Decoupled Black Hole Accretion and Quenching: The Relationship Between BHAR, SFR, and Quenching in Milky Way and Andromeda-mass Progenitors Since $z = 2.5$

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We investigate the relationship between the black hole accretion rate (BHAR) and star-formation rate (SFR) for Milky Way (MW) and Andromeda (M31)-mass progenitors from $z = 0.2 - 2.5$. We source galaxies from the K_s-band selected ZFOURGE survey, which includes multi-wavelenth data spanning $0.3 - 160\mu$m. We use decomposition software to split the observed SEDs of our galaxies into their active galactic nuclei (AGN) and star-forming components, which allows us to estimate BHARs and SFRs from the infrared (IR). We perform tests to check the robustness of these estimates, including a comparison to BHARs and SFRs derived from X-ray stacking and far-IR analysis, respectively. We find as the progenitors evolve, their relative black hole-galaxy growth (i.e. their BHAR/SFR ratio) increases from low to high redshift. The MW-mass progenitors exhibit a log-log slope of 0.64 ± 0.11, while the M31-mass progenitors are 0.39 ± 0.08. This result contrasts with previous studies that find an almost flat slope when adopting X-ray/AGN-selected or mass-limited samples and is likely due to their use of a broad mixture of galaxies with different evolutionary histories. Our use of progenitor-matched samples highlights the potential importance of carefully selecting progenitors when searching for evolutionary relationships between BHAR/SFRs. Additionally, our finding that BHAR/SFR ratios do not track the rate at which progenitors quench casts doubts over the idea that the suppression of star-formation is predominantly driven by luminous AGN feedback (i.e. high BHARs).

Fig. 1

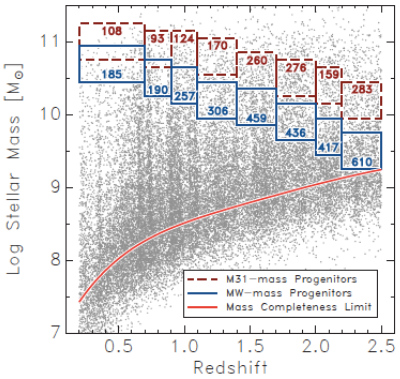
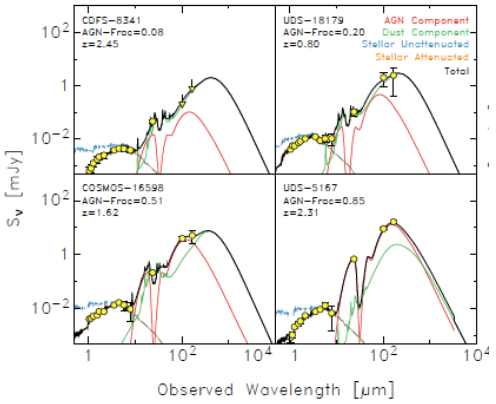


Fig. 2



❖Introduction

- 観測技術の向上により、Milky WayやM31のhigh-z progenitorの赤方偏移進化を調べることが可能となった
- MWやM31のprogenitorは赤方偏移が小さいほどquenched, bulge-dominatedになる (e.g. Papovich+15)
- 近傍で見られるM-σ relationのように、銀河とSMBHは共進化していると考えられており、AGN feedbackもそのひとつ
- AGN光度とSFRの相関はいくつか報告されているが、progenitor biasの影響を強く受けている可能性がある

❖Data

- ZFOURGE catalogの多波長データ + ChandraのX線データ
- z=0.2−2.5のMW-mass progenitor 2860個とM31-mass progenitor 1473個
- CIGALE (Burgarella+05)でSED fitting
  - 各コンポーネントの寄与も同時に算出
- X線光度はSTACFAST (Hickox+07)を用いて各赤方偏移ビンでスタックした平均を使用する
- FIRとX線からAGN光度を算出し、ブラックホール降着率（BHAR）を計算

$$\mathrm{BHAR} = 0.15\frac{\epsilon}{0.1}\frac{L_{\mathrm{AGN}}}{10^{45}\mathrm{erg\ s^{-1}}}$$

❖Result

Fig. 4

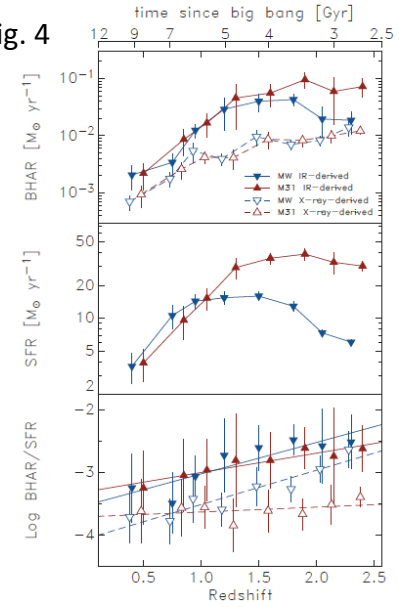
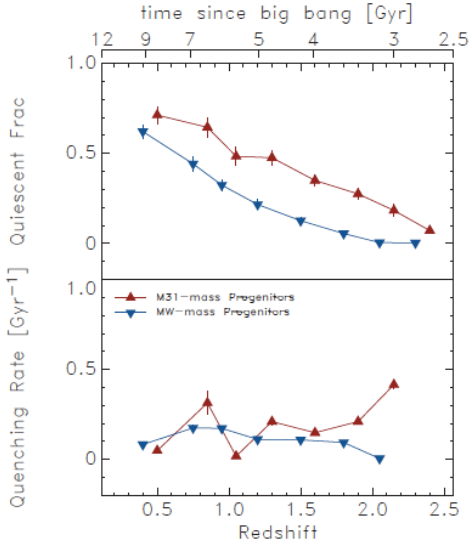


Fig. 5



- BHAR/SFRはhigh-zほど大きい（先行研究の多くはflat）
- AGN feedbackが強く働くならば、quenchingが起きる時代でBHARは大きくなると予想されるが、そうなっていない
- 従来のサンプル選択法（mass, X-ray, etc.)は銀河進化を正しく追えていない可能性（全く異なる銀河種族を比較してしまっている）