EVIDENCE FOR NON-STELLAR REST-FRAME NEAR-IR EMISSION ASSOCIATED WITH INCREASED STAR FORMATION IN GALAXIES AT $z \sim 1$

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ABSTRACT

We explore the presence of non-stellar rest-frame near-IR (2–5 μm) emission in galaxies at $z \sim 1$. Previous studies identified this excess in relatively small samples and suggested that such non-stellar emission, which could be linked to the 3.3 μm polycyclic aromatic hydrocarbons feature or hot dust emission, is associated with an increased star formation rate (SFR). In this Letter, we confirm and quantify the presence of an IR excess in a significant fraction of galaxies in the 3D-HST GOODS catalogs. By constructing a matched sample of galaxies with and without strong non-stellar near-IR emission, we find that galaxies with such emission are predominantly star-forming galaxies. Moreover, star-forming galaxies with an excess show increased mid- and far-IR and Hα emission compared to other star-forming galaxies without. While galaxies with a near-IR excess show a larger fraction of individually detected X-ray active galactic nuclei (AGNs), an X-ray stacking analysis, together with the IR-colors and Hα profiles, shows that AGNs are unlikely to be the dominant source of excess in the majority of galaxies. Our results suggest that non-stellar near-IR emission is linked to increased SFRs and is ubiquitous among star-forming galaxies. As such, the near-IR emission might be a powerful tool to measure SFRs in the era of the *James Webb Space Telescope*.

Key words: galaxies: active – galaxies: high-redshift – galaxies: star formation

星種族合成モデルでは説明できないNIR excess成分の調査 @ z~1

- 銀河のSEDには、星由来 (<1um)、PAHやwarm dust由来 (>10um) 以外にdominantな成分はないのか？
- JWSTでの近赤分光時代に備えて、**2-5um付近のSED**の情報を調査してみる。
- 3D-HST sampleについて、**NIR excess**が大きいもの・小さいものから、similar redshift, Msで169 pairsを選出。

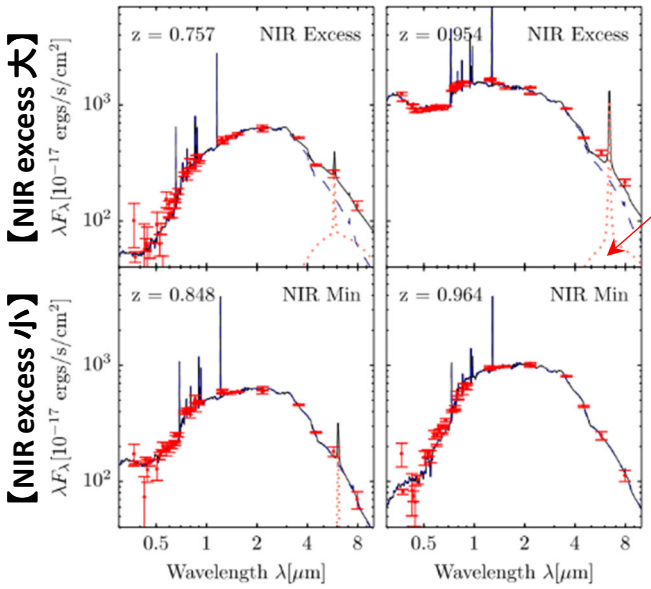
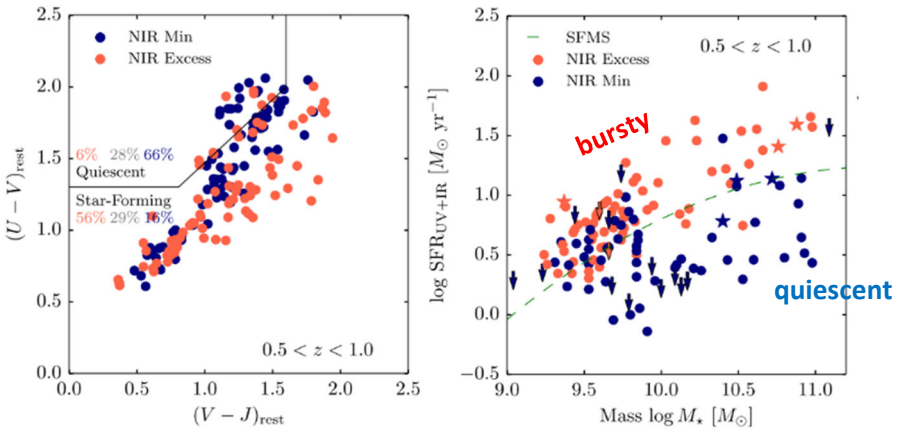


Figure 1. SED fitting w/ EAZY + PAH + graybody

❖ 後々NIR Excessを見たいので、NIR dataは重みを下げてfitしている。

Figure 2. NIR excessの有無とプロパティの相関



↑NIR excessを示す銀河はbursty、示さない銀河でmassiveなものはquiescent。

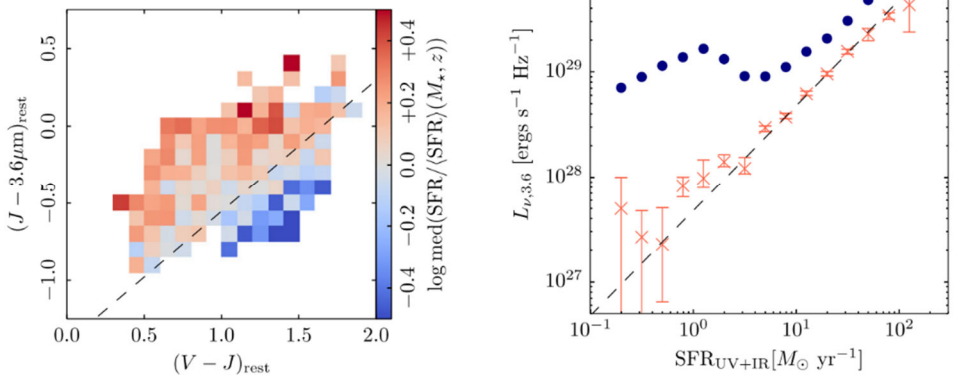


Figure 4. Left: rest-frame $V-J$ vs. $J-3.6$ μm colors of all star-forming galaxies in our sample. Colors indicate the median star formation rate with respect to the SFMS. Redder NIR colors correlate strongly with increased SFRs. Right: median rest-frame IRAC1 stellar and non-stellar luminosity as a function of SFR for all galaxies in the broader sample, except X-ray AGNs. Error bars are computed from 100,000 bootstrap realizations and the dashed line shows the best-fit linear relation.

- J-3.6が赤い(→NIR Excessが大きい) ほどMSから外れる。
- 星由来でない3.6um強度はSFRに線形相関。→ 逆手に取って、NIRSpec/JWSTではNIR excessからSFRが推定できる (?)
- どのSEDモデルでも若い星だけではNIR excessは説明できない。
- Av~10のdustなら説明可能だが、銀河全体の平均で10magの吸収は非現実的。

NIR excessは星形成銀河に付随し、そのSFRと相関を示す性質のようだ。

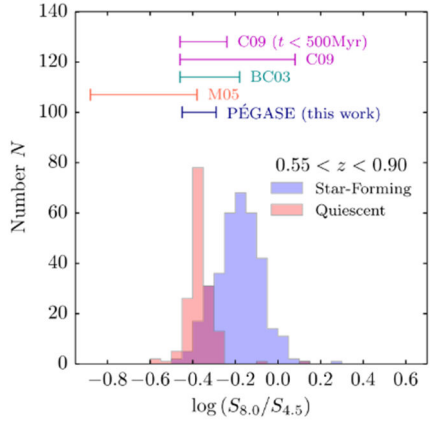


Figure 5. Distribution of [8.0] − [4.5] IRAC colors for galaxies in our sample with $0.55 < z < 0.90$. We also show the ranges allowed by our PÉGASE templates and other SPS models. Star-forming galaxies show systematically redder colors, indicative of excess emission redward of the 3.3 μm PAH feature.