

## **The Tail of Two Distributions**

*Maddy Stratton*

Density fluctuations of dark matter are erased on scales smaller than the free streaming length, which leads to a cut-off in the matter power spectrum. This cut-off is important for the onset of structure formation in the early universe. What can determine the shape and location of the cut-off is the velocity distribution of dark matter. In this project, we employ the Cosmic Linear Anisotropy Solving System (CLASS) to investigate how the velocity distributions of warm dark matter (WDM) and cold dark matter (CDM) affect the shape and location of the cut-off in their respective matter power spectra.

We find that as the momentum of a typical particle is increased, even as the shape of the momentum distribution function is held constant, the transfer function of the matter power spectrum for both WDM and CDM becomes increasingly inconsistent with standardized models. We find that the velocity distribution is actually changing, and that the momentum distribution given to CLASS is no longer equal to its velocity-space distribution for relativistic particles. Therefore, the cut-off in the matter power spectrum output from CLASS is altered by increasingly relativistic particles for both WDM and CDM.