

Low-z (Evolution)

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Evolution)	BCGs (cluster)	Suppress cooling flow	Cooling flow calculations; (difficult) AGN modeling	X-ray cavities	Yes

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Evolution)	Massive early-types (field)	Suppress cooling flow and SF	MACER	Massive BHs; AGNs on primarily in more massive galaxies; radio emission + base of “jet”, CRs, energetics?	Yes

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Evolution)	Lower mass early-types (field)	Suppress cooling flow and SF	MACER/FIRE argues SN Ia are ok	Massive BHs; Episodic AGN; these follow the 'same' relation; dust suggest a sequence	?

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Ejective (Evolution)	Massive early-types (field)	Remove ISM (<50 kpc) and halo gas (<250 kpc)	MACER argues against; Choi argues for both	X-ray emission; Cool gas absorption; PG dust masses	No

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Ejective (Evolution)	Less massive early-types (field)	Remove ISM (<50 kpc) and halo gas (<250 kpc)	MACER argues for ISM; Choi argues for both	Weak X-ray emission in inner regions; Cool gas absorption at ~100 kpc	?

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Evolution)	Massive SF galaxies (field)	Impact halo gas	Suresh+17, MP+17; SF may be sufficient (e.g. FIRE)	Fermi bubbles; OVI, OVII halos, red bulges, weak X-ray emission	4 Yes 7 No 4 ?

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Ejective (Evolution)	Massive SF galaxies (field)	Enrich halo gas (i.e. eject from ISM but not halo)	Sanchez+18 (SNe are insufficient)	MgII, OVI halo gas; Yusef+17; The gas may be over-heated (e.g. weak HI halo);	

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Formation)	Moderate mass (field)	Transition spiral to S0			

AGN Impacts on Galaxy Formation

High-z (Formation)

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Formation)	Lower mass SF galaxies at high-z (field)	Heat the halo, suppress SF	Galaxy formation theory needs something to avoid over-cooling	Aird+18; BHs in every bulge; strong OVI (but HI too); Quasars show massive cool-gas halos (QPQ, Farina+15)	

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Preventative (Formation)	Massive SF galaxies at high-z (field)	Heat the halo, suppress SF	Needed as part of the quenching process?	High AGN fraction in z~2 green/red galaxies; QPQ (excess of cool gas around quasars)	

AGN Impacts on Galaxy Formation

Process	Galaxy Type	Effect	Theory	Obs.	Convinced ??
Ejective (Formation)	Massive SF galaxies at high-z (field)	Remove the ISM	Sanders, Hopkins, etc.; Tacchalla+16, Faucher-Giguere ; Feldman+15	Hot DOGs; molecular outflows, BALs; QPQ; PG dust masses, ionized outflows	

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