Predicting Radio Signals from the First Stars for Lunar Radio Telescopes

Future low frequency lunar radio telescopes, such as the FARSIDE array, have the potential to offer a window into the formation of the first generation of stars in the early universe through the hydrogen spin-flip transition. However, these telescopes will rely on robust physical models to interpret the radio signals as constraints on these exotic sources. We construct a semi-analytic model for the formation of Pop III stars to explore the combined effects of the fluctuating ultraviolet background and relic streaming velocity from the early universe, both of which suppress cooling of gas and the subsequent formation of early stars. Building on the semi-analytic model developed in Mebane et al. 2017, we examine how these effects manifest as fluctuations on very large physical scales (potentially measurable with a lunar interferometer) and on the global star formation history and radio signal (potentially measurable with a smaller lunar radio telescope).