FLATIRON INSTITUTE

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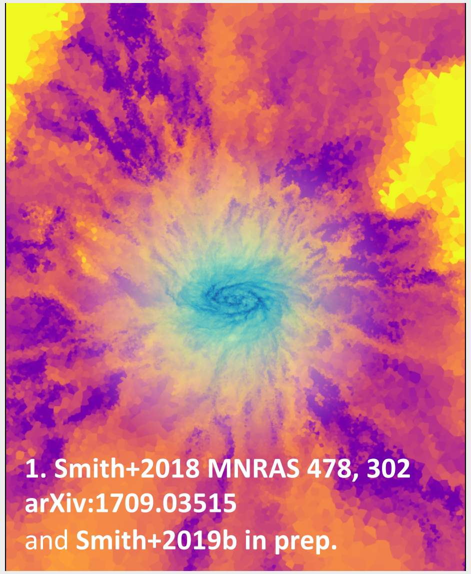
Talk to me about:

1. A new scheme for explicit modelling of the ISM in galaxy formation simulations with novel star formation and stellar feedback prescriptions.

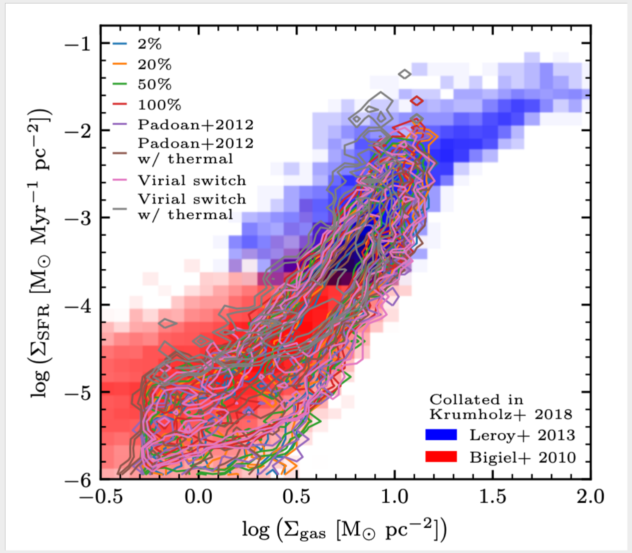
2. The connection between small scale star formation laws and global galaxy properties in feedback regulated dwarfs.

3. Why supernova feedback alone is inefficient at regulating properties of dwarf galaxies (in z = 0 10^{10} $M_\odot$ haloes) at high redshift.

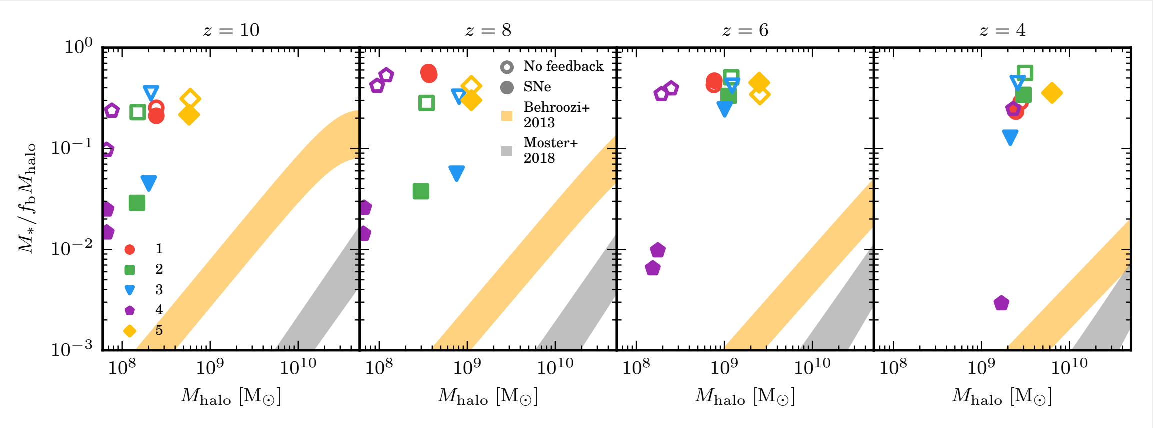
4. Simulating Multiscale Astrophysics to Understand Galaxies (SMAUG) and a novel approach to model galactic winds in large volume cosmological simulations.



1. **Smith+2018 MNRAS 478, 302 arXiv:1709.03515** and **Smith+2019b in prep.**



2. **Smith+2019c in prep.**: When in a feedback regulated equilibrium configuration, global properties of dwarf galaxies (e.g. SFRs, morphology etc.) are largely insensitive to the assumed GMC scale star formation law adopted. However, feedback efficiency (e.g. p_*/m_*) is marginally dependent on the SF law due to modulation of stellar clustering. In a cosmological environment at high redshift, where star formation is very bursty, evolution of the galaxy can be highly dependent on the small scale SF law.



3. **Smith+2019a MNRAS 485, 3317 arXiv:1807.04288**: A suite of very high resolution cosmological zoom-ins of isolated dwarf galaxies. Rapid build up of dense gas from mergers and cosmic inflow at high redshift critically reduces the impact of supernova feedback in progenitors of z = 0 $M_{vir} = 10^{10}$ $M_\odot$ dwarfs resulting in an overproduction of stellar mass and extremely compact galaxies. We conclude that the ability of supernovae to regulate dwarf galaxy properties is dependent on other physical processes, such as turbulent pressure support, the clustering and runaway of supernova progenitors and other sources of stellar feedback.

SMAUG

4. SMAUG utilizes a nested set of simulations that span scales from individual stars, supernovae, and black holes, up through global galaxy scales, to cosmological scales. The eventual goal is to develop a ladder of sub-grid prescriptions that reproduce the coarse-grained properties arising from higher resolution simulations. In particular, we are developing a new prescription to model multiphase galactic winds in large volume cosmological simulations, based on high resolution simulations instead of tuning to large scale observables.