Dwarf galaxy formation beyond supernovae: magnetism, radiation and cosmic rays

Sergio Martin-Alvarez*[1], Debora Sijacki[2], and Martin Haehnelt[3]

[1]University of Cambridge [Cambridge] – United Kingdom
[2]Institute of Astronomy, University of Cambridge (IoA) – United Kingdom
[3]University of Cambridge [UK] (CAM) – The Old Schools, Trinity Lane, Cambridge CB2 1TN, United Kingdom

Abstract

Understanding star formation in dwarf galaxies has proven a persistent challenge for galaxy formation numerical simulations. In order for these simulations to produce results that better match observed galaxies, accounting for additional baryonic physics (e.g. stellar radiation, magnetic fields, and cosmic rays) has been frequently advocated. Nonetheless, in their absence, methods such as calibrating stellar feedback have allowed simulations to more effectively reproduce e.g. expected stellar masses. However, doing so has the detrimental effect of disrupting the match attained for other observables. Investigating our simulations devised to explore the role played by these additional physics, I present here our first results from radiative transfer, cosmic rays, magnetohydrodynamical (RTCRMHD) simulations of a dwarf galaxy formation in a cosmological context. I compare our simulations with observational measures of stellar mass, morphology, kinematics, and metal enrichment. Our suite of simulations provides encouraging prospects suggesting RTCRMHD physics may contribute to overcome various ongoing dwarf galaxy formation problems, and in particular, to resolve or alleviate our necessity for stellar feedback calibration.

*Speaker