MORPHOLOGY AND THE COLOR–MASS DIAGRAM AS CLUES TO GALAXY EVOLUTION AT $z \sim 1$

Meredith C. Powell[1], C. Megan Urry[1], Carolin N. Cardamone[2], Brooke D. Simmons[3,5], Kevin Schawinski[4], Sydney Young[1], and Mari Kawakatsu[1]

[1] Yale Center for Astronomy and Astrophysics, and Physics Department, Yale University, P.O. Box 2018120, New Haven, CT 06520-8120, USA

[2] Wheelock College, Boston, MA 02215, USA

[3] Center for Astrophysics and Space Sciences, University of California, San Diego, La Jolla, CA 92093, USA

[4] Institute for Astronomy, Department of Physics, ETH Zurich, Zurich 8093, Switzerland

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ABSTRACT

We study the significance of mergers in the quenching of star formation in galaxies at $z \sim 1$ by examining their color–mass distributions for different morphology types. We perform two-dimensional light profile fits to GOODS *iz* images of ~5000 galaxies and X-ray selected active galactic nucleus (AGN) hosts in the CANDELS/GOODS-north and south fields in the redshift range $0.7 < z < 1.3$. Distinguishing between bulge-dominated and disk-dominated morphologies, we find that disks and spheroids have distinct color–mass distributions, in agreement with studies at $z \sim 0$. The smooth distribution across colors for the disk galaxies corresponds to a slow exhaustion of gas, with no fast quenching event. Meanwhile, blue spheroids most likely come from major mergers of star-forming disk galaxies, and the dearth of spheroids at intermediate green colors is suggestive of rapid quenching. The distribution of moderate luminosity X-ray AGN hosts is even across colors, in contrast, and we find similar numbers and distributions among the two morphology types with no apparent dependence on Eddington ratio. The high fraction of bulge-dominated galaxies that host an AGN in the blue cloud and green valley is consistent with the scenario in which the AGN is triggered after a major merger, and the host galaxy then quickly evolves into the green valley. This suggests AGN feedback may play a role in the quenching of star formation in the minority of galaxies that undergo major mergers.

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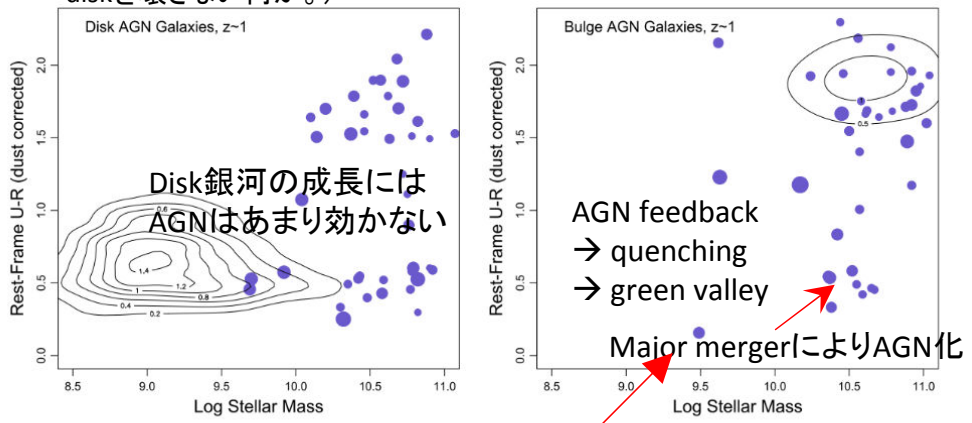
- z~1 GOODS-N/S領域の銀河
  - 静止系U-R・sersic index・形態非対称性・X線光度
- 色/形態進化とAGN (feedback) に何か関係はあるか？

（AGNに火をつける仕組みはdiskを壊さない何か。）

AGNを持つ銀河の星質量と静止系U-R



gure 10. Color–mass diagram for the host galaxies of AGNs, separated into disk-dominated galaxies (left) and bulge-dominated galaxies (right). The contours present the (much larger) distribution of inactive galaxies, and the size of the points roughly correspond to the black hole Eddington ratios. The distribution of AGN hosts is roughly uniform in color space for both morphologies. They are also approximately equal in number, showing that mergers cannot be the only or main trigger of AGNs.

形態別 (n<2, 2.5<n) の星質量と静止系U-R

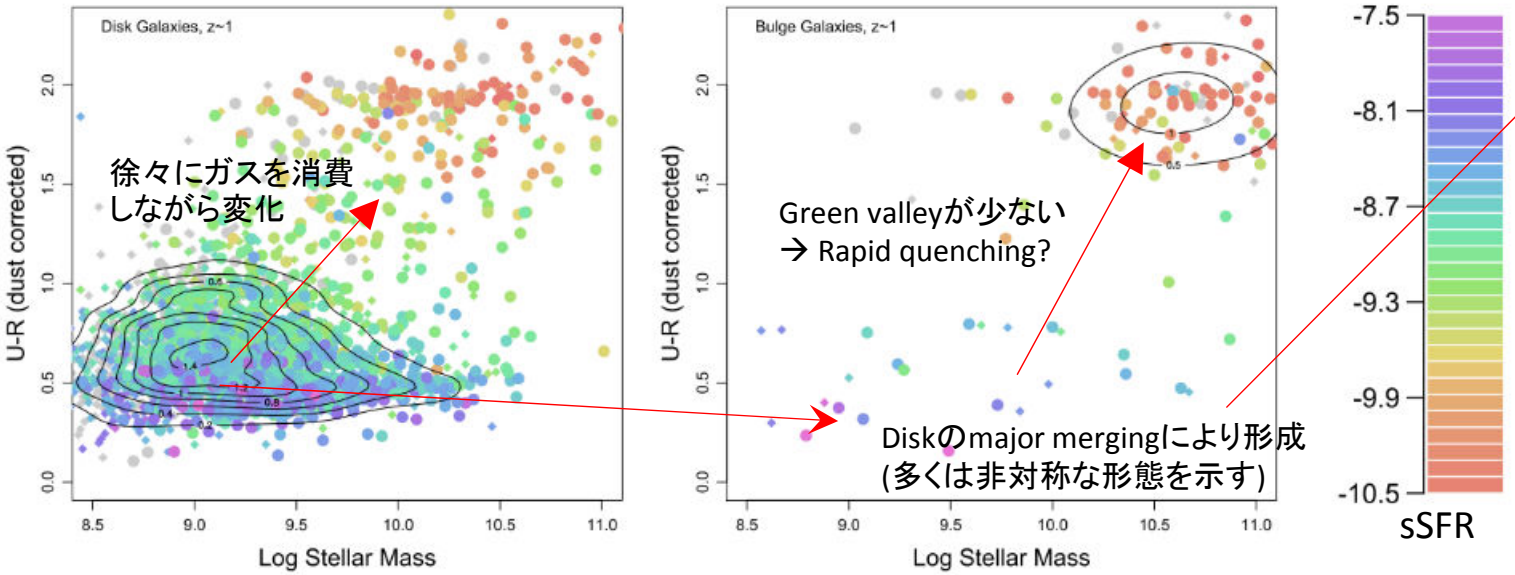


Figure 7. Dust corrected $U - R$ color vs. log stellar mass for $z \sim 1$ galaxies, shown separately for disk-dominated morphology (left; Sérsic index $n < 2$), and bulge-dominated morphology (right; $n > 2.5$). The color of each point corresponds to the galaxy's specific star formation rate from Whitaker et al. (2014) (shown by the colorbar at right labelled by the corresponding log of the specific star formation rate), and the shape corresponds to the redshift type (circle for spectroscopic and diamond for photometric). The unimodal distribution of disk galaxies extending toward higher masses suggests a slow quenching process, while the low number of spheroid galaxies in the green valley suggests a faster quenching time.

U-RとAGN fraction

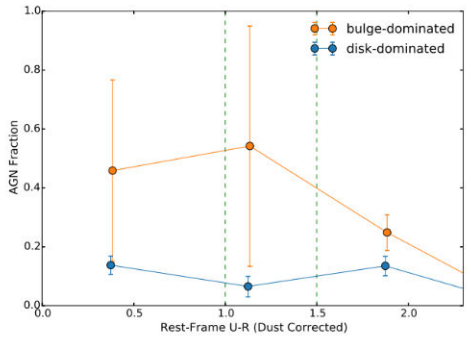


Figure 11. Fraction of galaxies above $M_* = 10^{10}\,M_\odot$ that host AGNs vs. rest-frame $U - R$ color for both bulge-dominated (orange) and disk dominated galaxies (blue). The green valley lies in between the two vertical dotted lines, and the normalization is corrected for the number of excluded galaxies and AGNs. Although not statistically very significant, the fraction of bulge-dominated AGN hosts is larger than for disk galaxies in the blue cloud and green valley. This suggests that AGN feedback is not significant for galaxies that have not undergone a major merger, but may play a role in quenching for galaxies that have.

➢ Early typeへの進化にはmajor merger + AGN feedbackが関わっているようだ