The environmental impact of galaxy evolution

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Galaxy Groups as Probes of Cosmic Feedback

Hot gas in groups (temperature, “entropy”, metallicity)
affected by cosmic feedback.

Groups are common and very susceptible to these effects.

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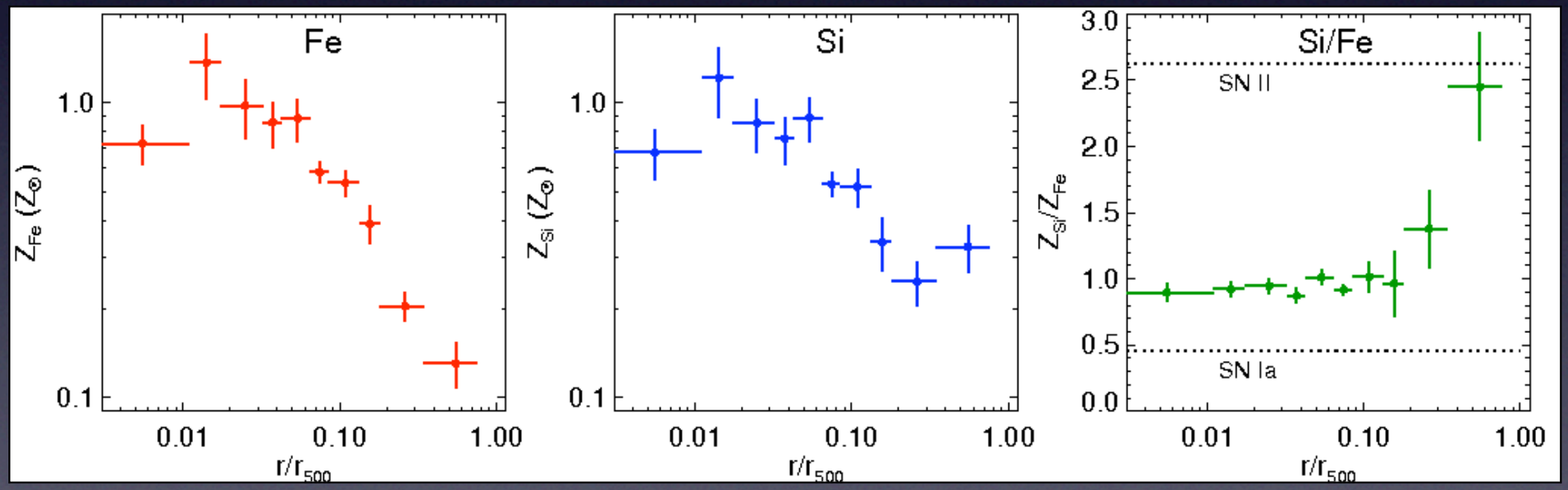
Binned abundance profiles of 15 groups (JR + Ponman 2007):



r_{500}:$\bar{\rho}(r \leq r_{500}) = 500\rho_{crit}$

Supernova Feedback

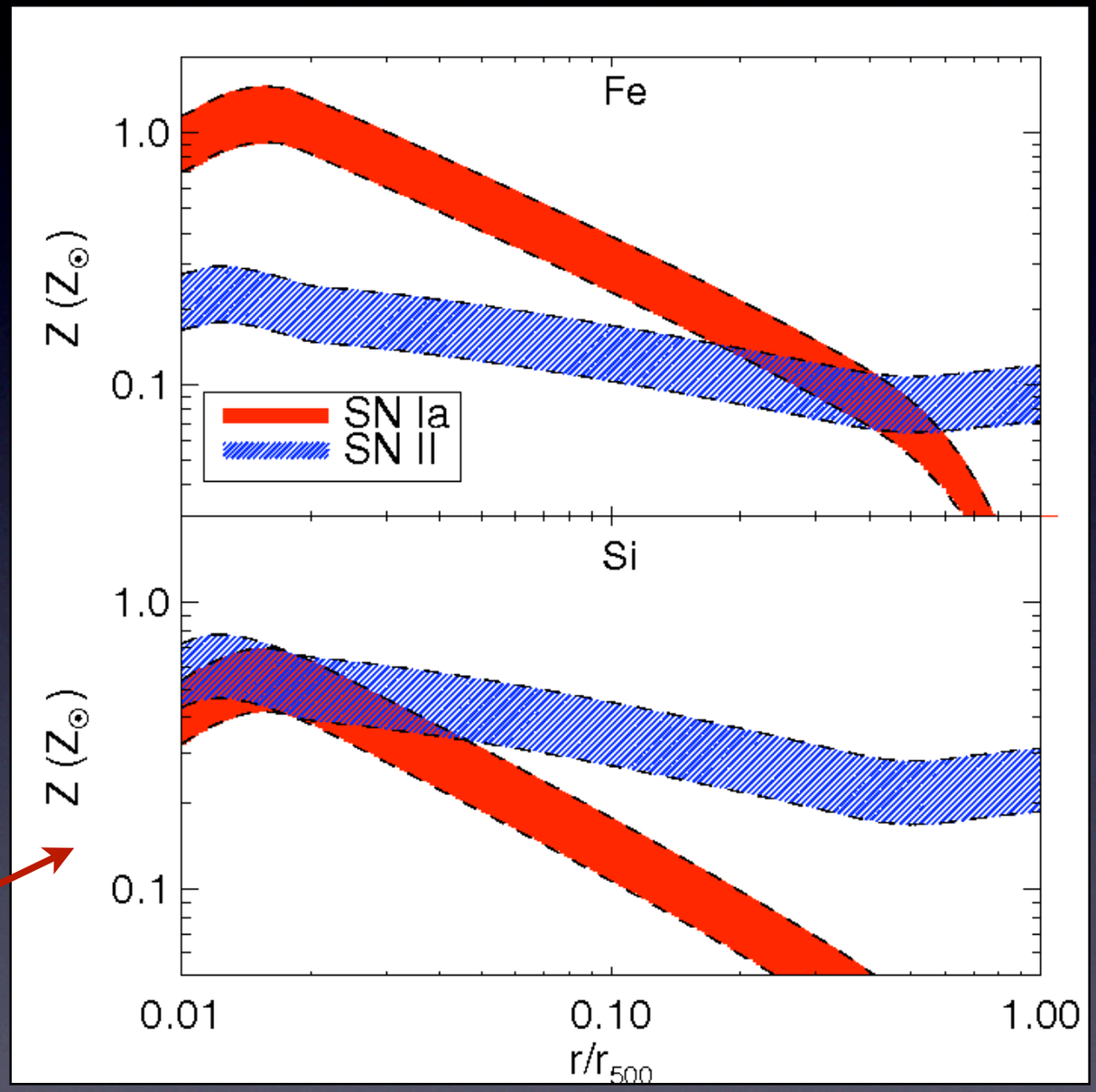
SN Ia/II ratio in core ⇒

"recent" enrichment
($z \lesssim 0.7$; HDF/CDF)

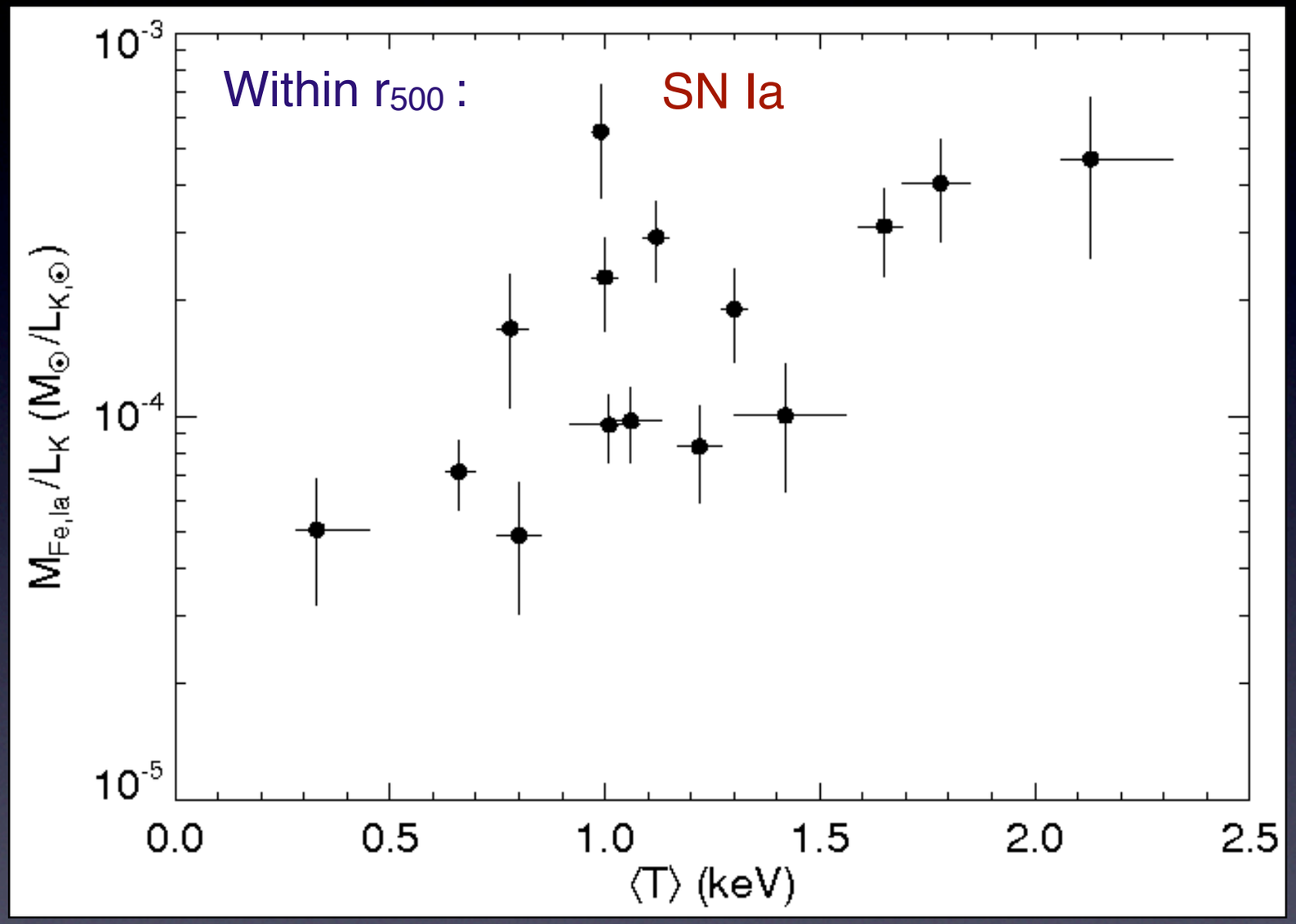
Ratio in outskirts:
Consistent with
predictions for $z \gtrsim 1$.
(Dahlen+ 04)

SN yields from
Iwamoto+ 99 (SN Ia),
Nomoto+ 06 (cc-SN)

SN Ia vs SN II, all 15 groups:



Supernova Feedback and Star Formation History



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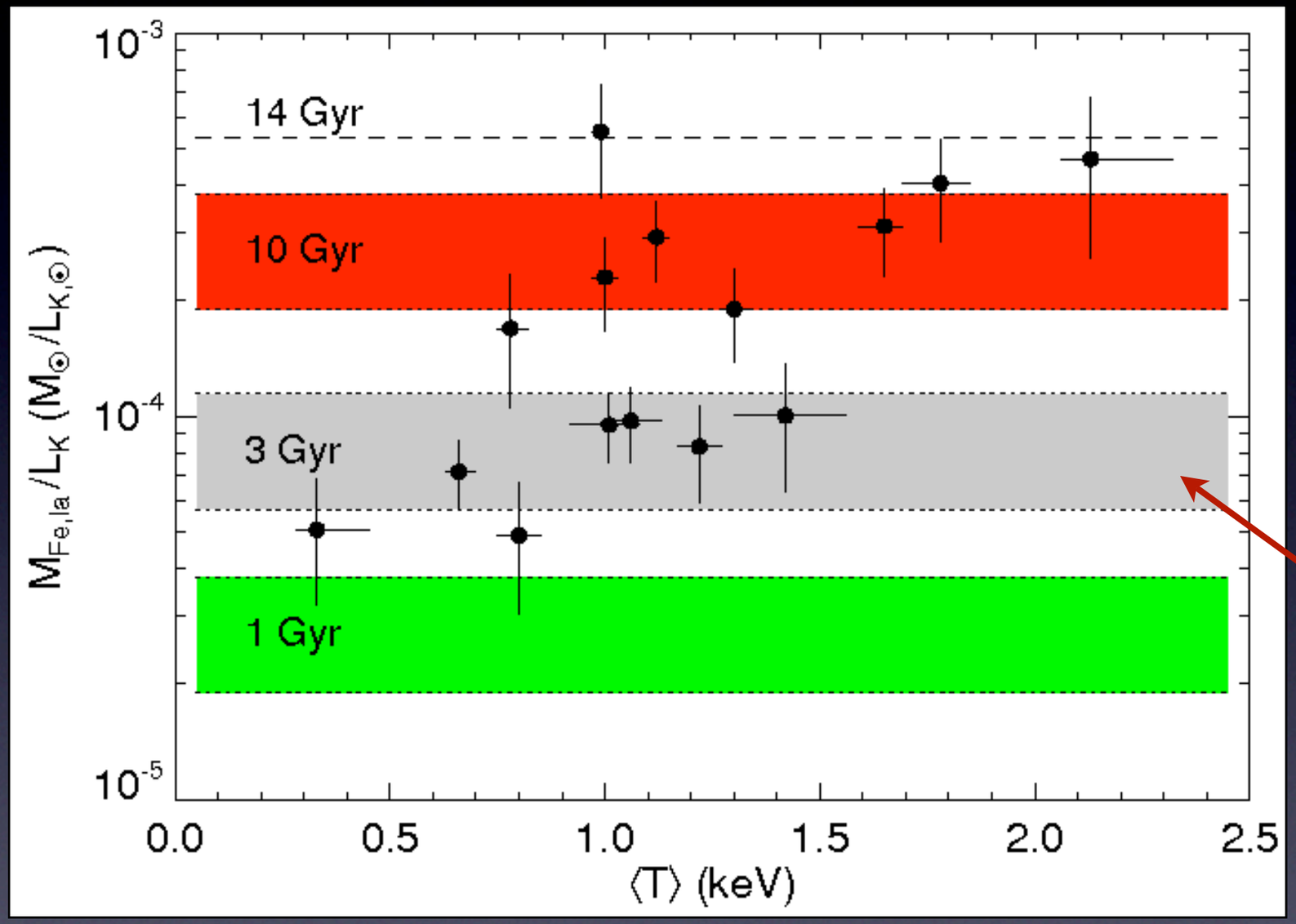
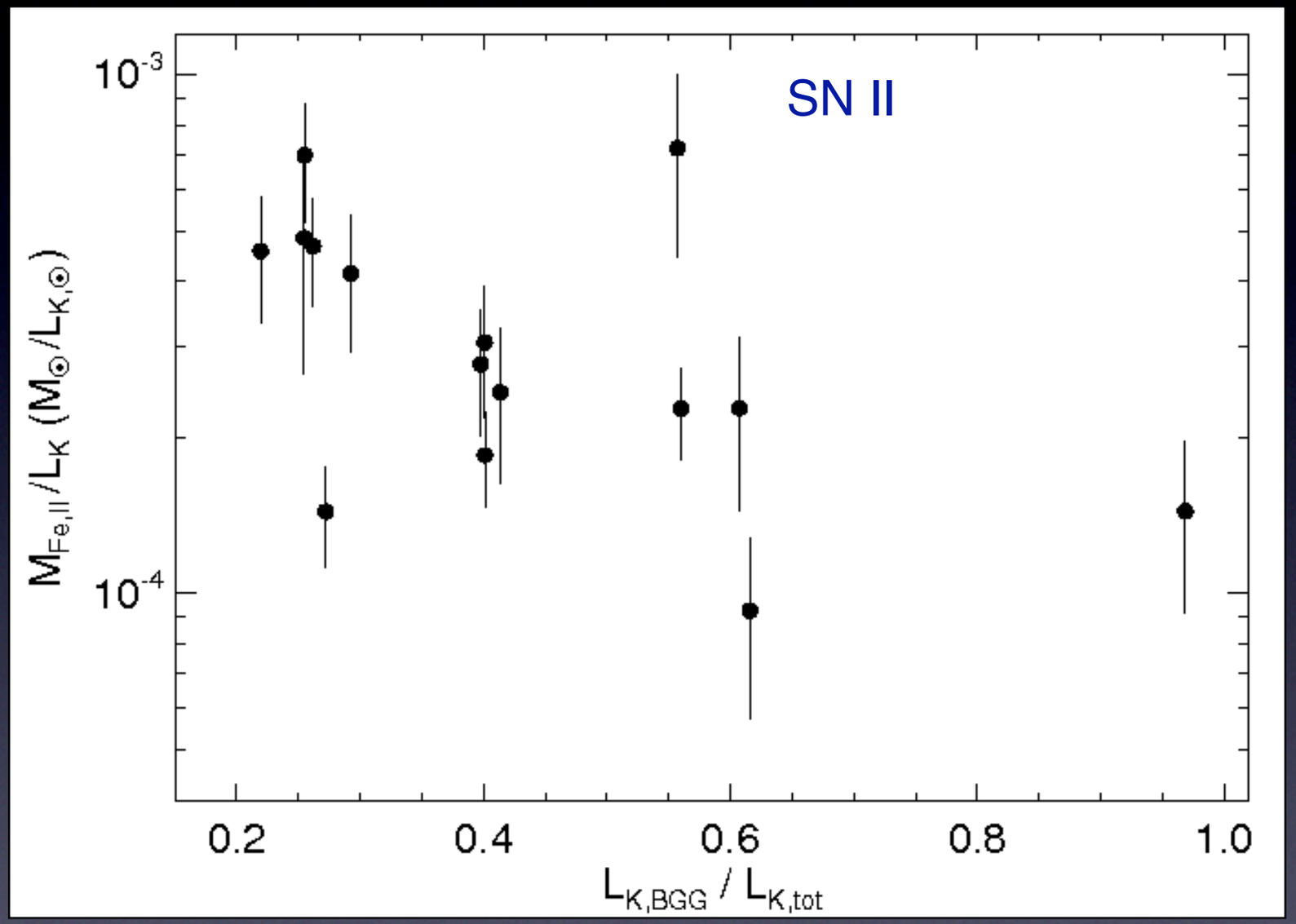


SN rates:
Mannucci+ 05
for local
early-types

Supernova Feedback and Star Formation History



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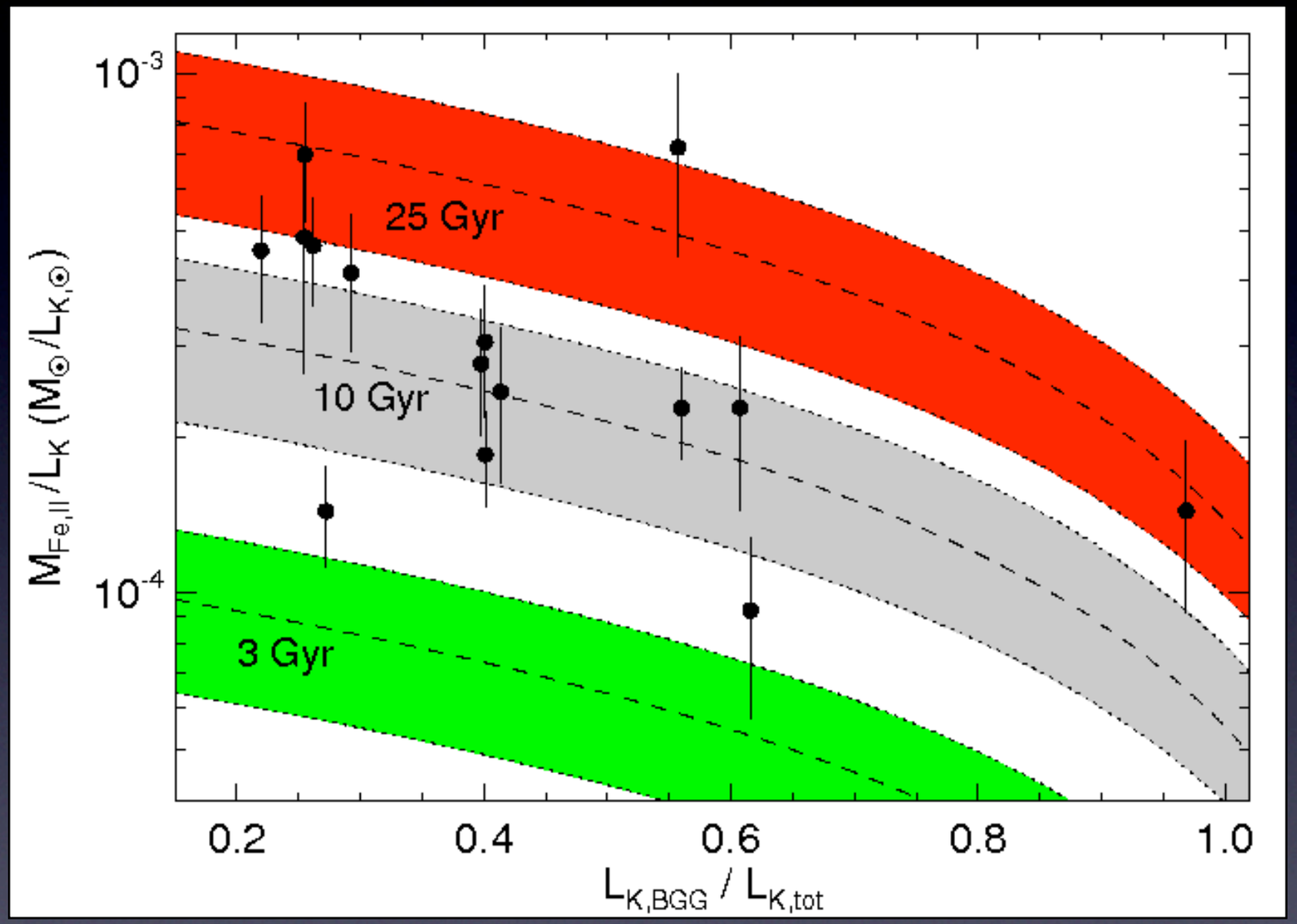

Enrichment timescales indicate much higher SN rates per unit luminosity in the past.

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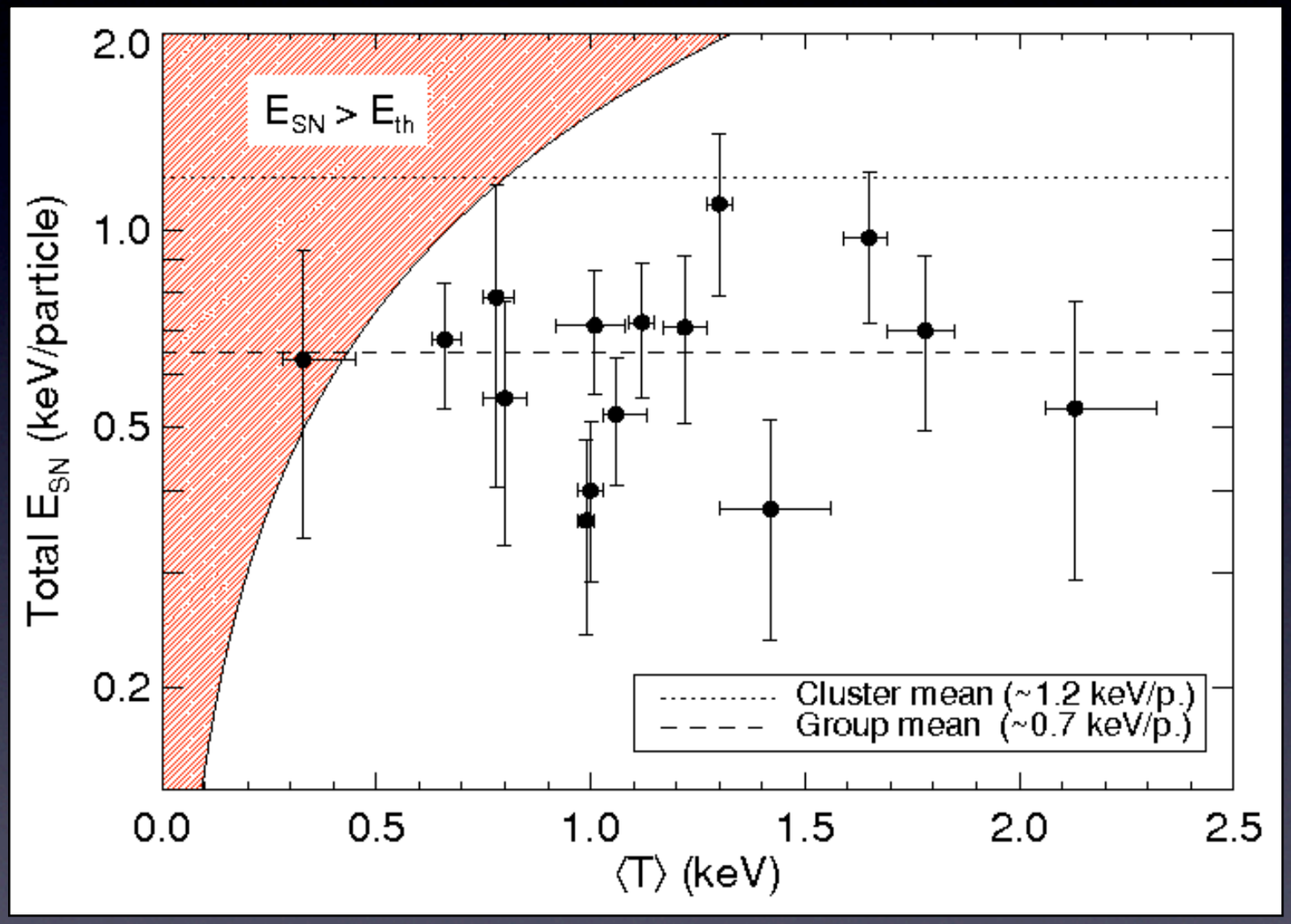
Quantifying SN Feedback

If each SN within r_{500} → 10^{51} ergs:

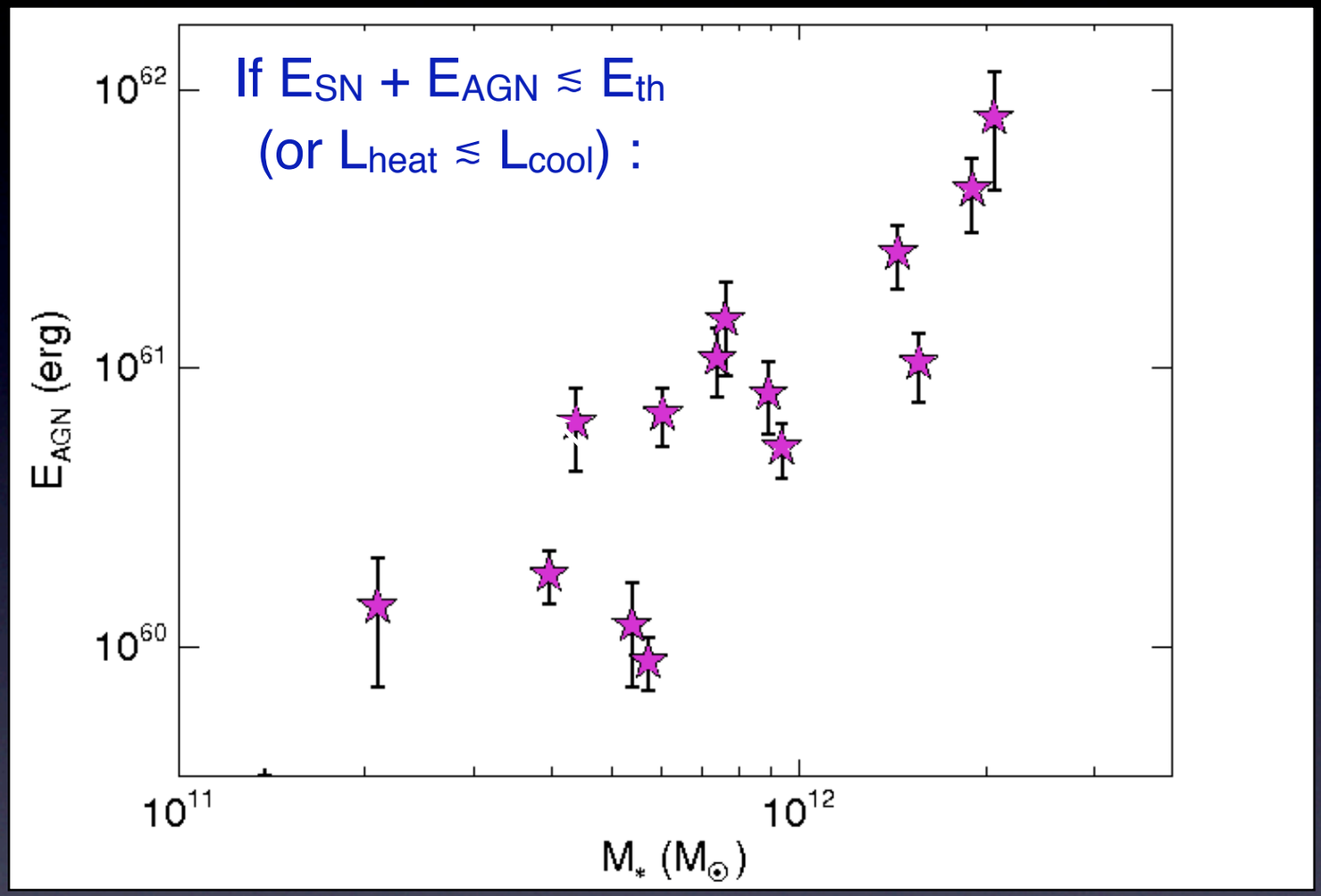


Enrichment levels correspond to ~0.7 keV per gas particle from SN (cf. also Davé+ 08)

Also limits AGN feedback

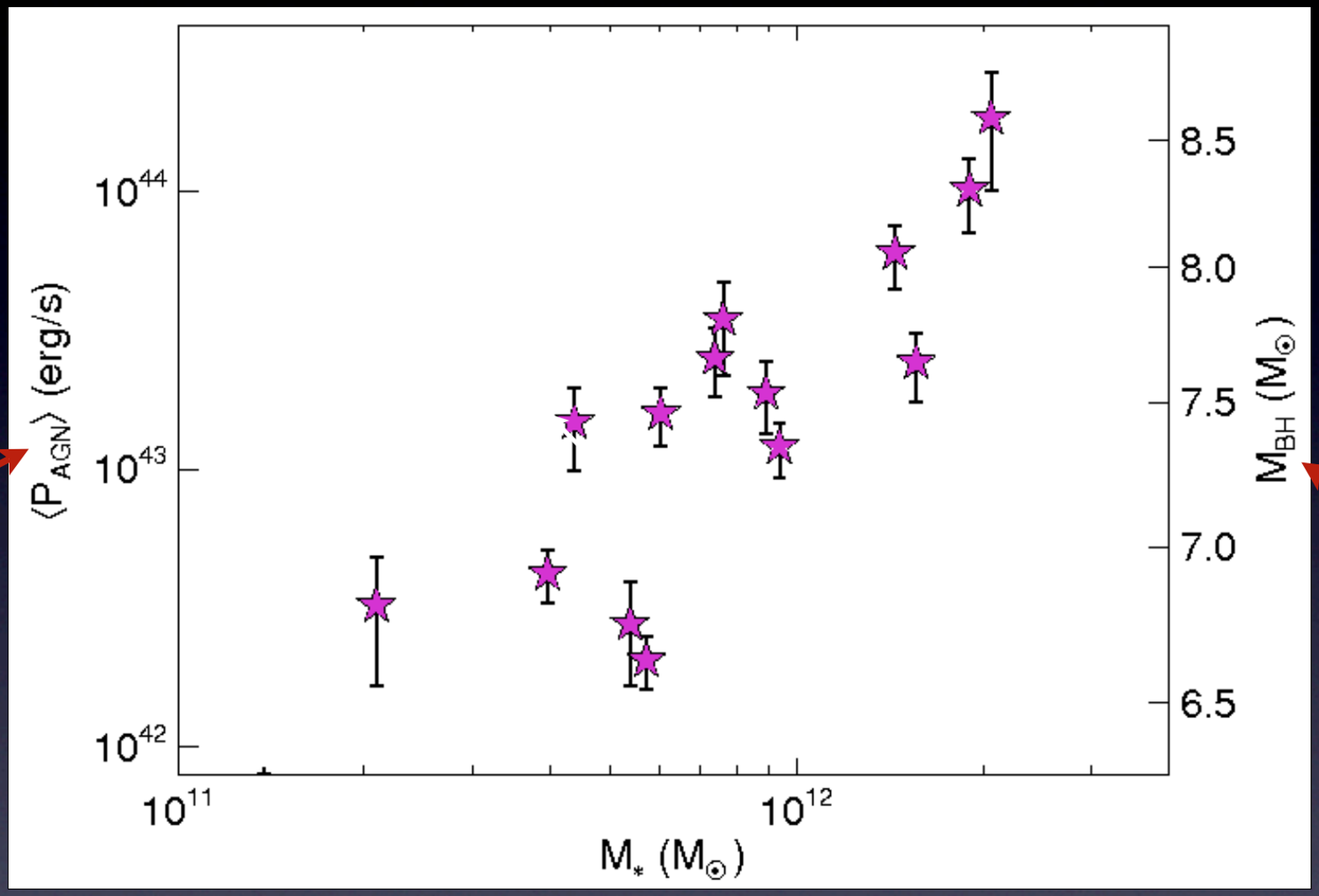
(virial theorem)

Quantifying AGN Feedback



For T ~ 1 keV systems, $E_{AGN} \sim 10^{49}$ erg per $M_\odot$ of stellar mass.
(independently of entropy constraints).

Quantifying AGN Feedback



1 order of mag.
>
current L_{mech} of AGN
(cf. Birzan+ 04)

Assuming
$\eta \approx 0.1$ for BH energy conversion eff.

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SFR(z) and $M_{\star}(z)$ can be checked against our results.

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Integrated AGN feedback limited
Results may help constrain galaxy formation models
(and possibly SMBH growth).