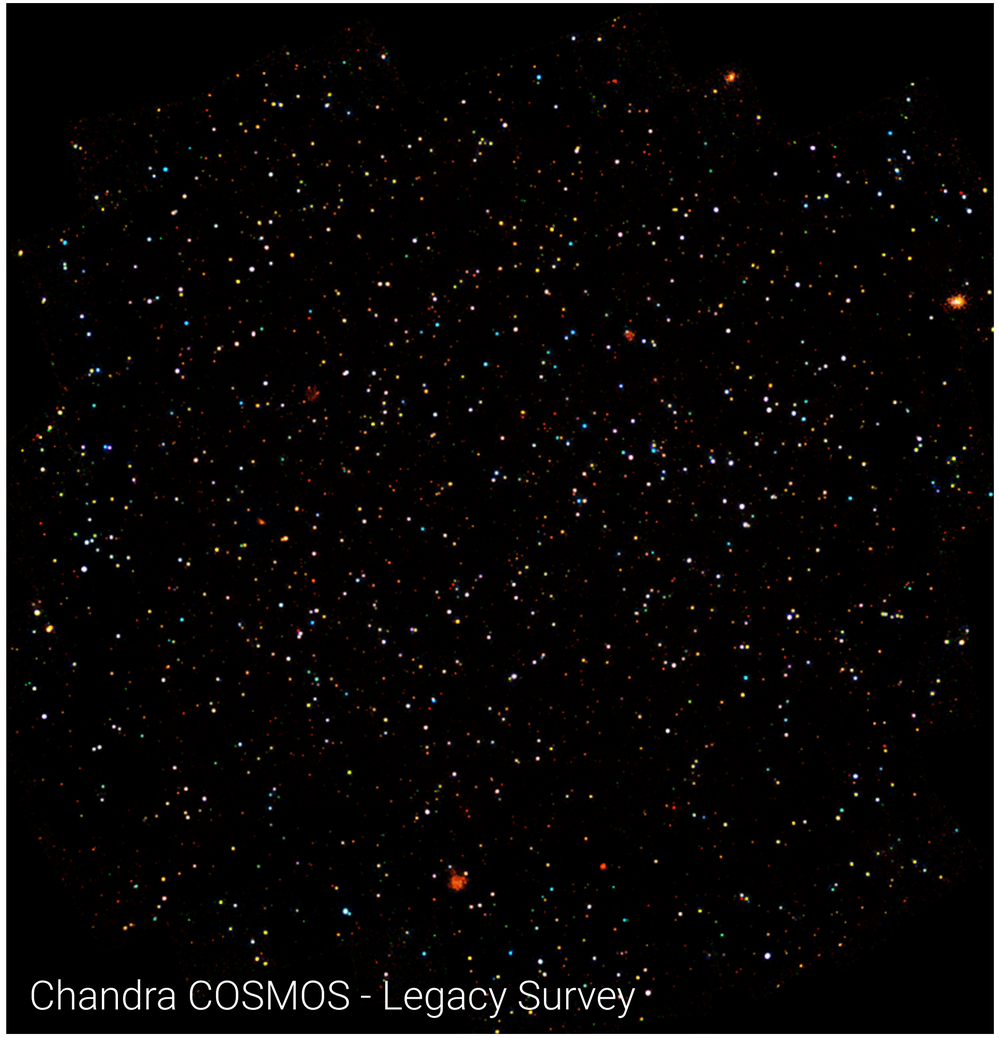
Uncovering AGN in the Cosmic X-ray background

Mackenzie Jones, R Hickox, S Mutch, D Croton, A Ptak, M DiPompeo



1 **Modeling the intrinsic AGN population**

A semi-numerical model of galaxy and dark matter halo growth plus a universal mode of black hole accretion

2 **Comparison to Observations**

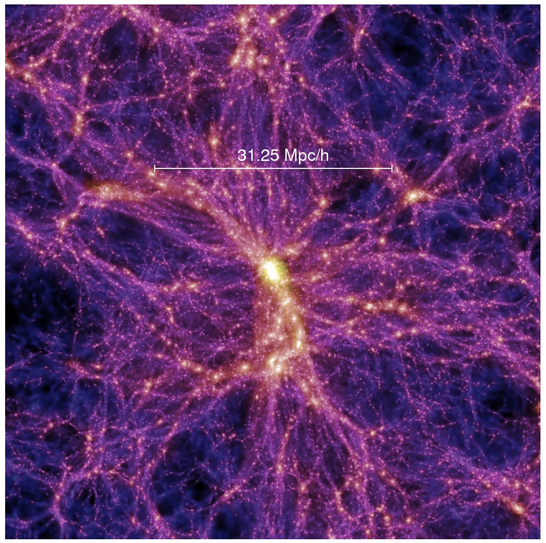
Can a simple model recreate observations?

3 **Modeling the X-ray Background**

What AGN make up the X-ray background?

A Simple Model
Halos, Galaxies, & Black Holes

Dark Matter Halos



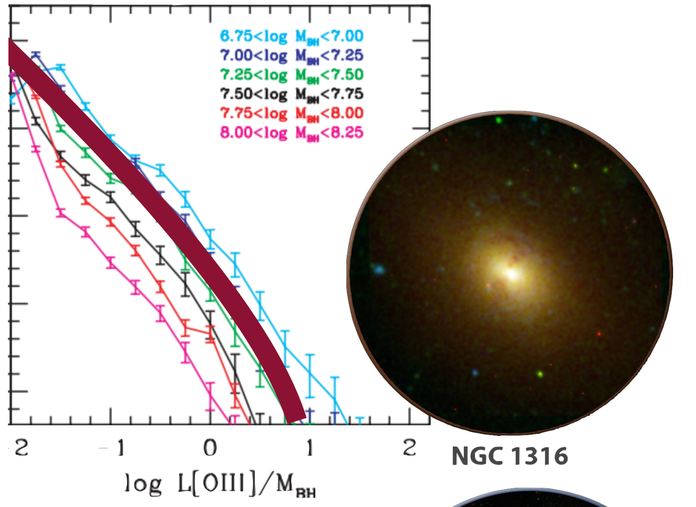
Springel et al. 2005

Galaxies

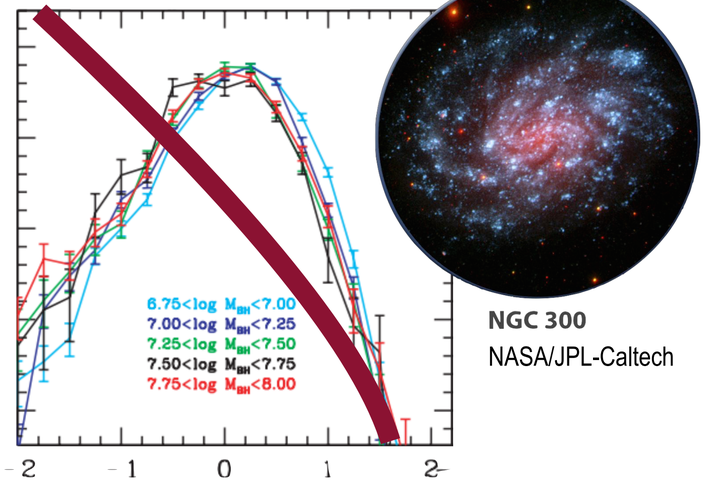
Mutch et al. 2013

UNIVERSAL
BROAD
EDDINGTON
RATIO
DISTRIBUTION

Jones et al 2016, ApJ 826,12



NGC 1316

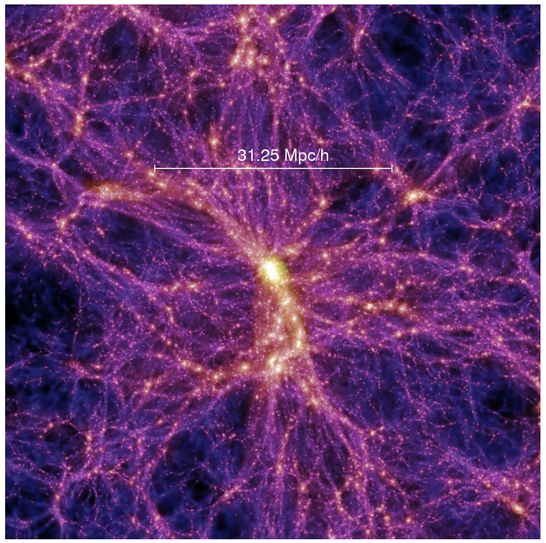


NGC 300
NASA/JPL-Caltech

(see also e.g., Hickox+ 2014, Schawinski+ 2010)

A Simple Model
Halos, Galaxies, & Black Holes

Dark Matter Halos



Springel et al. 2005

Galaxies

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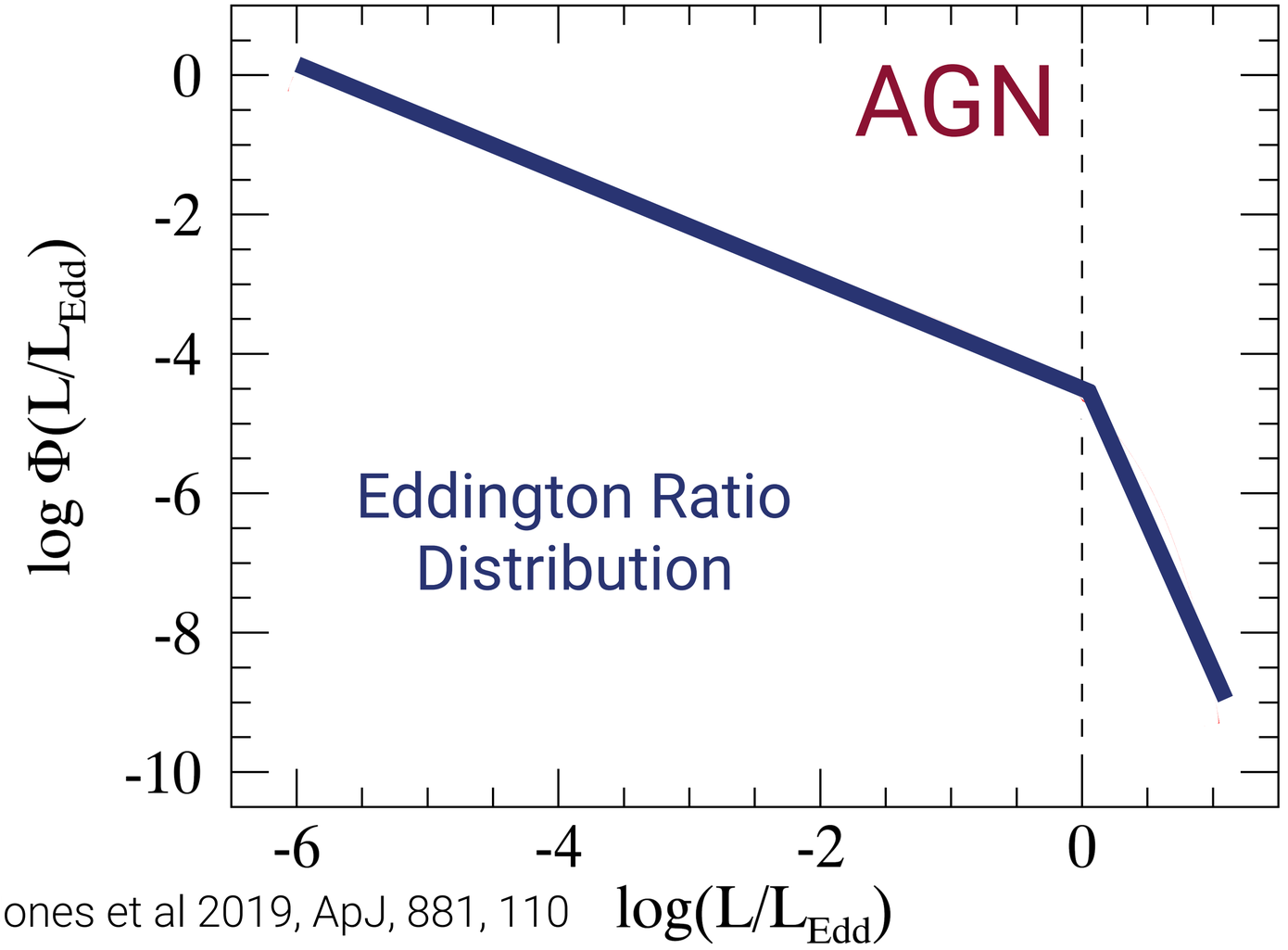
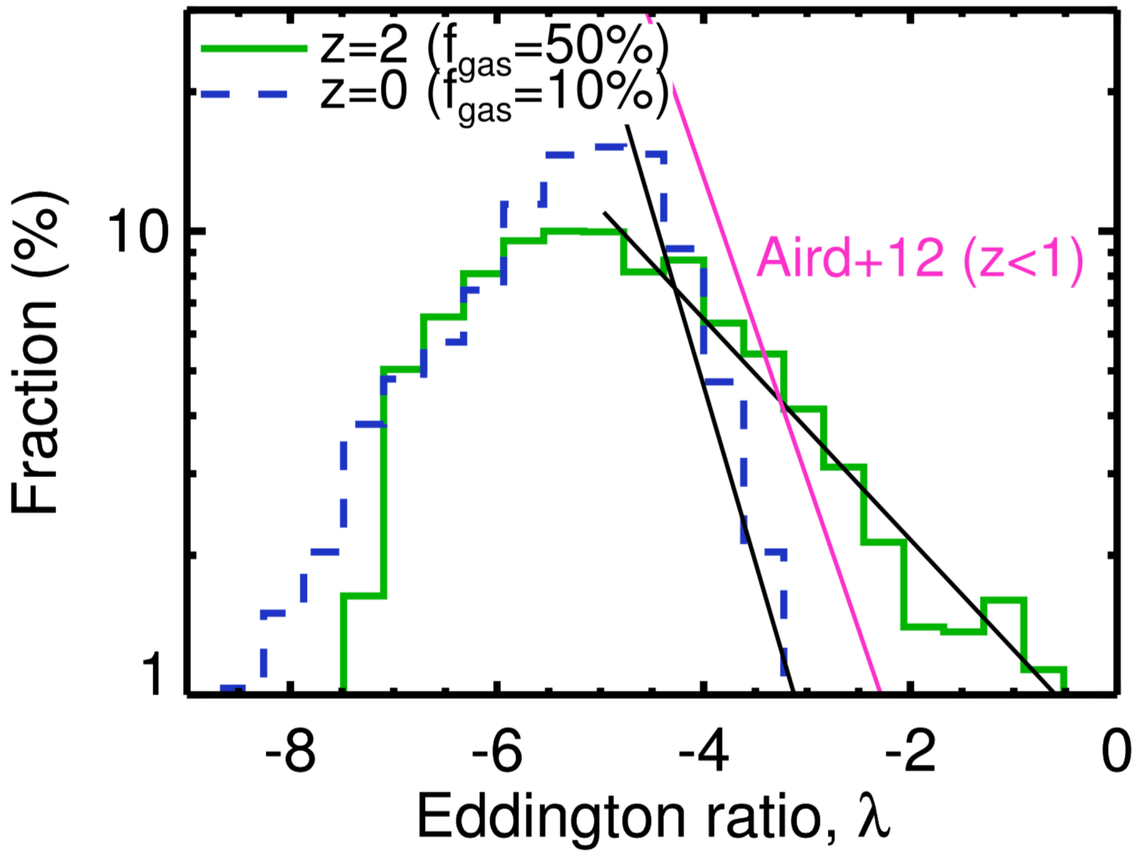
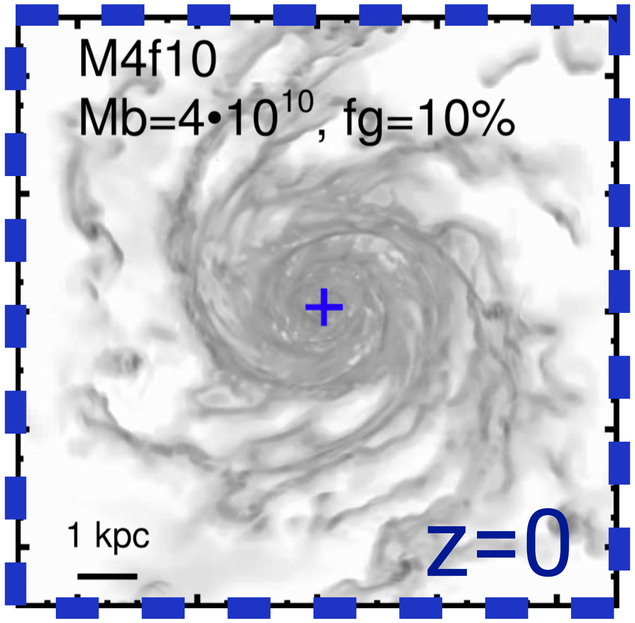


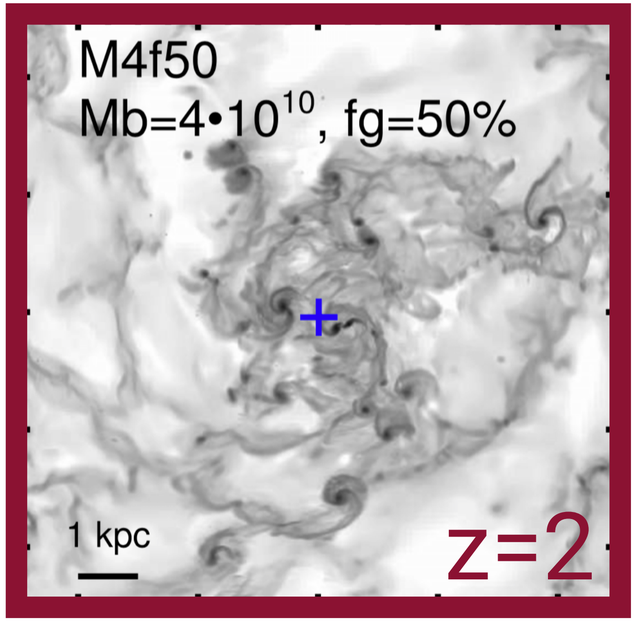
Jones et al 2019, ApJ, 881, 110

Evolution of the Eddington Ratio Distribution

EDDINGTON RATIO SLOPE DECREASES WITH INCREASING GAS FRACTION







Gabor & Bournaud 2013

Evolution of the Eddington Ratio Distribution

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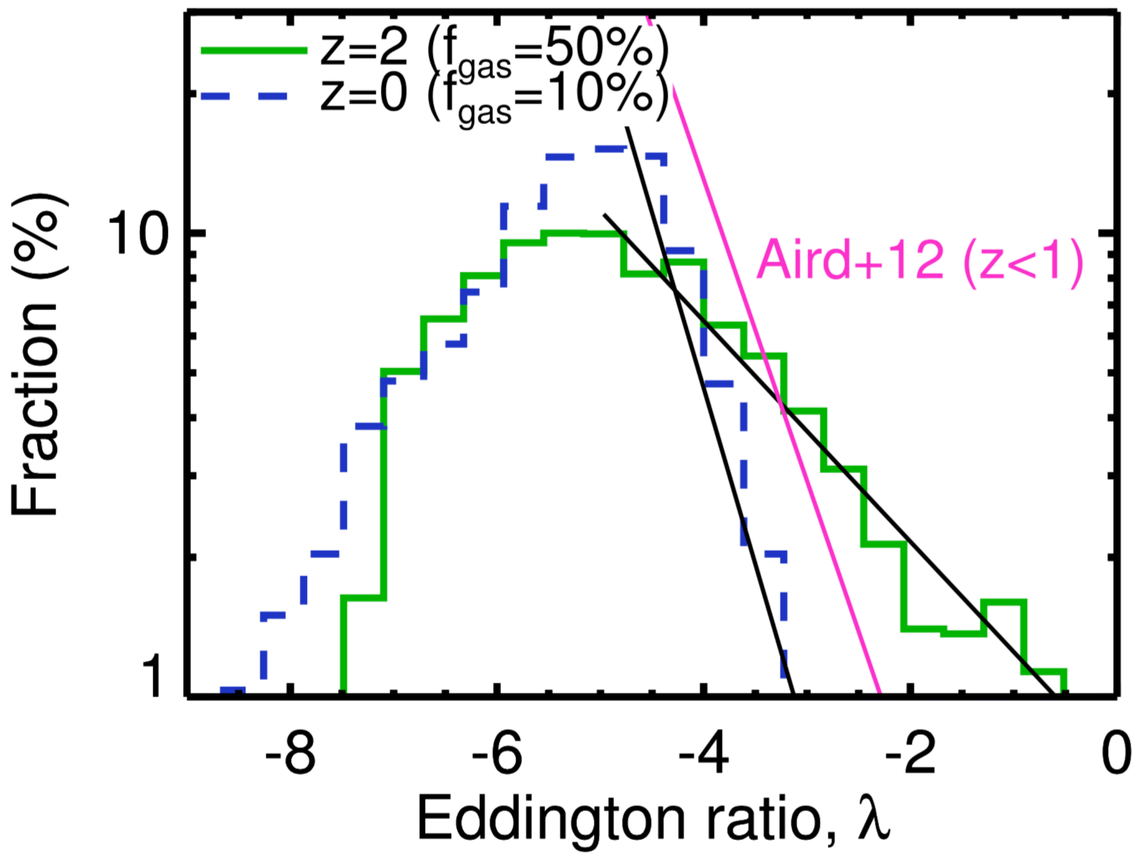
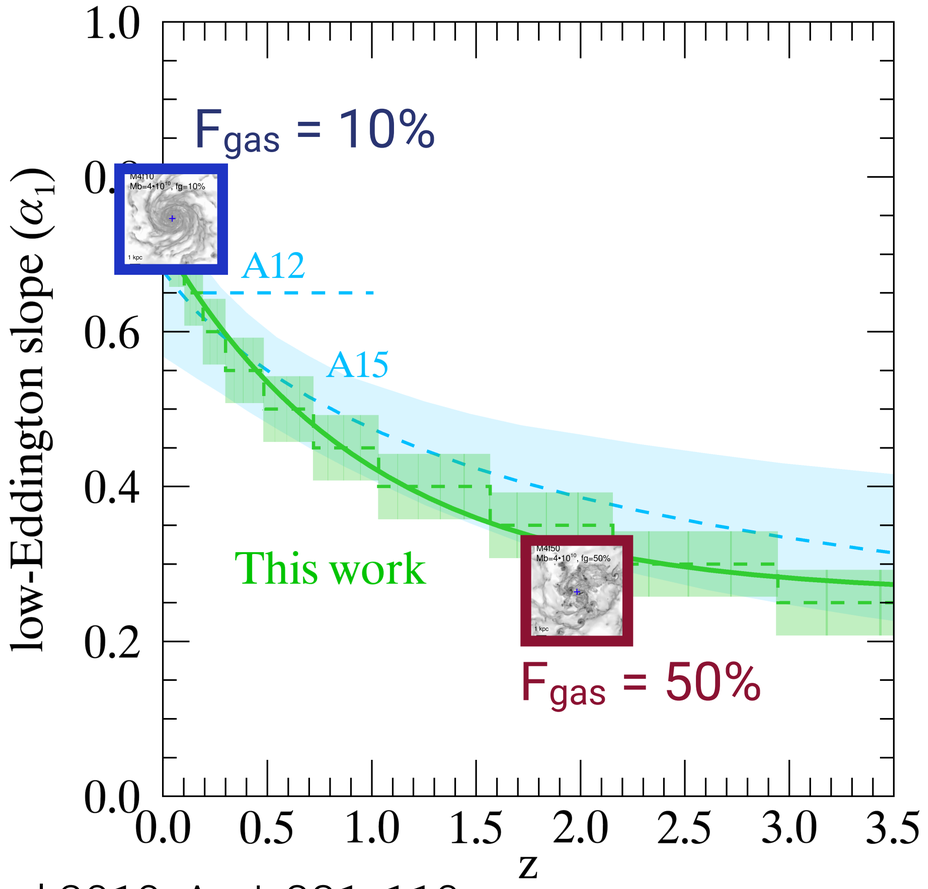
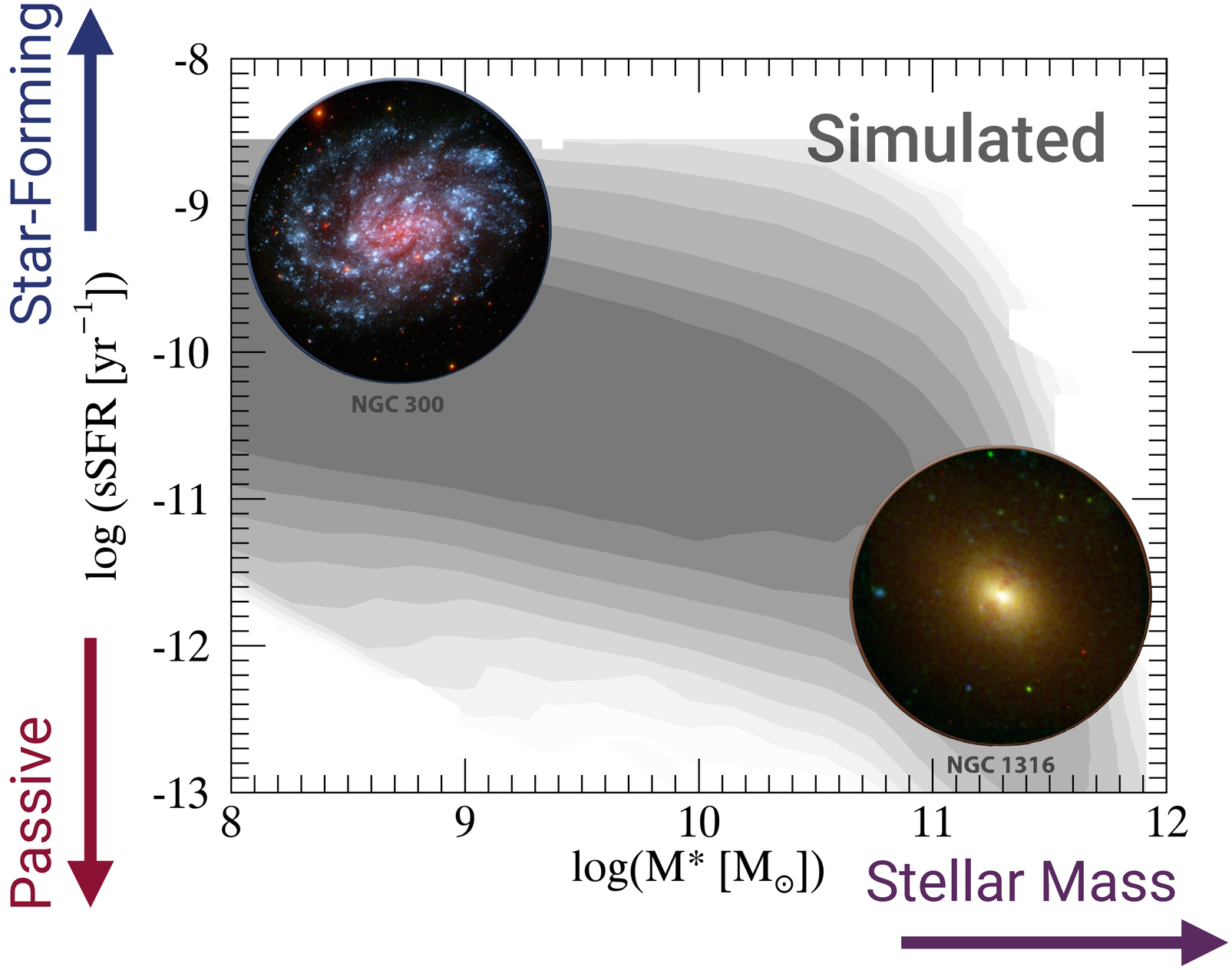




Jones et al 2019, ApJ, 881, 110

Observables
sSFR vs M⋆

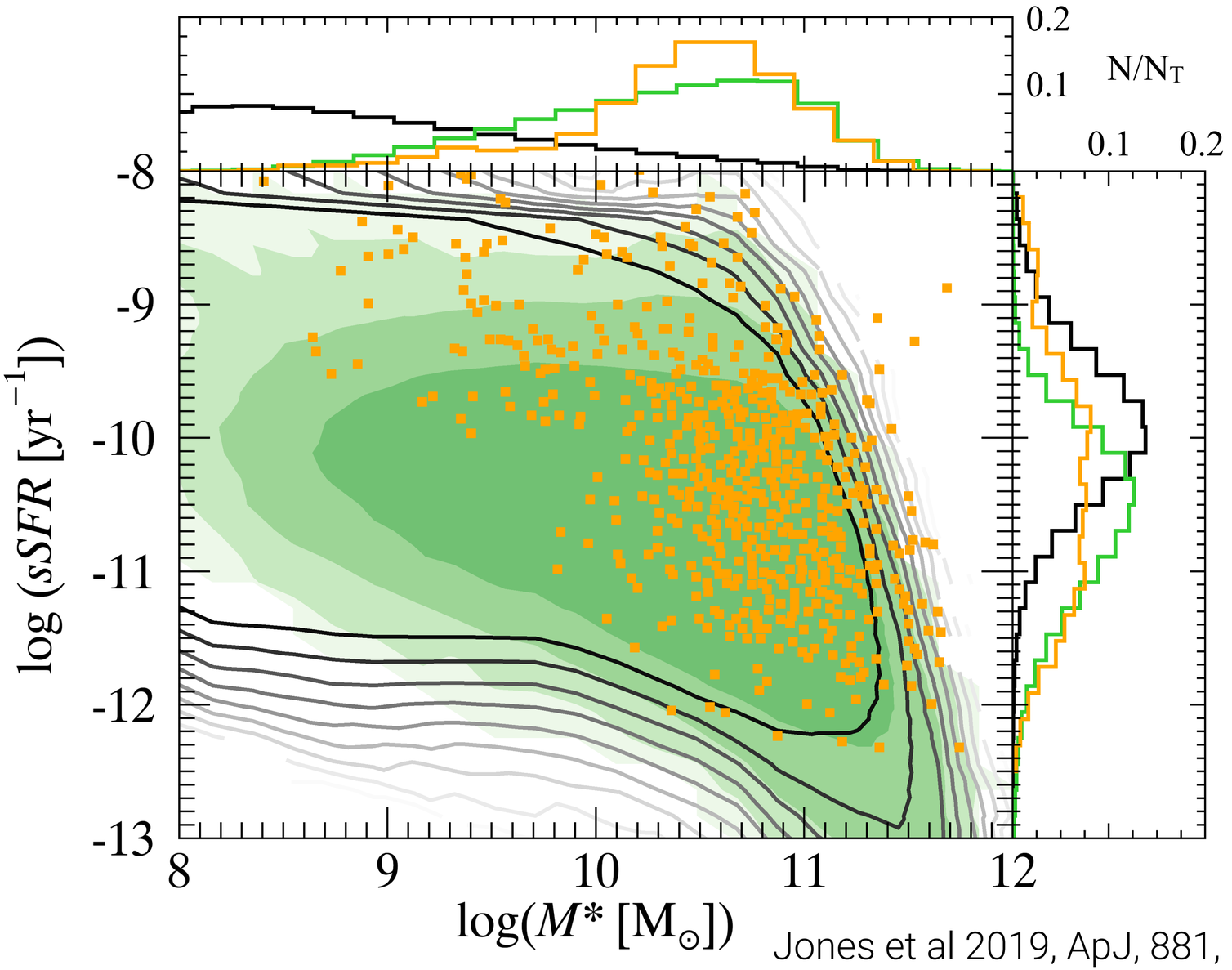
CAN WE RECREATE OBSERVED DISTRIBUTIONS BY APPLYING SELECTION EFFECTS TO THE INTRINSIC SAMPLE?



Observables
sSFR vs M★

- Mendez+ 2016
- Full Simulation
- Luminosity Limited

- $L_X > 10^{41.5}$ erg s^{-1}

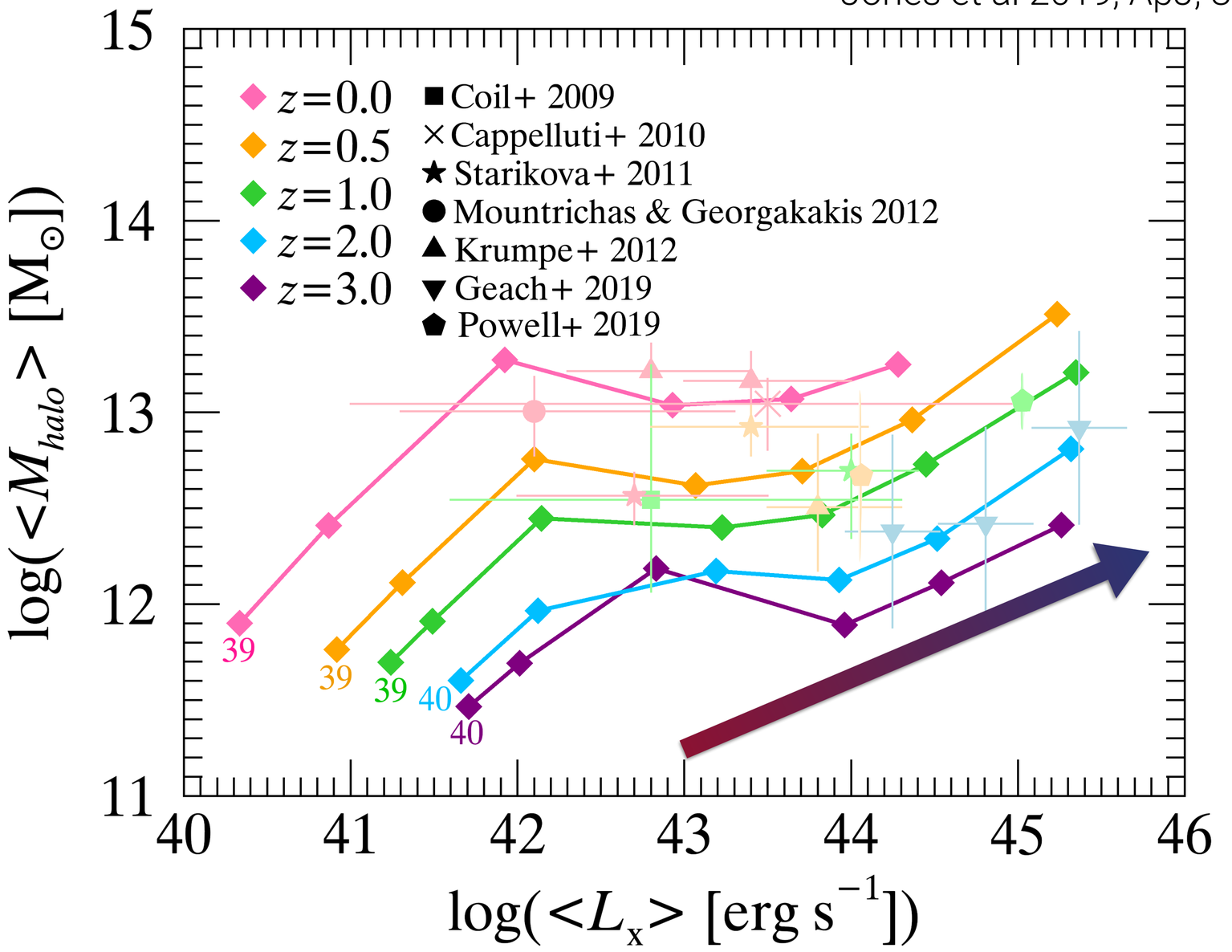


Jones et al 2019, ApJ, 881, 110

Observables
M_{halo} vs Lx

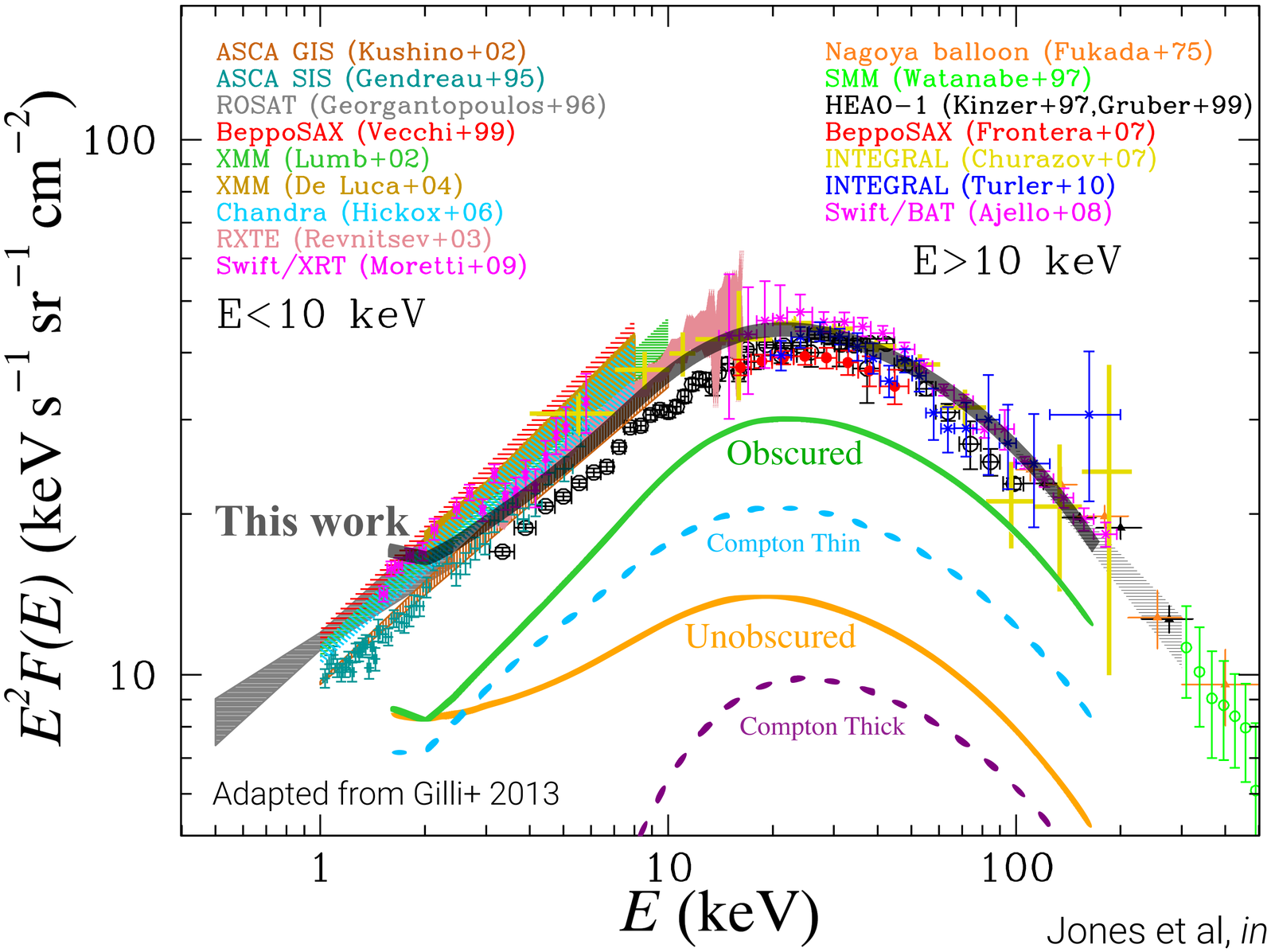
THE OBSERVED PLATEAU IS A DIRECT CONSEQUENCE OF THE EDDINGTON LIMIT

Jones et al 2019, ApJ, 881, 110



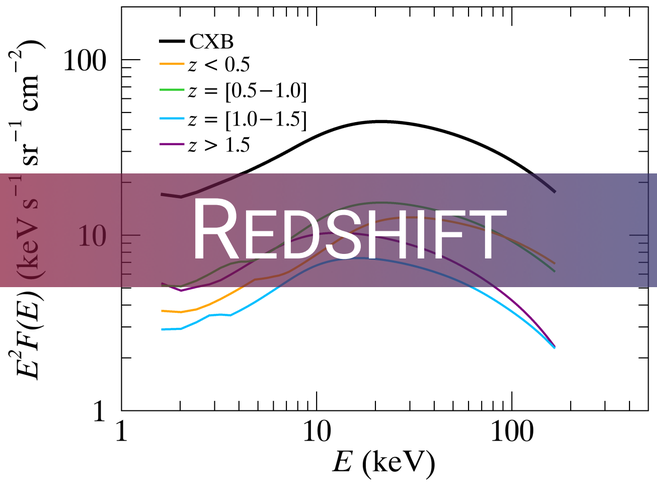
Modeling *Cosmic X-ray Background*

THE OBSCURED POPULATION IS THE MAIN CONTRIBUTOR TO THE CXB

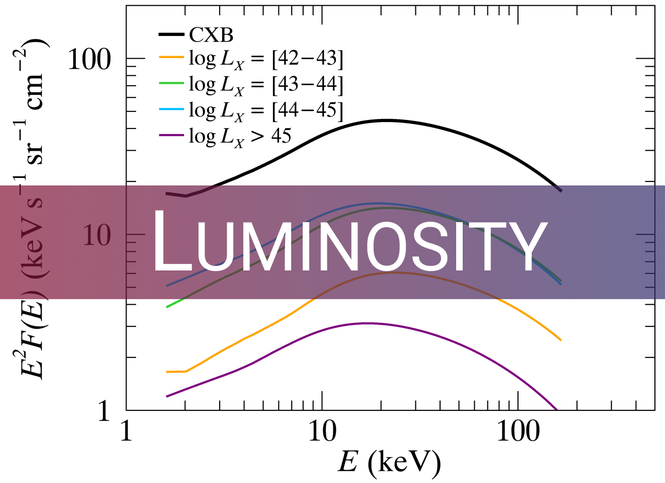


Jones et al, *in prep*

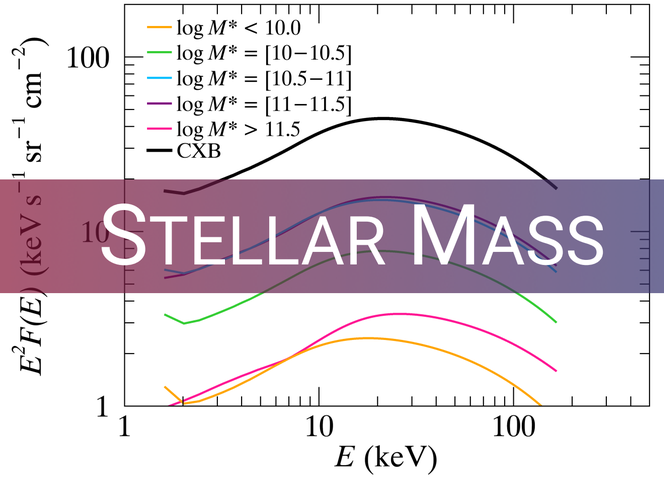
CXB
Intrinsic Properties



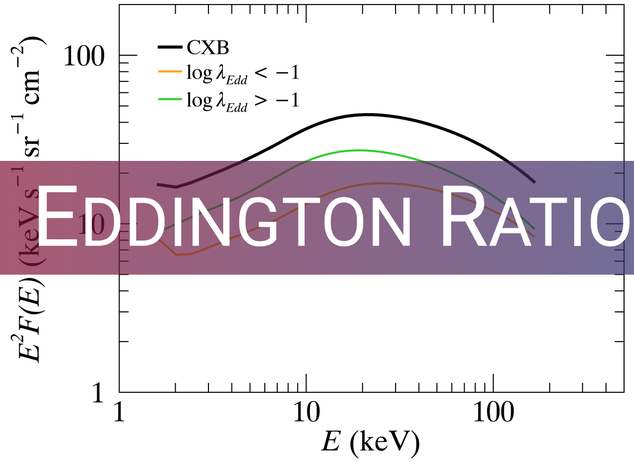
Redshift



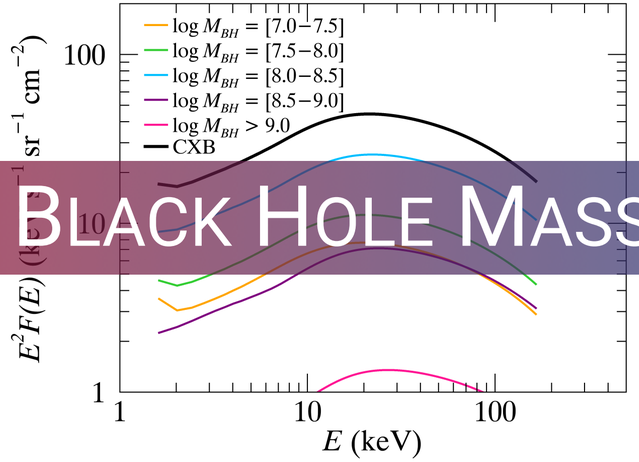
Luminosity



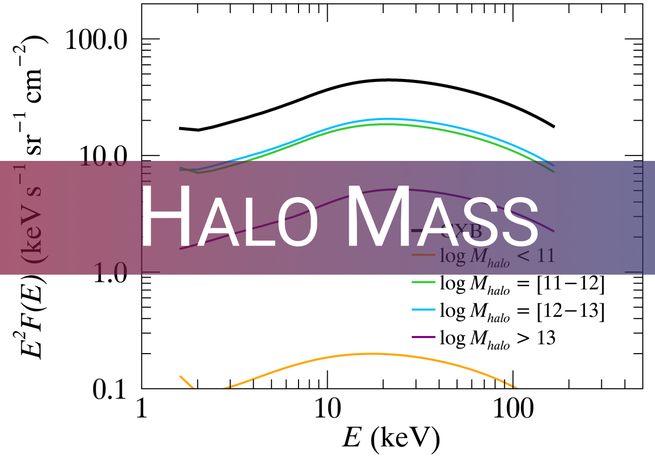
Stellar Mass



Eddington Ratio



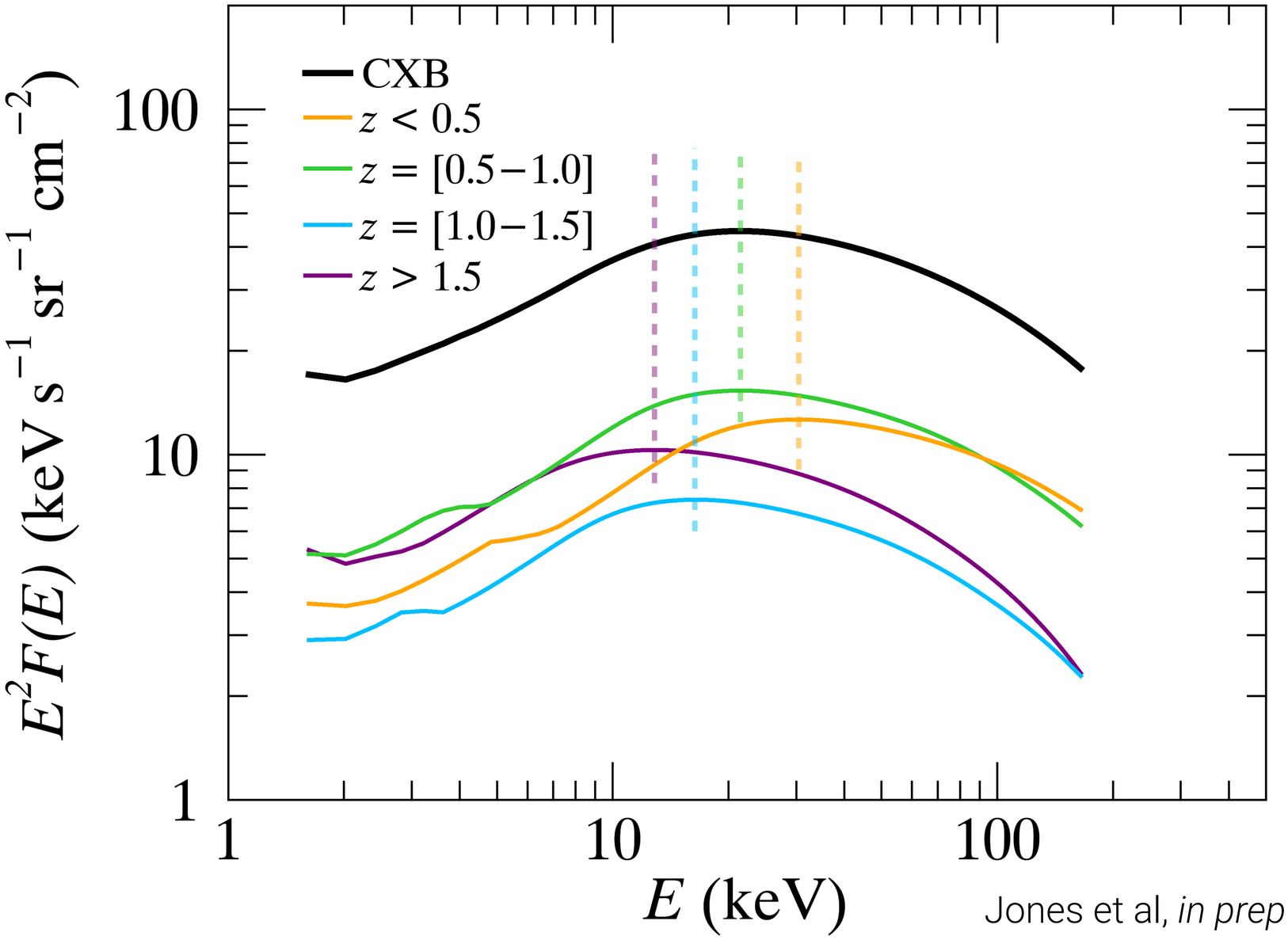
Black Hole Mass



Halo Mass

CXB *Redshift*

z

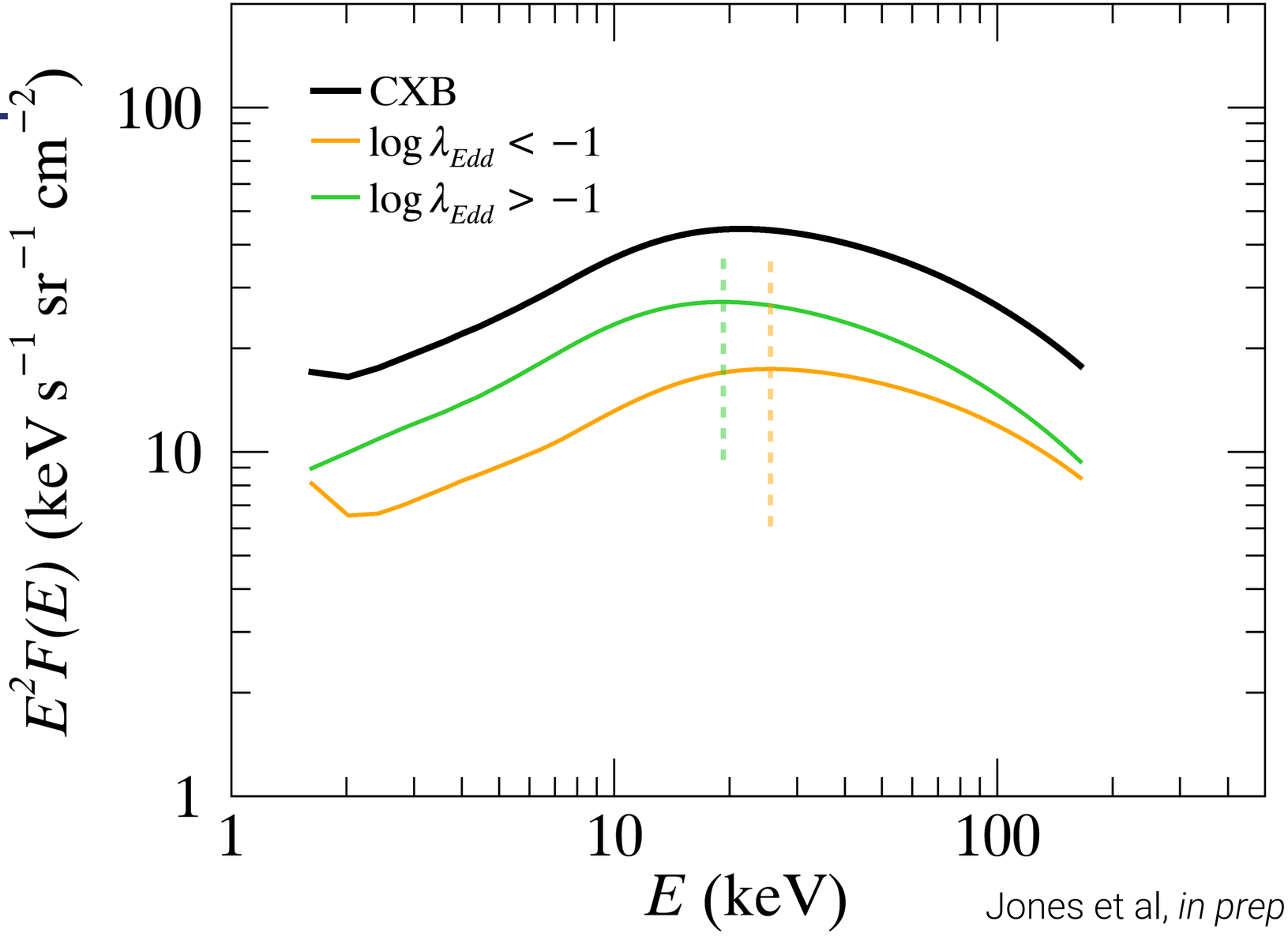


Jones et al, *in prep*

CXB
Eddington Ratio

z

λ_{Edd}

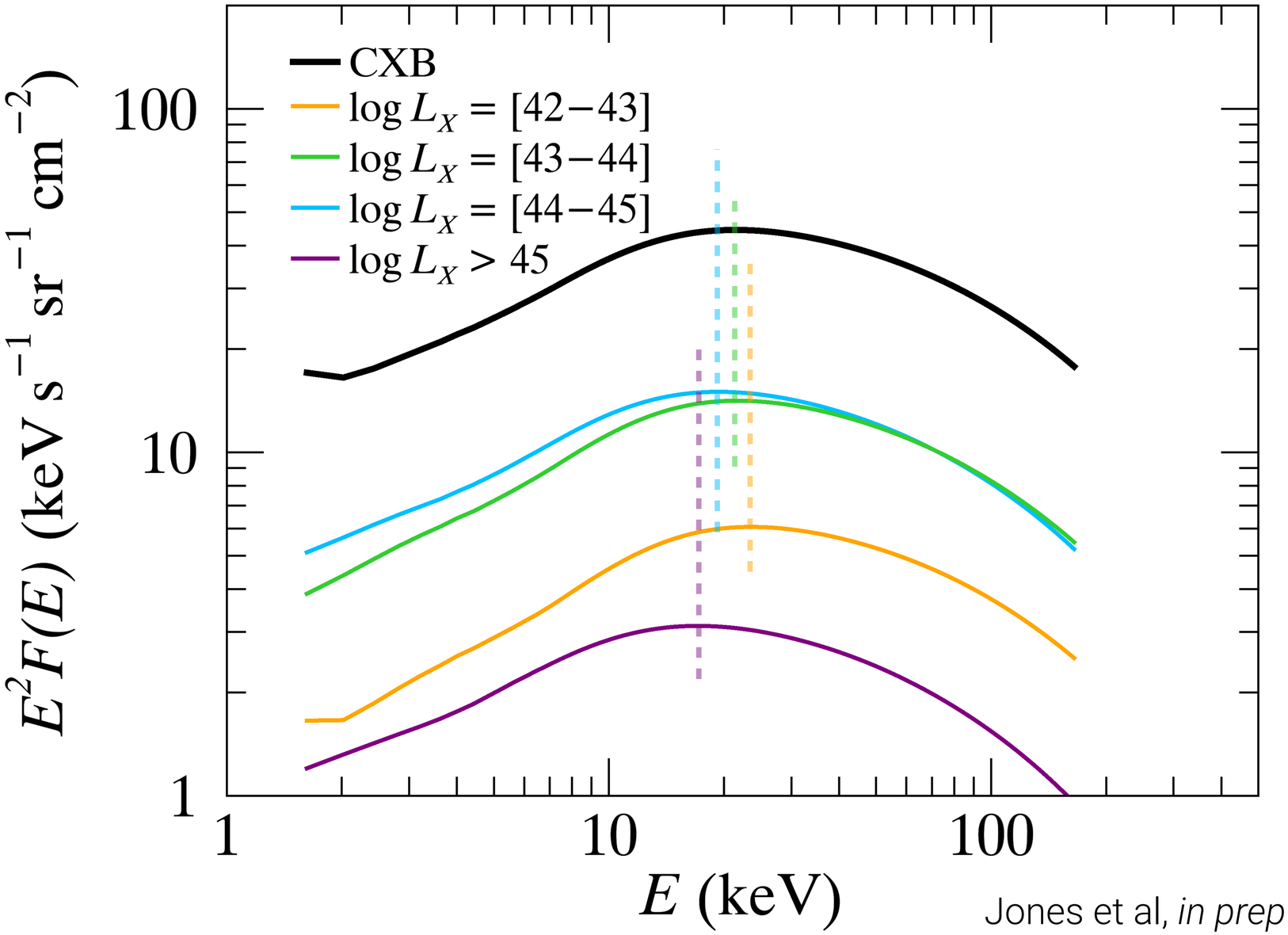


Jones et al, *in prep*

CXB *Luminosity*

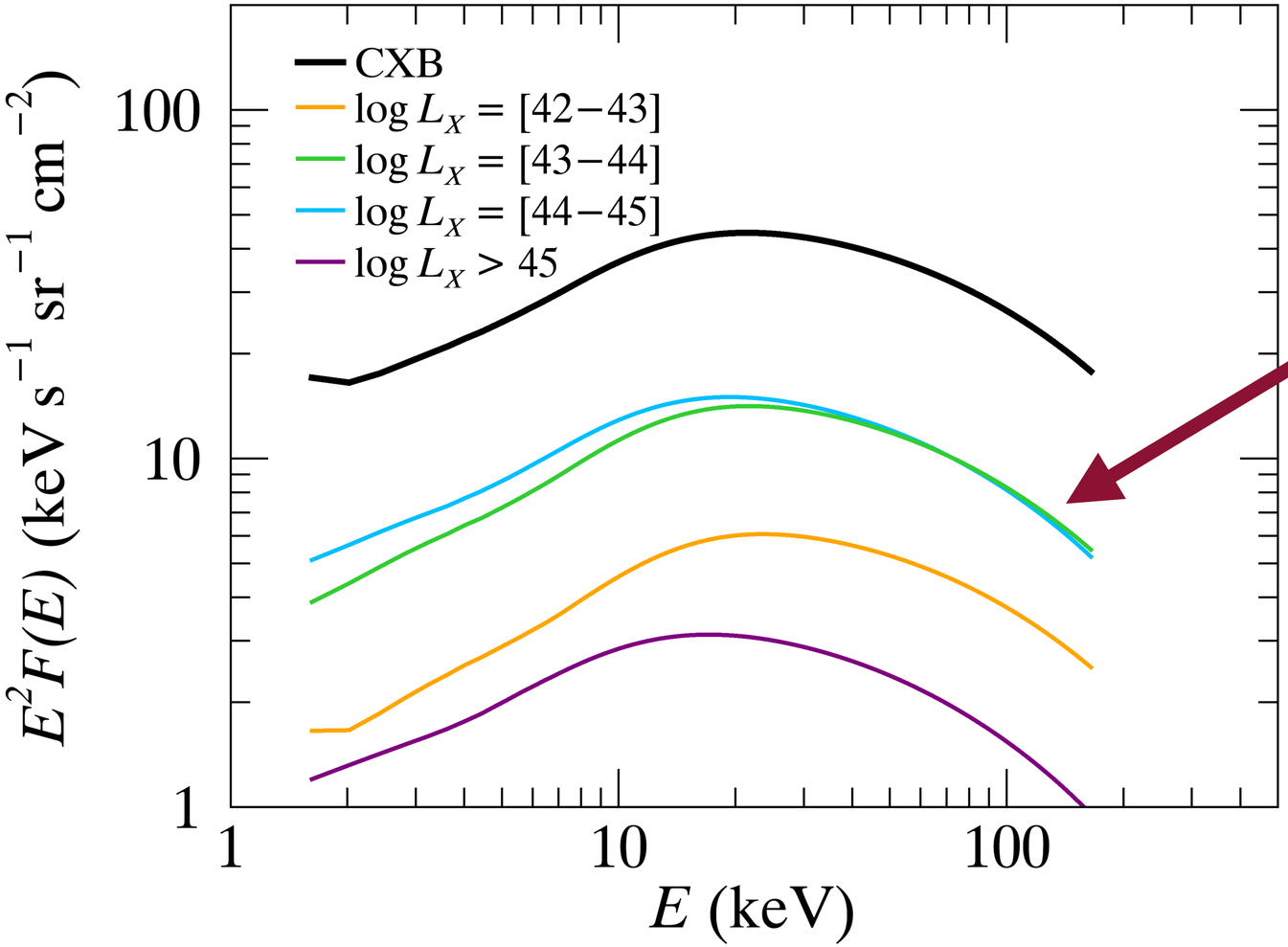
z

L_X

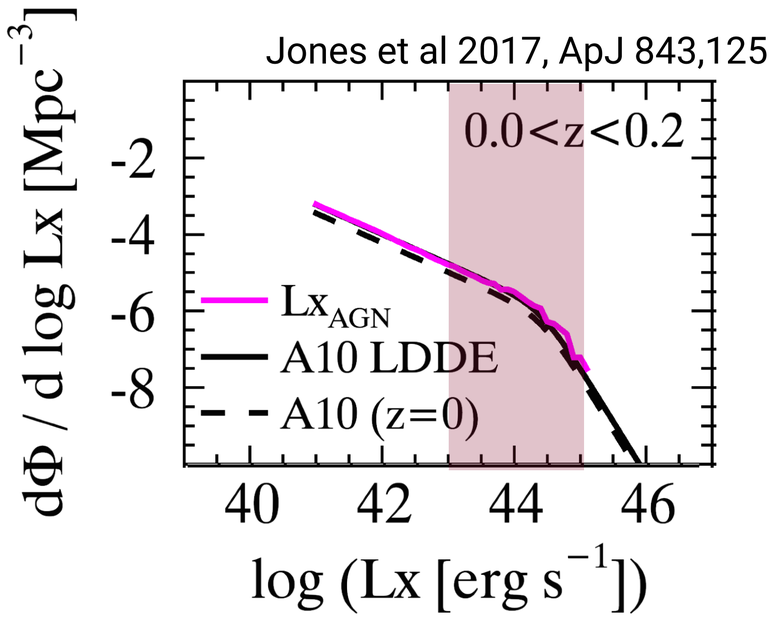


Jones et al, *in prep*

CXB *Luminosity*



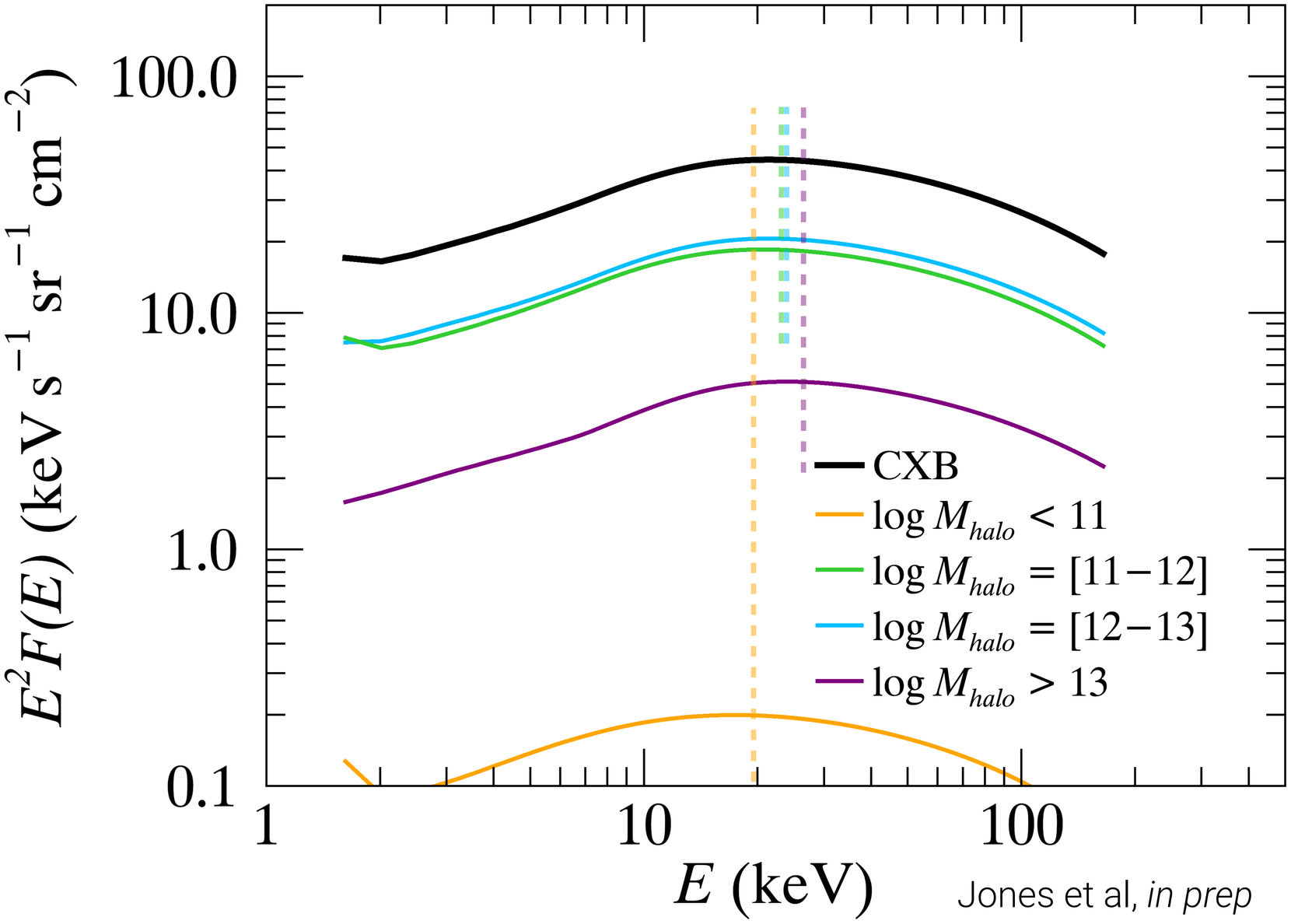
Corresponds to the “knee” of the luminosity function



CXB *Halo Mass*

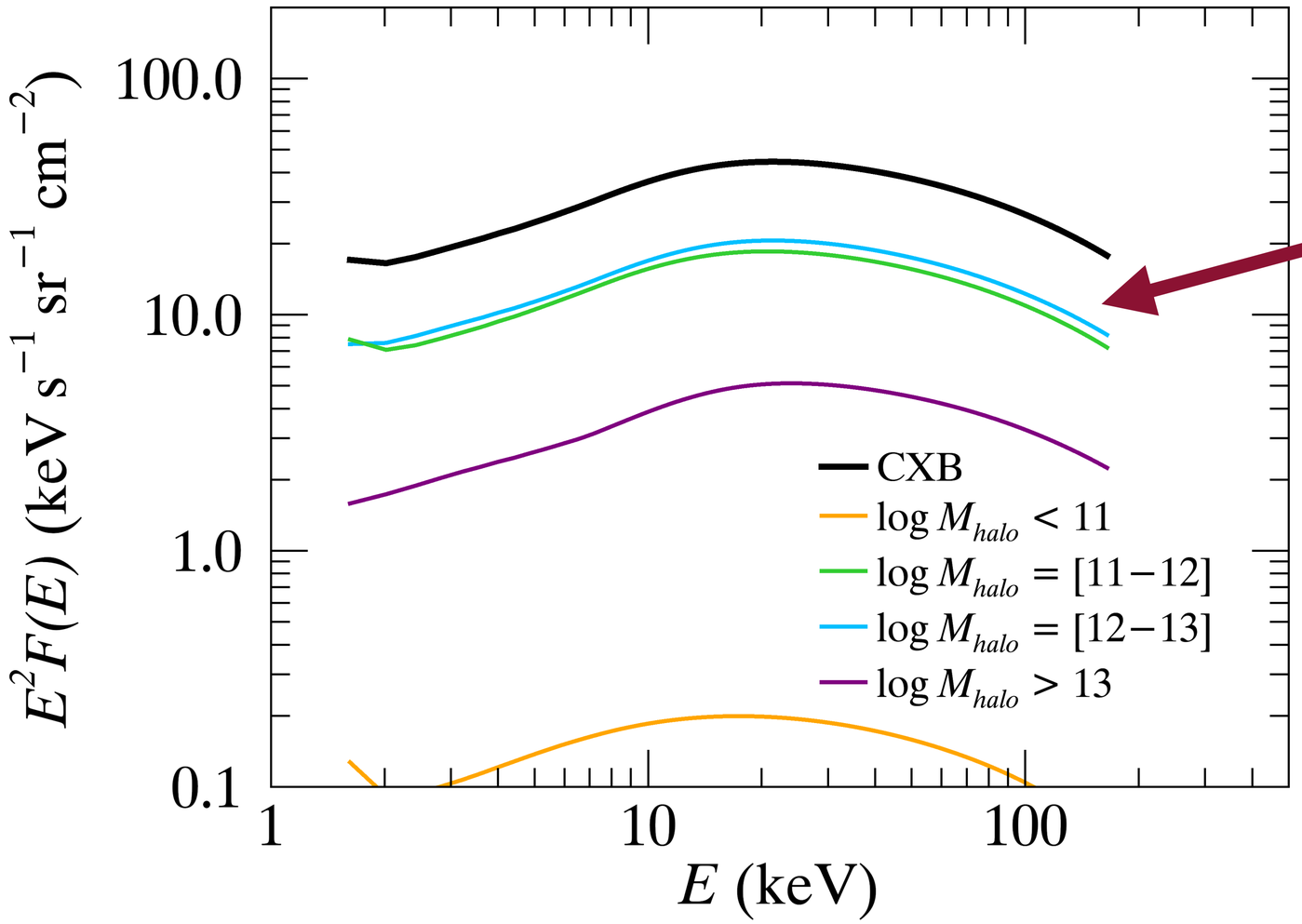
z

M_{halo}

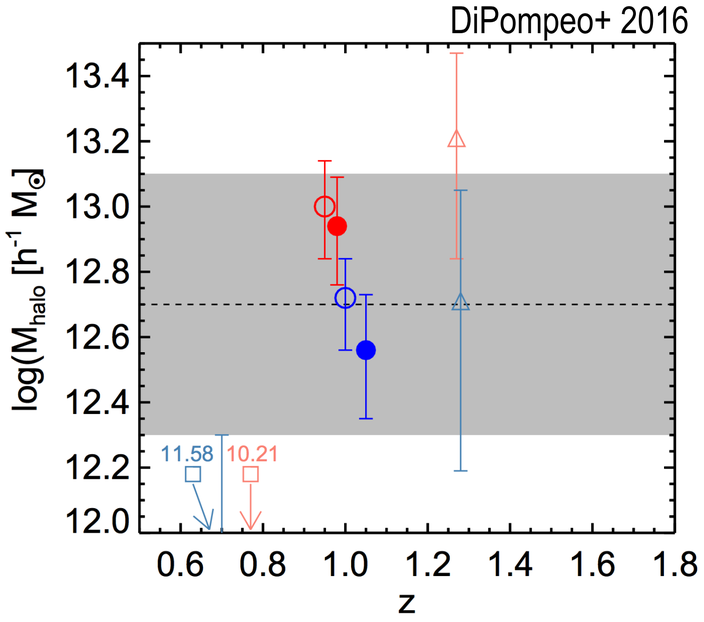


Jones et al, *in prep*

CXB *Halo Mass*



Corresponds to halos with the most quasar activity



What is the Intrinsic AGN Population Contributing to the *Cosmic X-ray Background?*

Forward modeling with a universal broad Eddington ratio distribution

➤| **recover optical and X-ray observables**

fueling mechanism between different AGN host galaxy populations may not be specific to type or age

➤| **recover the observed CXB**

possible to probe the host galaxy and halo properties of AGN that contribute to the CXB

WHAT'S NEXT : UNCOVERING WHERE *CHANDRA* SOURCES CONTRIBUTE TO THE CXB

with F Civano

Jones et al 2016, ApJ 826,12 Jones et al 2017, ApJ 843,125 Jones et al 2019, ApJ 881,110 Jones et al, in prep