

GALAXY STRUCTURE AS A DRIVER OF THE STAR FORMATION SEQUENCE SLOPE AND SCATTER

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ABSTRACT

It is well established that (1) star-forming galaxies follow a relation between their star formation rate (SFR) and stellar mass (M_*), the “star-formation sequence”, and (2) the SFRs of galaxies correlate with their structure, where star-forming galaxies are less concentrated than quiescent galaxies at fixed mass. Here, we consider whether the scatter and slope of the star-formation sequence is correlated with systematic variations in the Sérsic indices, n , of galaxies across the SFR- M_* plane. We use a mass-complete sample of **23,848 galaxies at $0.5 < z < 2.5$ selected from the 3D-HST photometric catalogs**. Galaxy light profiles parameterized by n are based on *Hubble Space Telescope* CANDELS near-infrared imaging. We use a single SFR indicator empirically-calibrated from stacks of *Spitzer*/MIPS 24 μ m imaging, adding the unobscured and obscured star formation. We find that **the scatter of the star-formation sequence is related in part to galaxy structure**: the scatter due to variations in n at fixed mass for star-forming galaxies ranges from 0.14 ± 0.02 dex at $z \sim 2$ to 0.30 ± 0.04 dex at $z < 1$. While the slope of the $\log \text{SFR} - \log M_*$ relation is of order unity for disk-like galaxies, galaxies with $n > 2$ (implying more dominant bulges) have significantly lower SFR/ M_* than the main ridgeline of the star-formation sequence. These results suggest that **bulges in massive $z \sim 2$ galaxies are actively building up, where the stars in the central concentration are relatively young**. At $z < 1$, the presence of older bulges within star-forming galaxies lowers global SFR/ M_* , decreasing the slope and contributing significantly to the scatter of the star-formation sequence.

イントロダクション

- 星形成銀河のSFRと星質量には相関がある
 - Star-formation sequence
- Quiescentな銀河はSersic indexが大きい
 - 表面輝度が中心に集中(bulge-dominated)
- Star-formation sequenceとSersic indexの相関を調べ、銀河の構造進化と星形成の間関係について考える

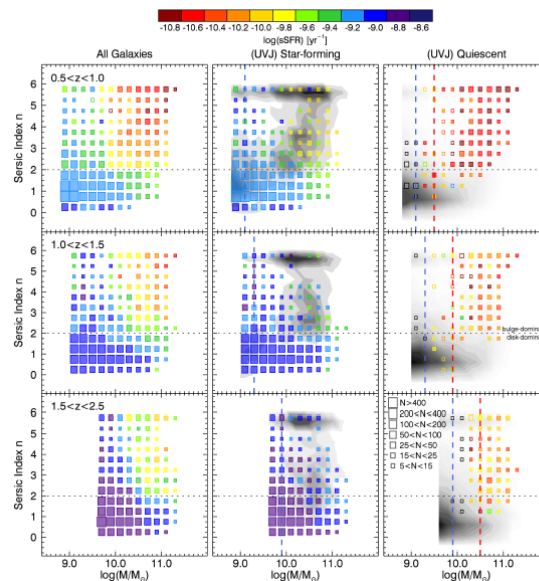
サンプル

- 0.5 < z < 2.5の銀河23,848個
 - 3D-HST photometric catalogs
 - $M > 10^{8.8} M_{\text{sol}}$
- n はHST/WFC3のデータを用いて測定
- SFRはSpitzer/MIPS 24 μ m photometryを用いたWhitaker et al. (2014)の方法で決定

結論

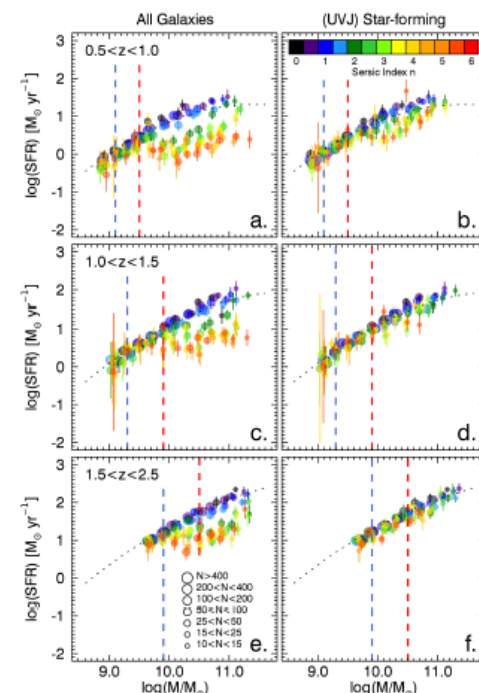
- Star-formation sequenceのscatterと銀河の構造(Sersic index)は関係している
- 1.5 < z < 2.5においては $n > 2$ の星形成銀河が多く存在する
 - $z \sim 2$ における急速なバルジ形成を示唆
- 顕著なバルジはクエンチングが起きるために重要なものかもしれない

Fig. 1



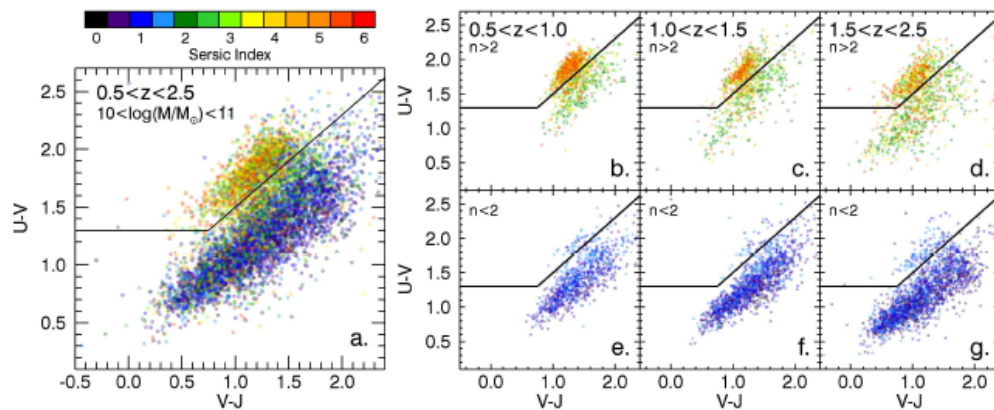
赤と青の破線はそれぞれquiescent, star-formingのmass limit

Fig. 2



点線はWhitaker et al. (2014)のstar-formation sequence

Fig. 4



UVJ colorでの銀河の分類