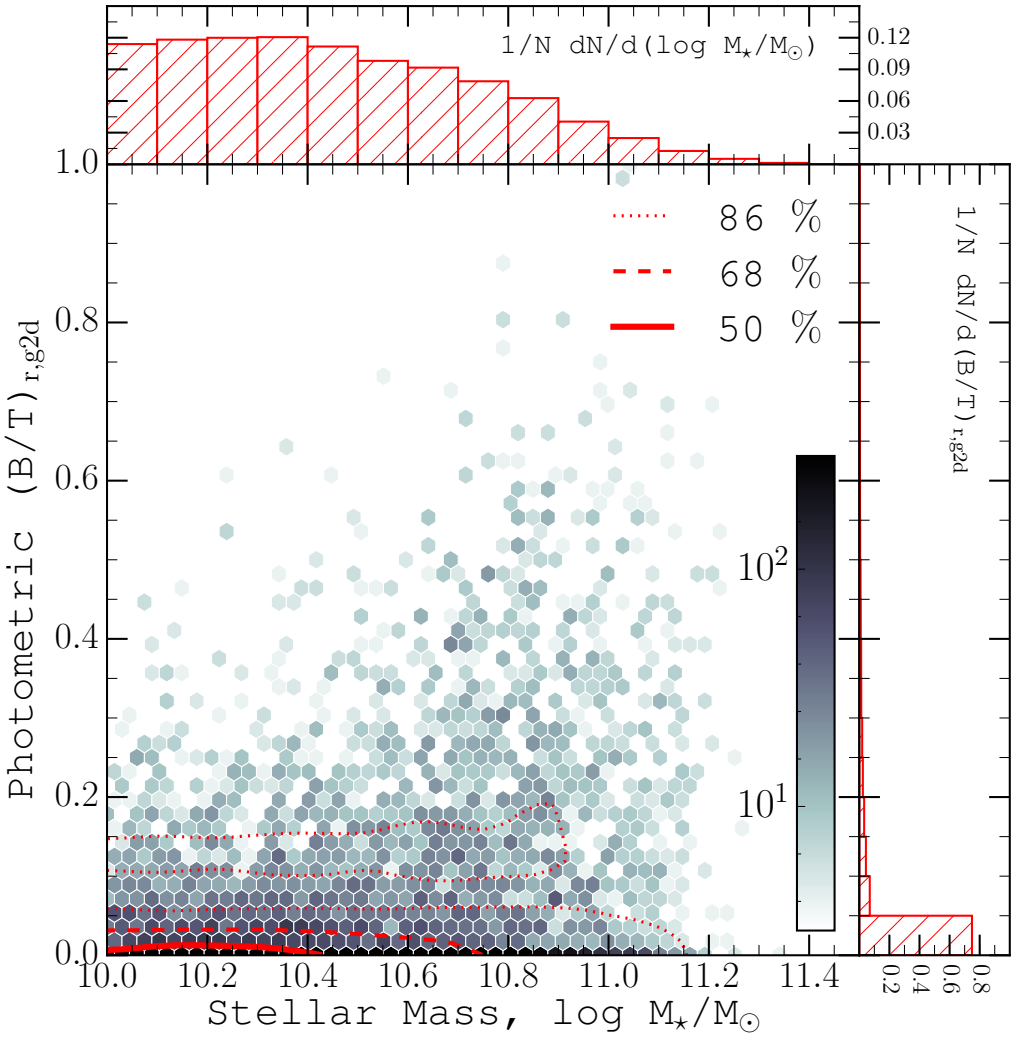
Size-luminosity relation is sensitive to morphology

Bulge to Total Fractions

SDSS

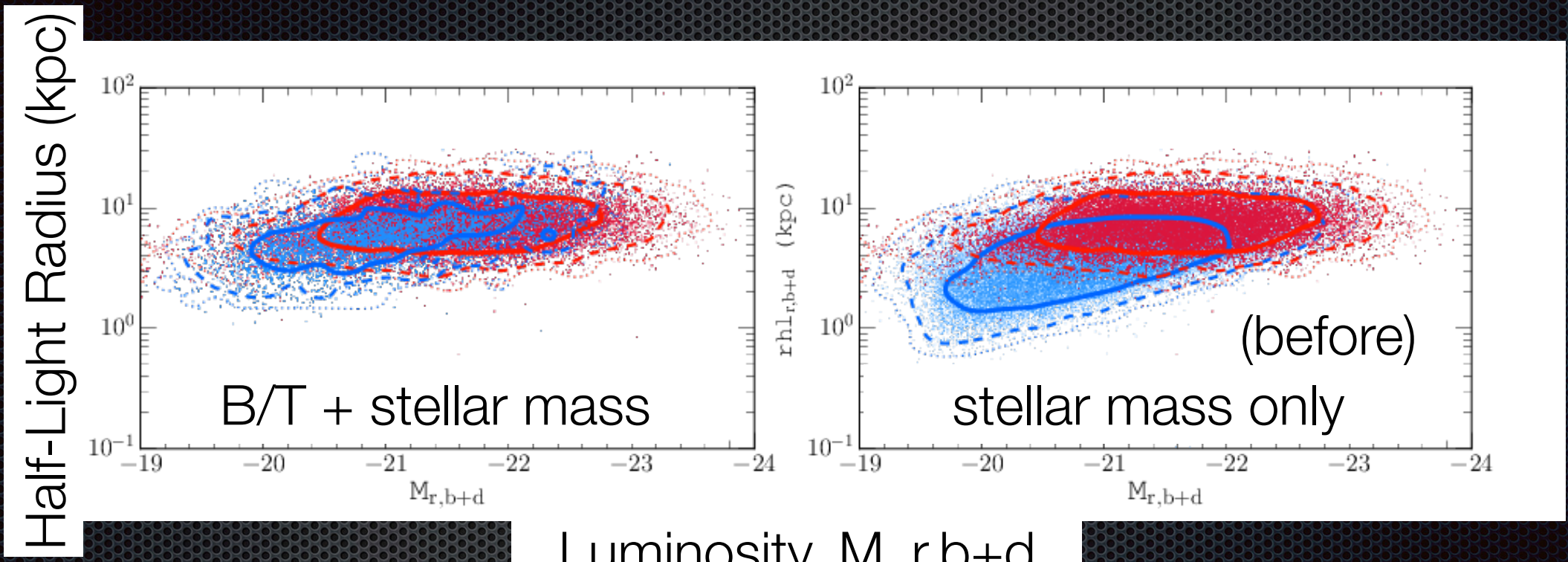


Illustris



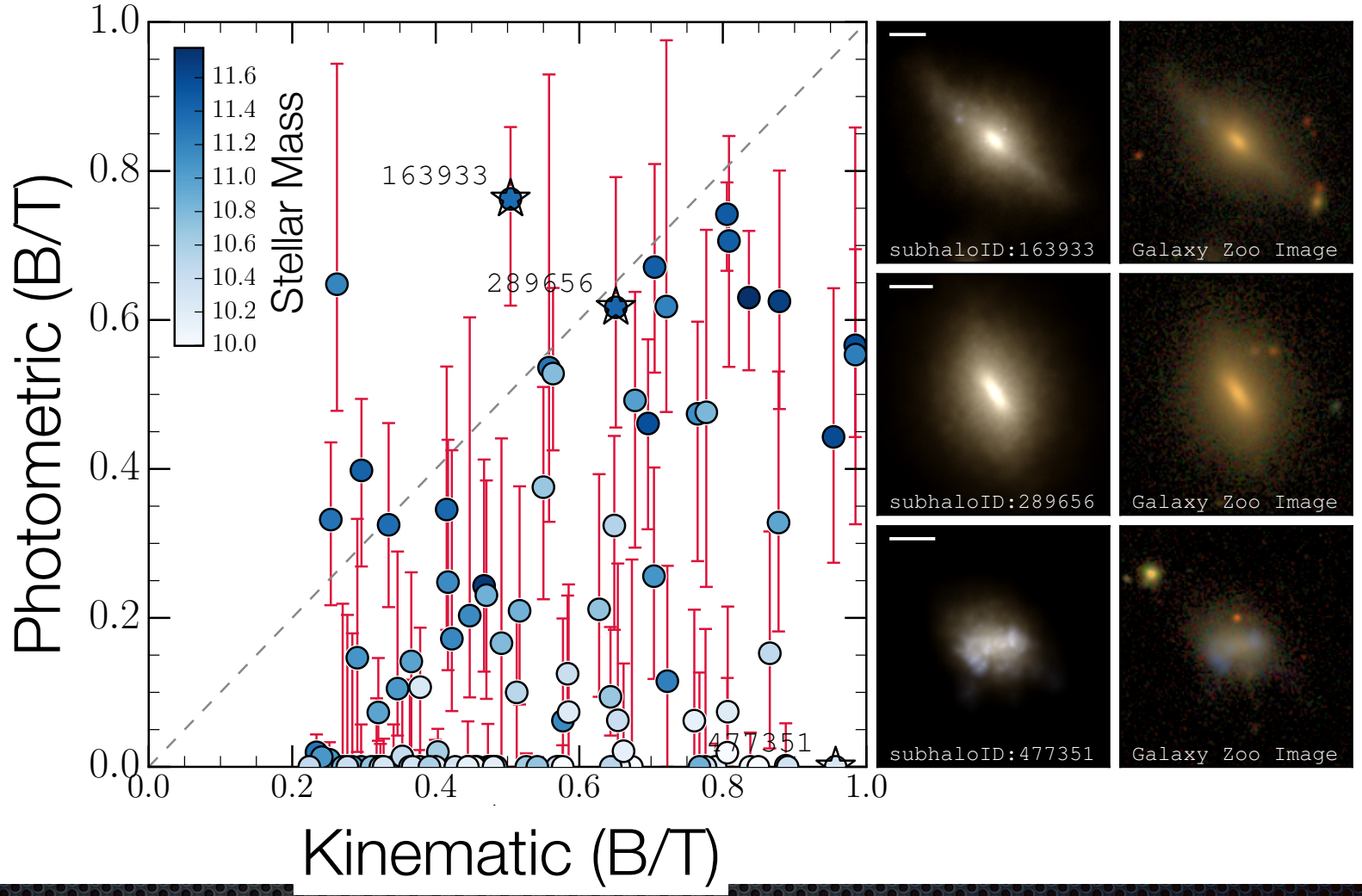
In samples matched by mass and (low) redshift, Illustris is bereft of bulges where real galaxies have diverse morphologies

Morphology Matched Size Luminosity Relation



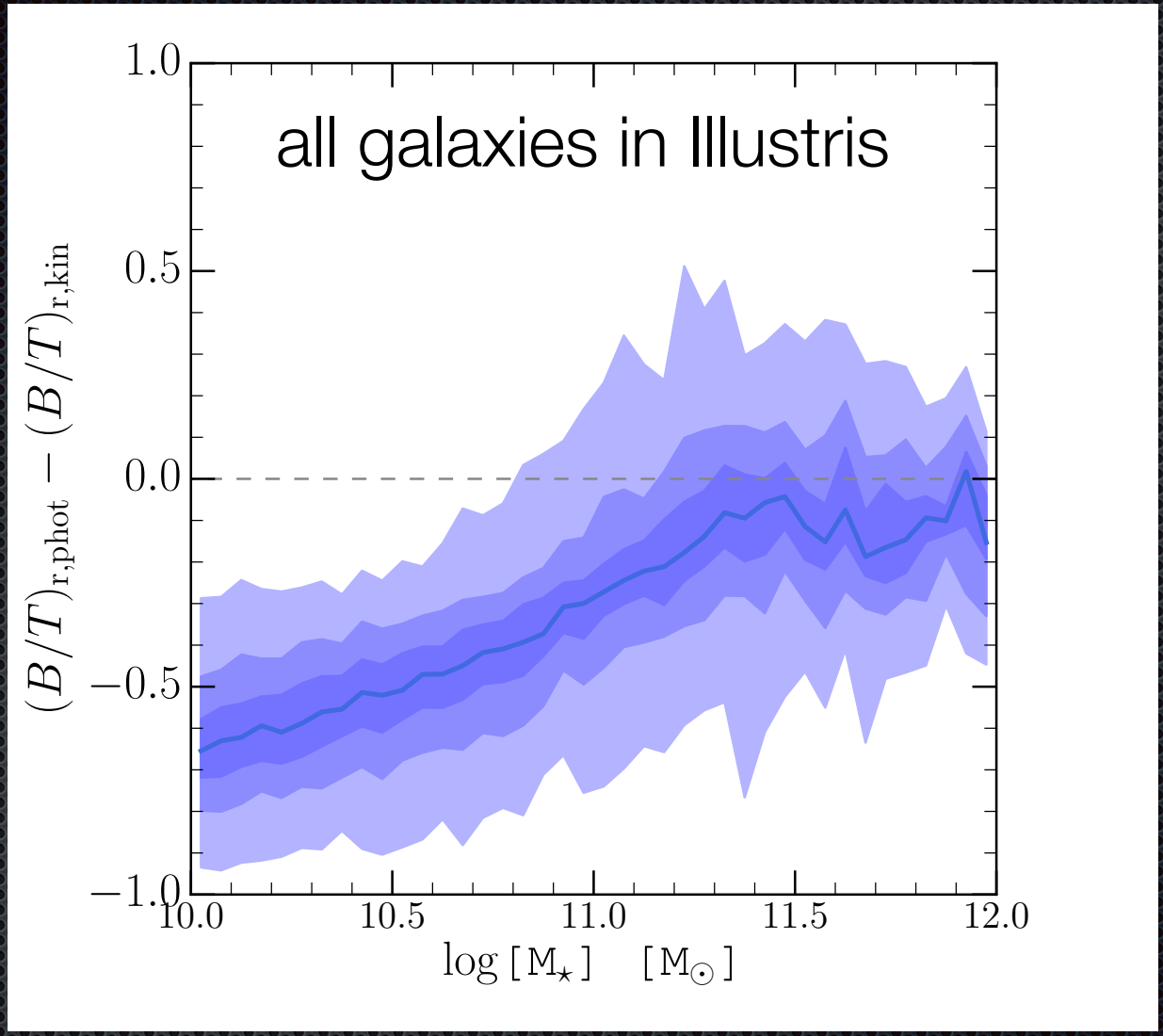
Morphology matching remedies broad differences in the SL relation, but is left with primarily the disc SL relation

Photometric and Kinematic Bulge Fractions



Photometric B/T systematically lower than kinematic B/T derived from stellar orbits. Lower mass galaxies most strongly affected.

Photometric and Kinematic Bulge Fractions



Photometric B/T systematically lower than kinematic B/T derived from stellar orbits. Lower mass galaxies most strongly affected.

- **Summary**
  - New image-based comparison method for observed galaxies and hydrodynamical simulations
    - Public Decomposition Catalogs and characterization of biases' affects on structural measurements

      Bottrell et al. 2016, MNRAS submitted. E-mail connor.bottrell@gmail.com for early access to catalogs
  - Difference in Size-luminosity relation driven by a deficit of bulge-dominataed galaxies in Illustris for galaxies with logM*<11 [Msun]
  - Discrepancy between kinematic and photometric B/T

Thank you