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The Connection between Galaxy Star Formation Rates and Supermassive Black Hole Accretion Rates from z=0-10

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We discuss the relationship between black hole and galaxy growth, as inferred from observations using the TRINITY empirical model. Key findings include: 1) the ratio between cosmic SMBH accretion rate and galaxy star formation rate stays constant at ~0.002 from z=0–4, and decreases at z>4; 2) the average SMBH Eddington ratio increases towards higher redshifts, nearly reaching η=1 at z~10; 3) at fixed redshift for z<3, SMBHs/galaxies with higher masses have lower Eddington ratios, consistent with AGN downsizing; 4) the average ratio of specific SMBH accretion rate (SBHAR) to average specific star formation rate (SSFR) is nearly mass-independent, with a value SBHAR/SSFR~1, which decreases slightly from z=10 to z=0; 5) similar to galaxies, SMBHs reach their peak efficiency to convert baryons into mass when host halos reach 10^12 M⊙. These findings combine to give a simple explanation for massive (10^9–10^10 M⊙) quasars at z>6: at these redshifts, dark matter halos experience ~Eddington specific growth rates, driving ~Eddington specific growth rates in both galaxies and SMBHs.

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