# R21b Cosmic-Ray Driven Galactic Winds from an Ultraluminous Galaxy

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In our most recent models of galaxy formation, halos with masses $\sim 10^{12}\ M_{\odot}$ overproduce stars at the present epoch. This mass appears to be the transition mass at which the main driver of regulating star formation (SF) is supernova (SN) feedback below and active galactic nucleus (AGN) feedback above. However, models of SN feedback at this scale have only included thermal energy to date. We therefore run simulations of galactic winds from such a galaxy including both SN thermal energy and cosmic-rays (CR). We use a galaxy with $5 \times 10^{12}\ M_{\odot}$ that resembles a local ultraluminous galaxy, in which SN thermal feedback alone is no longer effective in loading a large amount of gas from its deep potential, but AGN feedback still remains quiescent. We use a two-fluid model for the thermal gas and relativistic CR plasma with isotropic CR diffusion in the ENZO adaptive mesh refinement code. We employ a finest resolution of 0.2pc to resolve shocks and swept-up shells and their fragmentation by Rayleigh-Taylor instability. Our preliminary results show that the lower compressibility of the CRs drives a more effective outflow, and that CRs thicken the shells lowering their densities by a factor of a few, and so reduce radiative loss of thermal energy as well as the amount of fragmentation, compared to our pure SN thermal energy-dirven wind. We will show the effects of CR pressure on accelerating fragmented shells out to the halo and discuss its role in regulating future SF.