Using simulations across multiple experiments: Questions?

- What volume / fidelity required? (Gpc regime, full hydro with resolved galaxies…)
- What physics are we missing? (neutrinos, primordial black holes, X-ray feedback…)
- What is required for self-consistent cross correlation analysis? (self-consistent modelling of probes…)
- What landscape of models? (dynamical dark energy, PNG…)
- What do we need to exploit with modern inference methods (e.g. SBI, gradient based optimization)? (differentiability, large suites, flexible…)
- What forward models do we need? (cluster colour distribution, observed sizes and shapes…)

Wechsler 2018

Approaches to modeling the galaxy-halo connection

← physical models — empirical models →

Hydrodynamical Simulations	Semi-analytic Models	Empirical Forward Modeling	Subhalo Abundance Modeling	Halo Occupation Models
Simulate halos & gas; Star formation & feedback recipes	Evolution of density peaks plus recipes for gas cooling, star formation, feedback	Evolution of density peaks plus parameterized star formation rates	Density peaks (halos & subhalos) plus assumptions about galaxy−(sub)halo connection	Collapsed objects (halos) plus model for distribution of galaxy number given host halo properties