

Radial Star Formation Histories in 32 Nearby Galaxies

Daniel A. D. et al. 2020 arXiv : 2003.10260

ABSTRACT

The spatially resolved star formation histories are studied for 32 normal star-forming galaxies drawn from the the *Spitzer* Extended Disk Galaxy Exploration Science survey. At surface brightness sensitivities fainter than 28 mag arcsec⁻², the new optical photometry is deep enough to complement archival ultraviolet and infrared imaging and to explore the properties of the emission well beyond the traditional optical extents of these nearby galaxies. Fits to the spectral energy distributions using a delayed star formation history model indicate a subtle but interesting average radial trend for the spiral galaxies: the inner stellar systems decrease in age with increasing radius, consistent with inside-out disk formation, but the trend reverses in the outermost regions with the stellar age nearly as old as the innermost stars. These results suggest an old stellar outer disk population formed through radial migration and/or the cumulative history of minor mergers and accretions of satellite dwarf galaxies. The subset of S0 galaxies studied here show the opposite trend compared to what is inferred for spirals: characteristic stellar ages that are increasingly older with radius for the inner portions of the galaxies, and increasingly younger stellar ages for the outer portions. This result suggests that either S0 galaxies are not well modeled by a delayed- τ model, and/or that S0 galaxies have a more complicated formation history than spiral galaxies.

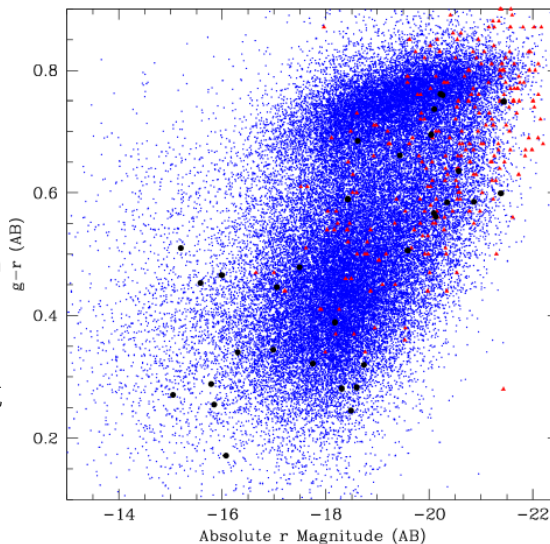
論文のポイント

- EDGESサーベイによって得られた赤外データを使って、32の銀河を6つの円環apertureに分けて傾向を調べた

サンプル

- EDGES (Extended Disk Galaxy Exploration Science) survey @ WIRO (Wyoming Infrared Observatory)
- 銀緯 $|b| > 60^\circ$ 、見かけの等級 $m_B < 16$ 、可視角径 $2 < D(') < 13$
- 6個のS0、10個の、16個の渦巻
- 距離は $3 < d < 22$ Mpc、median値は約9 Mpc
 - 9 Mpcで10'だと銀河の大きさは260 kpcくらい
- 形態分類や天の川銀河による減光などの数値はNASA/IPAC Extragalactic Database (NED)から

Fig. 1



黒：EDGES
青：SDSS近傍銀河
赤：CALIFA渦巻銀河

研究

- FUV/NUV, ugr, 3.6 μ m, 12 μ m, 24 μ mなどのデータをSED-fit
- 遅延星形成史モデル、Chabrier IMF、Calzetti dust attenuation curveなどを仮定

$$SFR(t) \propto A_0 t e^{-(t-t_0)/\tau}, \quad A_0(t-t_0 < 0) = 0$$
- CIGALEソフトウェア (Buat et al. 2014, Ciesla et al. 2015)

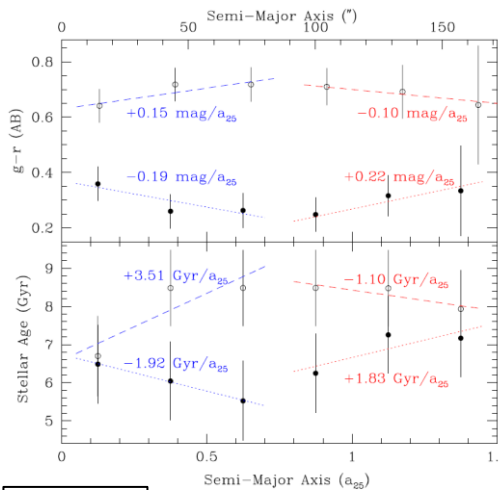
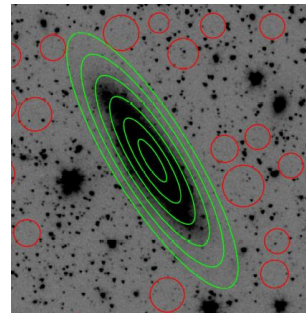


Fig. 5

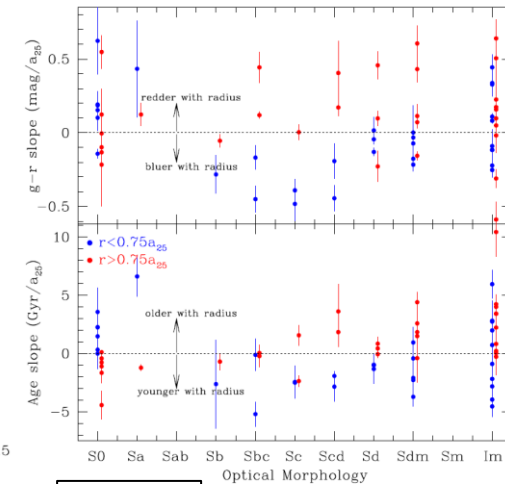


Fig. 6

結論

- 渦巻銀河はinner diskで負のslope(外側に向けて若くなる)を持ち、outer diskで正のslope(外側に向けて古くなる)を持つ
 - Inside-out star formationを示唆
 - Outer-diskに関してはaccretionやmergerによって外部から星が堆積した可能性を示唆
- 一方S0は逆トレンド
 - 早期型は遅延星形成史モデルでは表せない、複雑な星形成史を持つ可能性がある