

The AGN-Star Formation Connection in the Local Universe

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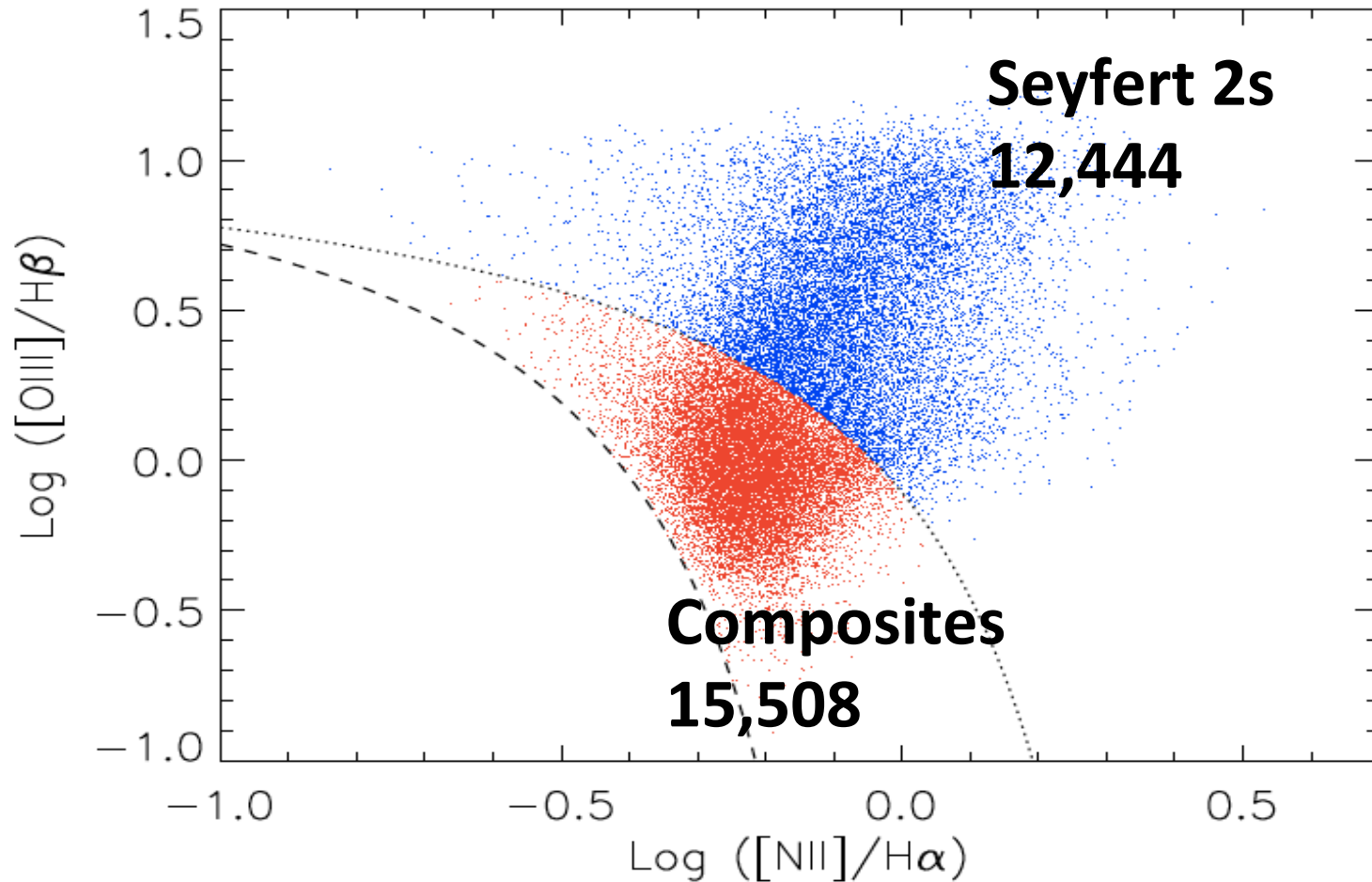
Timothy Heckman, Andrew Ptak, C. Megan Urry

(ApJL 765, 33, 2013)

Questions Addressed

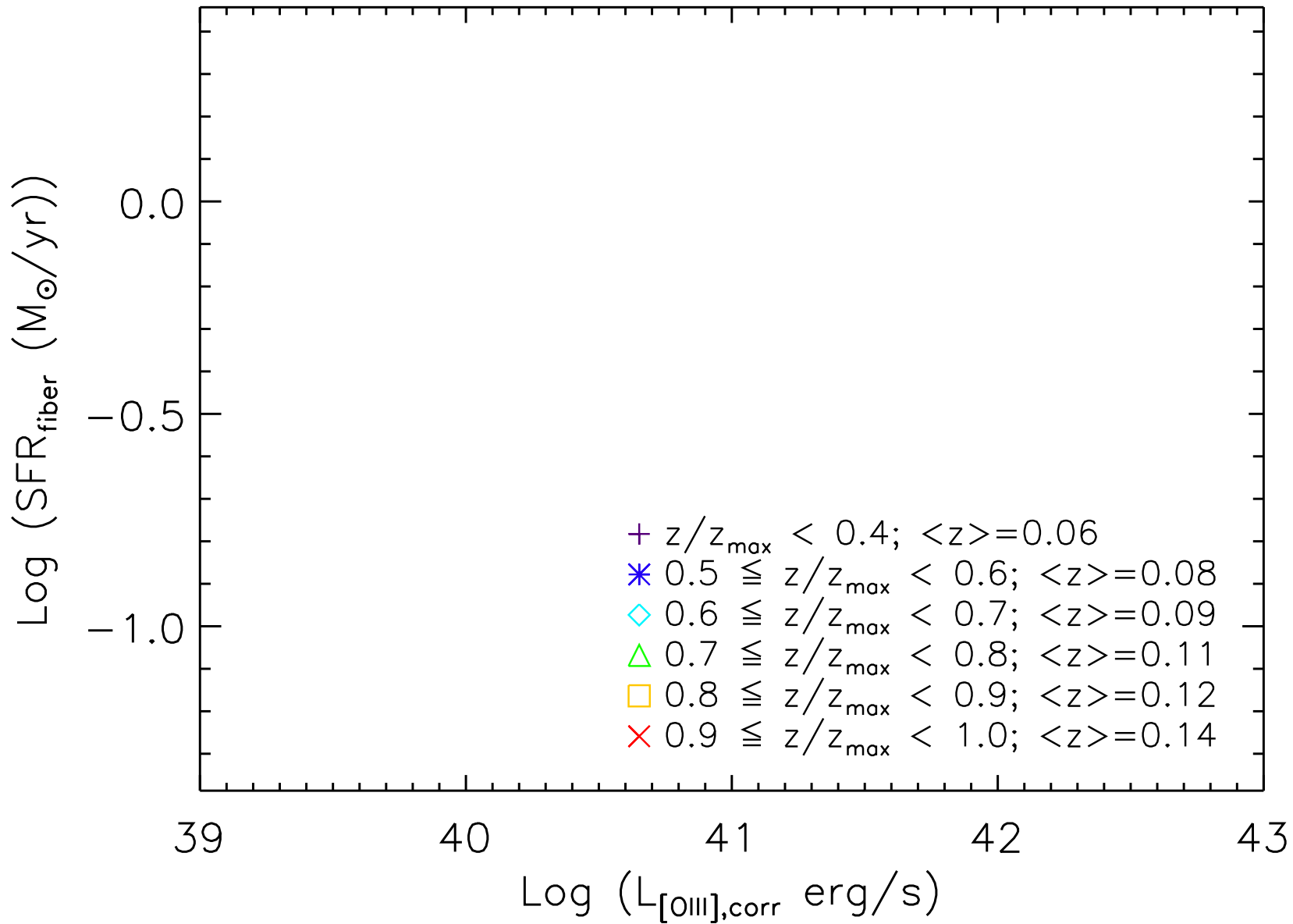
- Does the AGN-star formation connection change with physical scale?
- Is the relationship dependent on AGN luminosity?

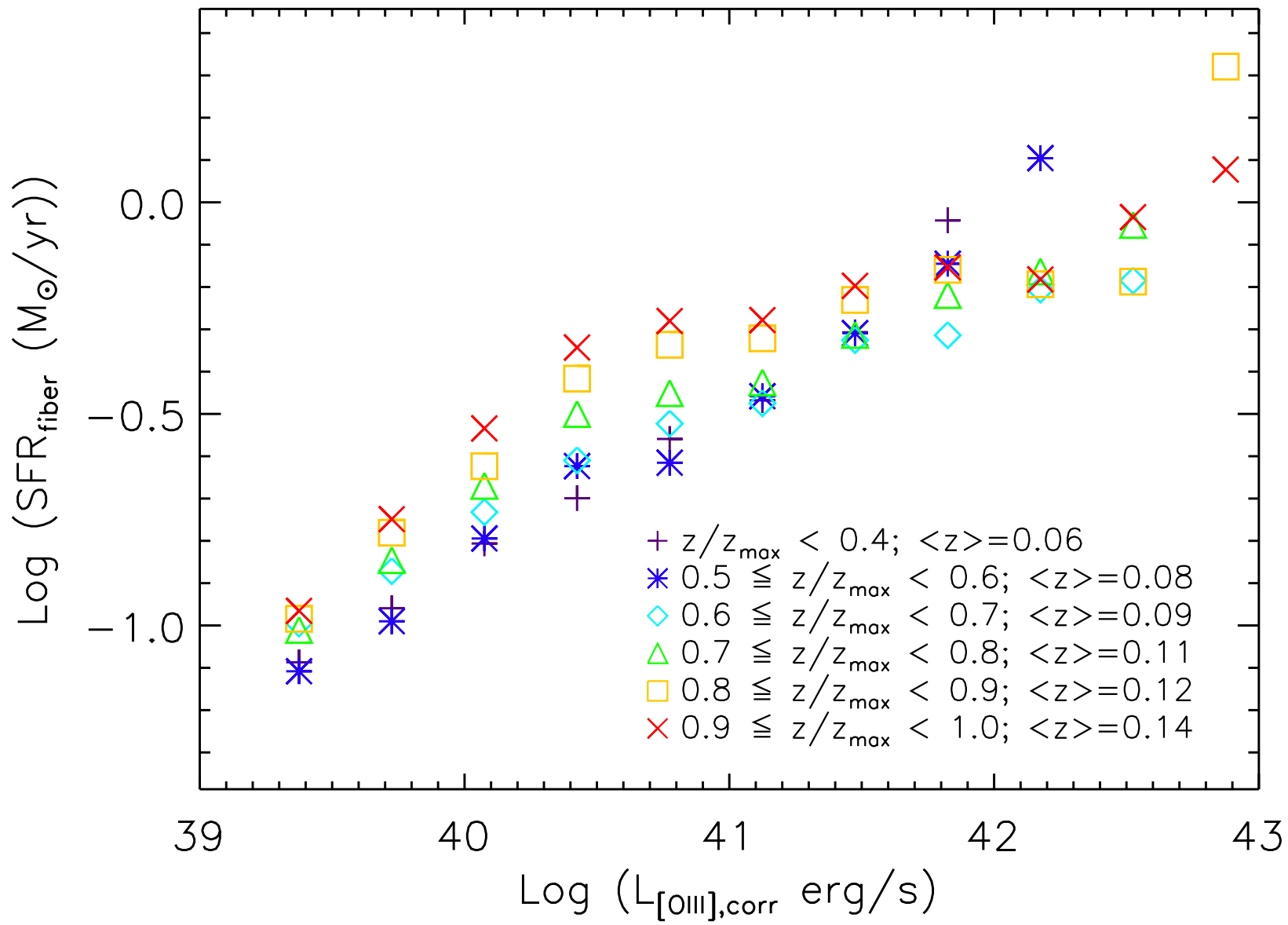
- $\sim 28,000$ galaxies from SDSS DR7
 - 5σ $H\alpha$, $H\beta$, $[\text{NII}] 6584 \text{ \AA}$, $[\text{OIII}] 5007 \text{ \AA}$ detections

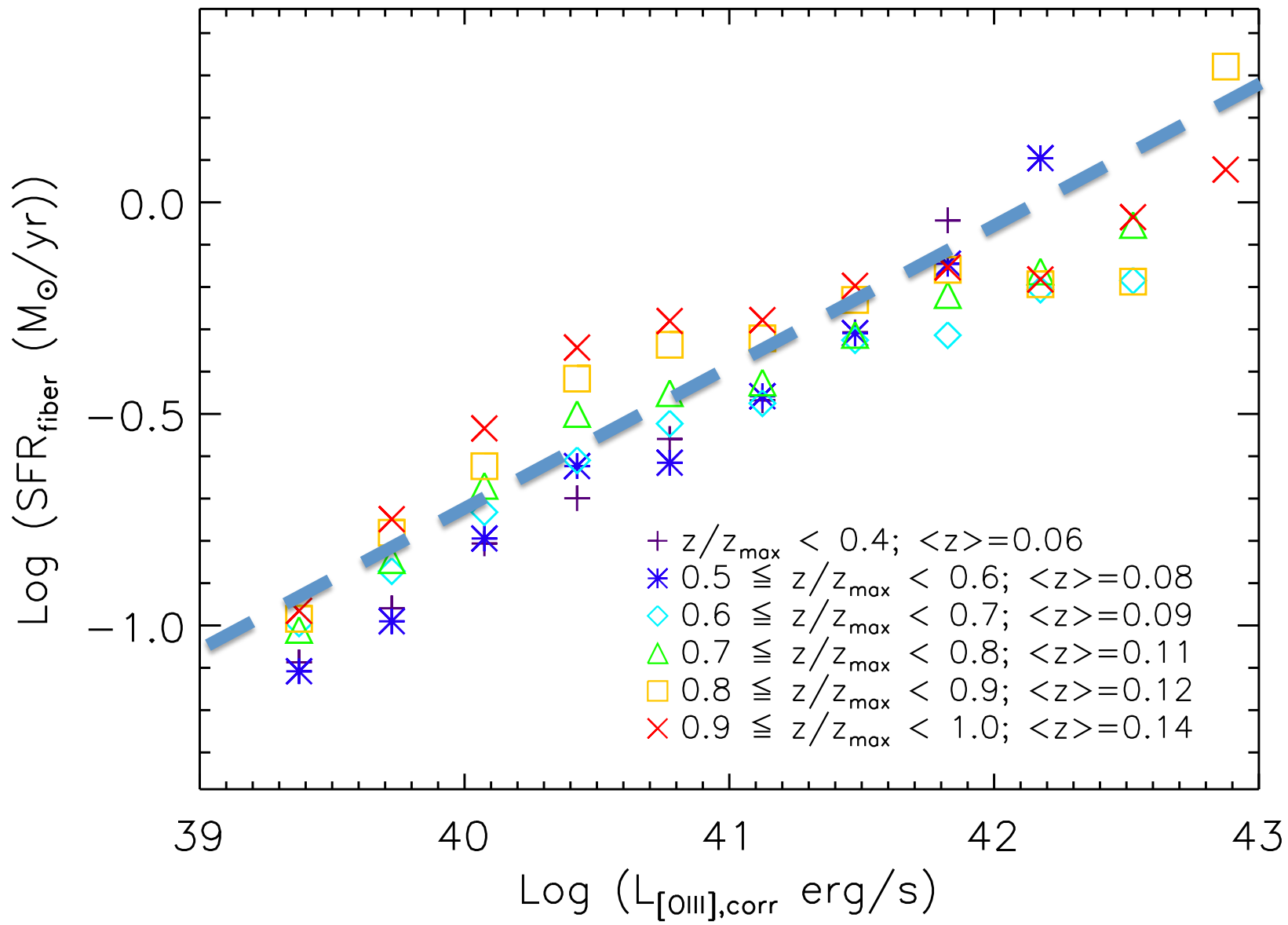


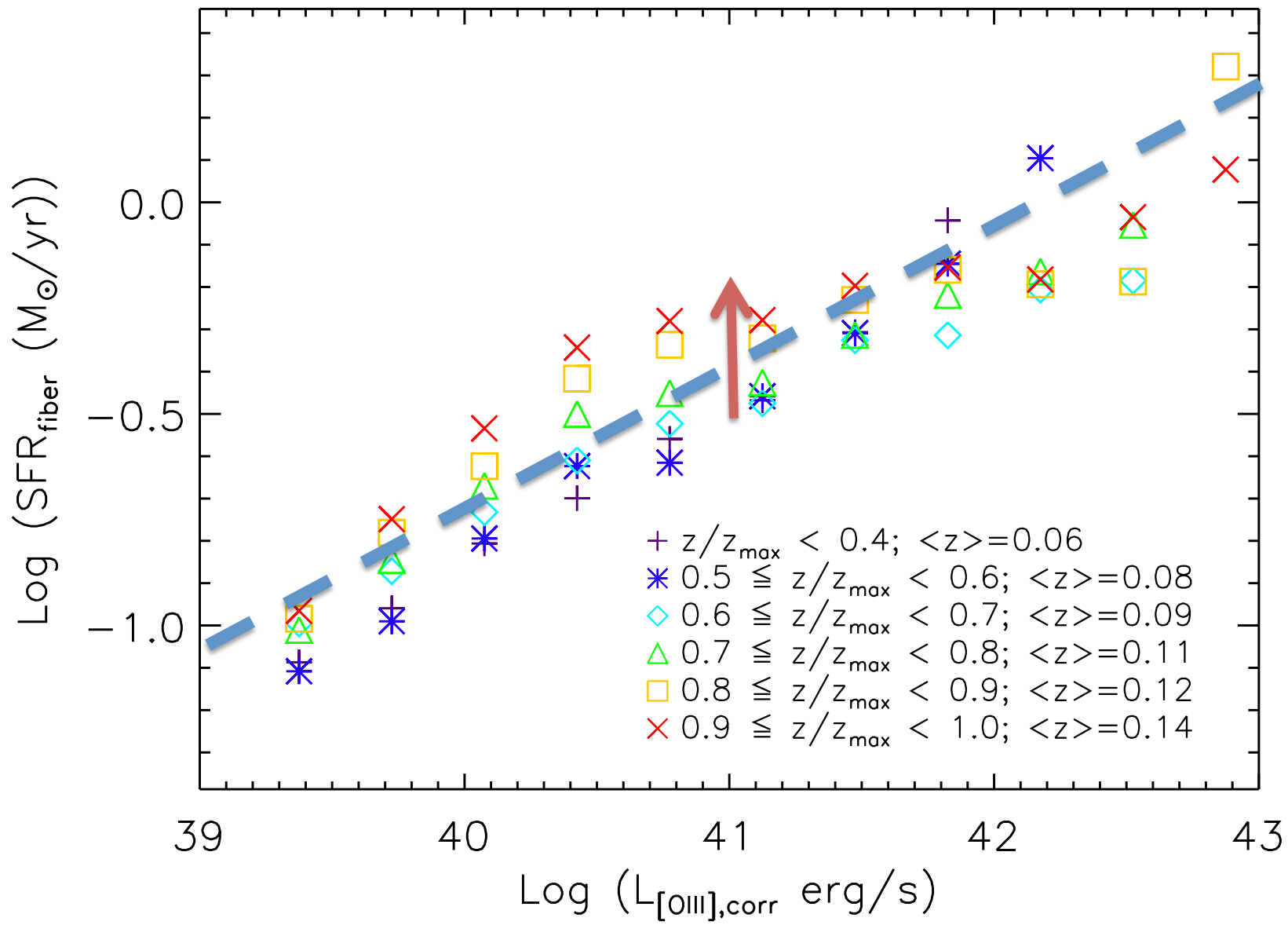
Quantifying Key Parameters

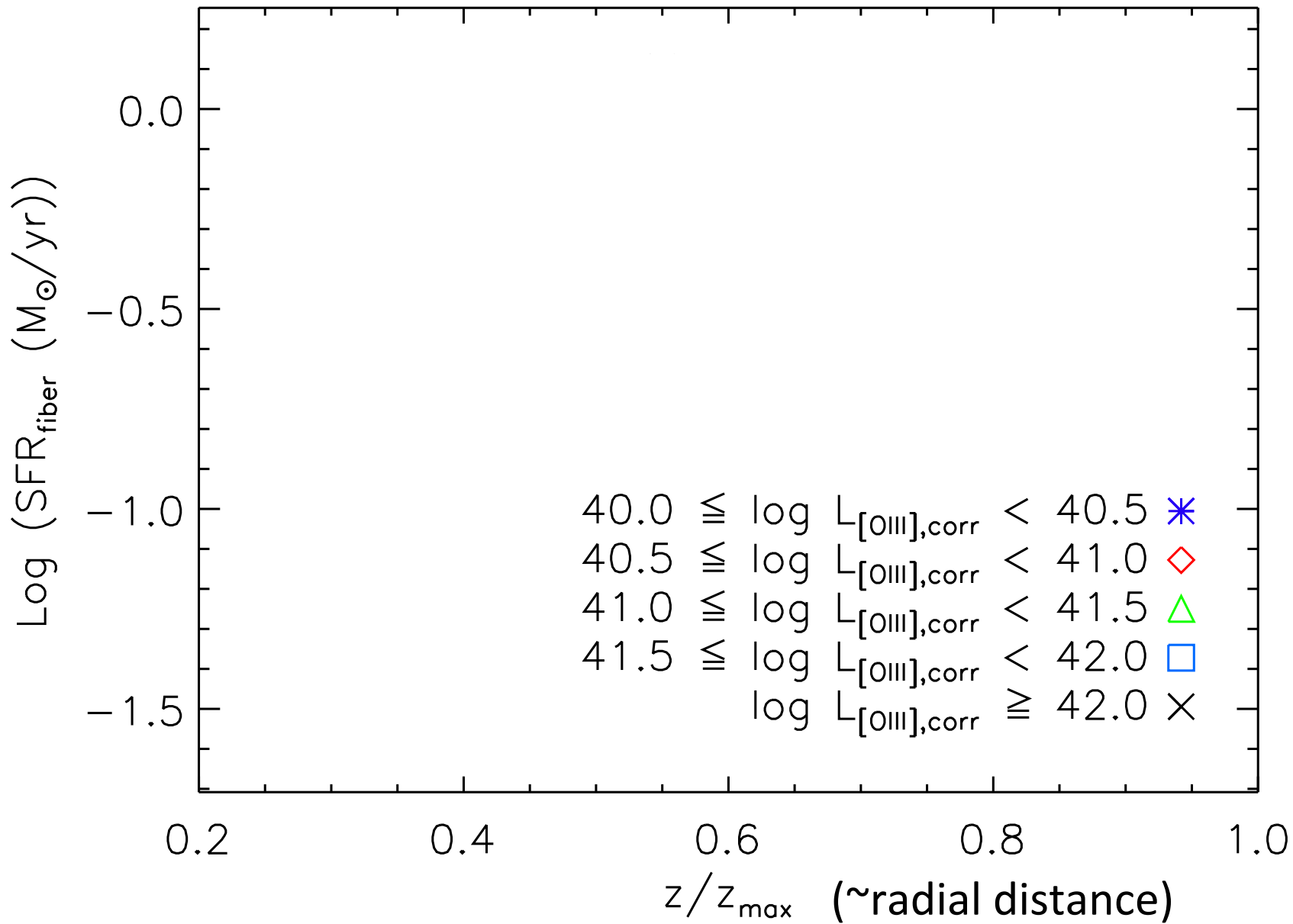
- AGN intrinsic luminosity
 - Extinction corrected, AGN-only [OIII] luminosity (Wild et al. 2010)
- SFR_{fiber}
 - Calibrated on Dn(4000) break (Brinchmann et al. 2004)
 - Agrees w/ IR SFR indicators (LaMassa+ 2012a)
- z/z_{max} as distance proxy
 - $0.06 < z < 0.14$ (1.7 – 3.5 kpc)
- Completeness via $V/V_{\text{max}} = 0.5 \pm 0.1$

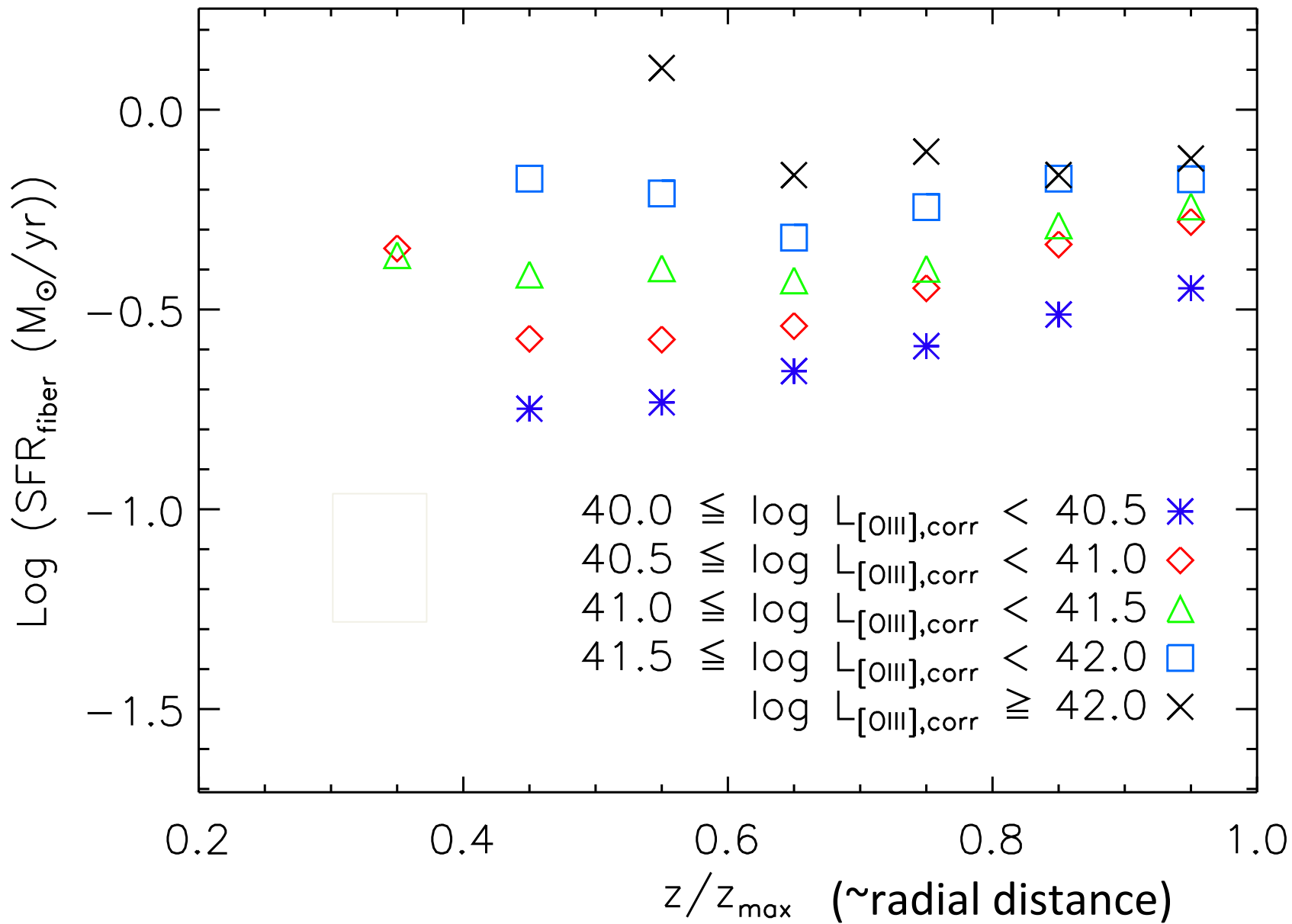




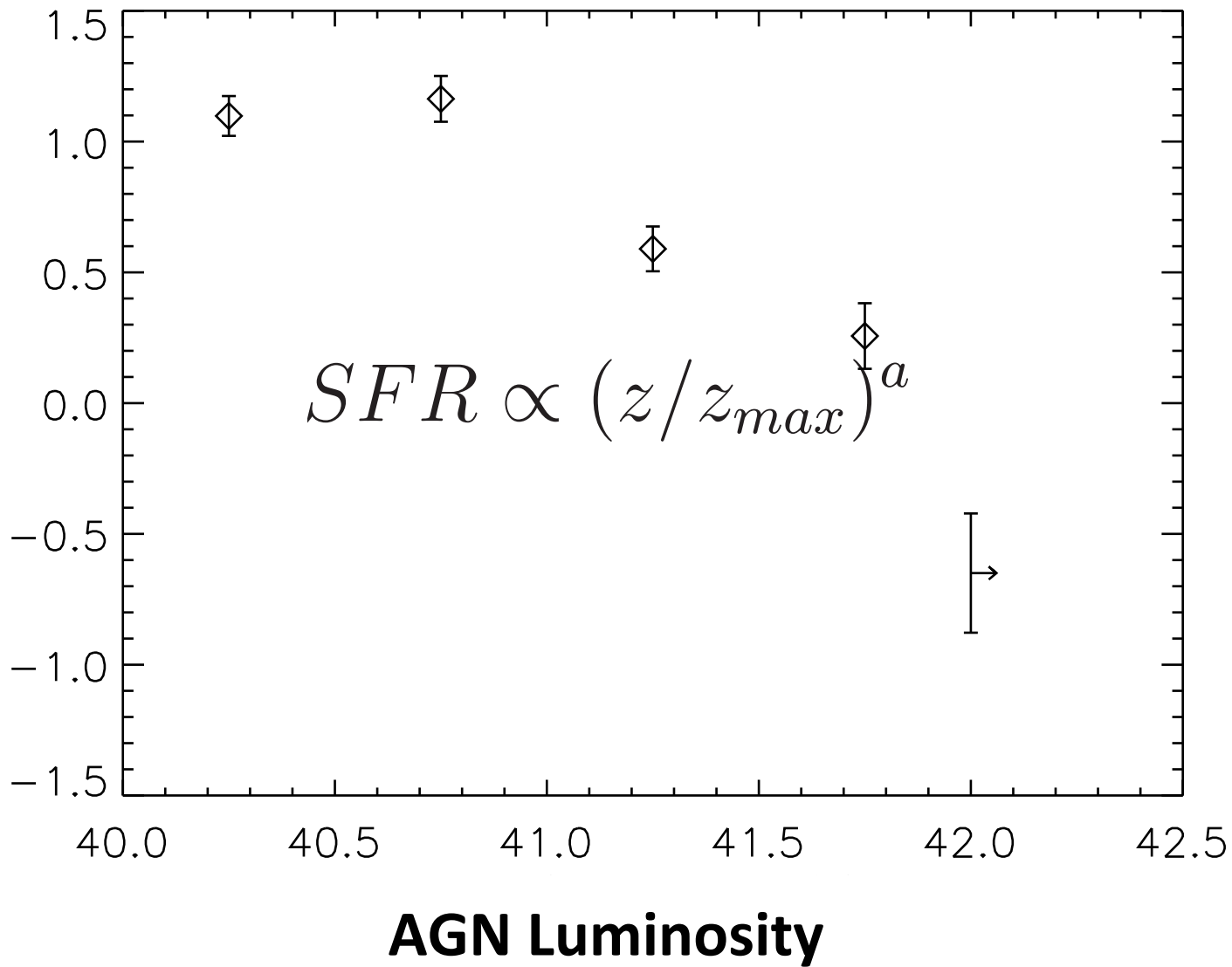








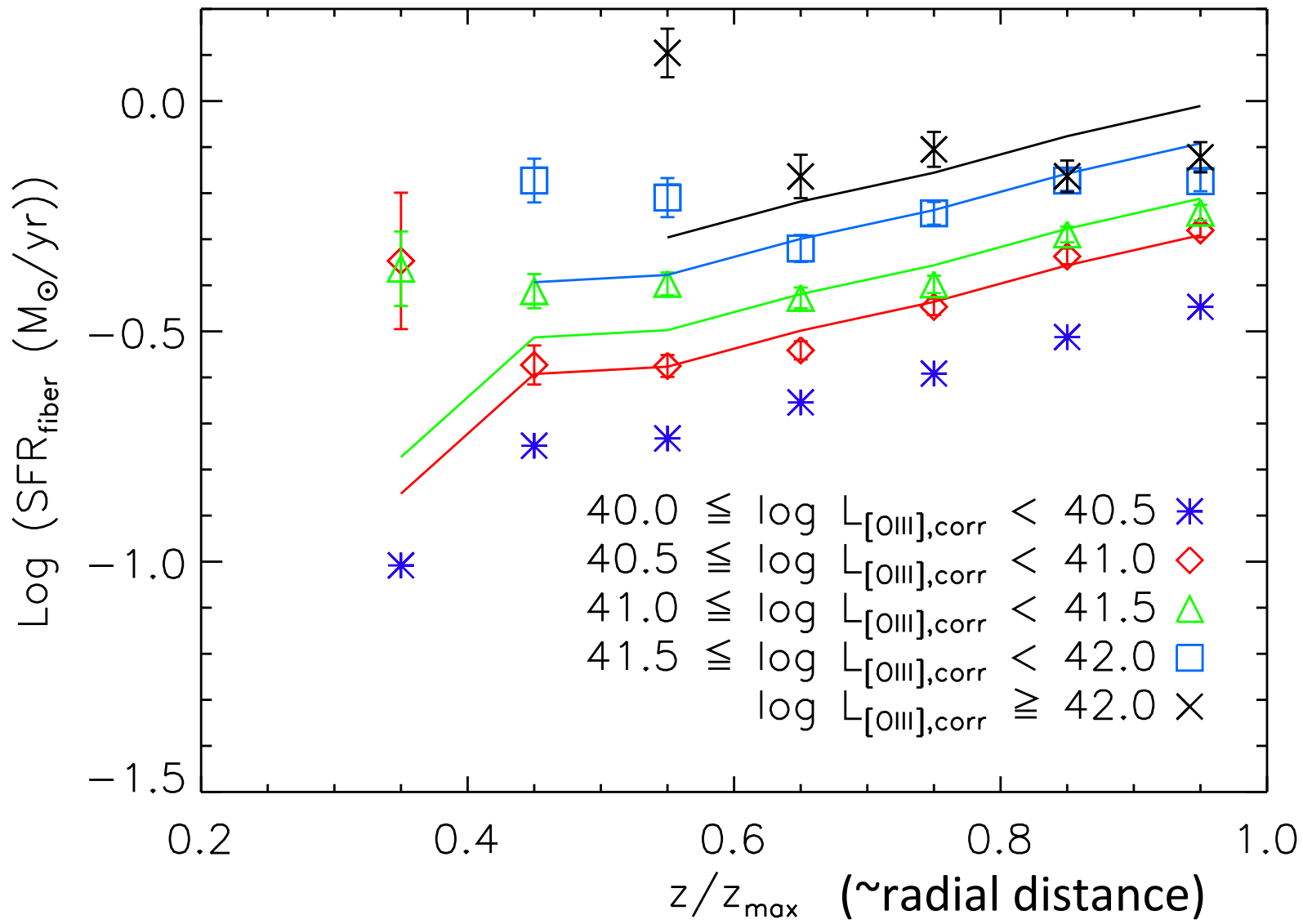
Dependence of SFR on radial distance



$$SFR_{fiber} = SFR_{nucleus} + SFR_{disk}$$

$$SFR_{nucleus} = \alpha (M_{\odot}/yr) \times (L_{[OIII],corr}/10^{42} \text{ erg/s})^{\beta}$$

$$SFR \propto \dot{M}^{0.36}$$



Physical Implications

Mergers?

- Trigger circumnuclear star formation (e.g., Springel + 2005) ✓
- Not lopsided (Reichard + 2009) ✗
- Not luminous enough (Treister + 2012) ✗

Bars, bars-in-bars, spiral arms?

- Galactic-scale star formation (Hopkins & Quataert 2010) ✗

Stellar mass loss?

- Recycled circumnuclear gas is radiatively unstable: feed BH while triggering SF (Ciotti & Ostriker 2007) ✓

Conclusions (ApJL 765, 33, 2013)

- Connection between AGN/SF on circumnuclear scales
 - Consistent with Kauffman + (2007) & Diamond-Stanic & Reike (2012)
- Dependence on AGN luminosity
- Constrains theories: circumnuclear instead of galactic scale SF
- Sub-linear dependence of SFR on SMBH accretion