THE NON-EQUILIBRIUM FUSION PLASMA RESEARCH CENTER AND DEVELOPMENT OF A FUSION AUGMENTED THRUSTER. J. Cassibry[2], University of Alabama in Huntsville, Technology Hall N205, Huntsville, AL 35899, [1]The University of Alabama in Huntsville, Technology Hall S232, Huntsville, AL 35899.

Introduction: In this talk we illustrate how nonequilibrium plasmas are ubiquitous, and they result in velocity distributions far from Maxwellian equilibrium. The characteristics which result in these velocity distributions are accessible in small to large scale laboratory plasmas and can be put to use in many applications from fusion, to rockets to medical. This is the basis for the non-equilibrium fusion center recently proposed to the DOE. We will discuss this proposal and its value statement.

Nonequilibrium plasma and reactivity: We compare the Maxwellian and so called kappa (κ) distribution distributions for deuterium ions at 10 keV to facilitate the discussion, Figure 1. At low κ, the peak of the distribution shifts to lower energies whereas the tail flattens. As κ exceeds 10, the departure from Maxwellian becomes difficult to distinguish except at energies >1 MeV. It is because of the high energy tail that fusion reactivities in these plasma states can be significantly higher, especially at temperatures below 10 keV, Figure 2.

We will describe the mechanisms for particle acceleration to cause this distrubtion. Some applications will be discussed, including an efficient neutron source, laboratory astrophysics, and fusion augmented propulsion. For the propulsion concept, a competitive analysis of thusters will culminate the talk.

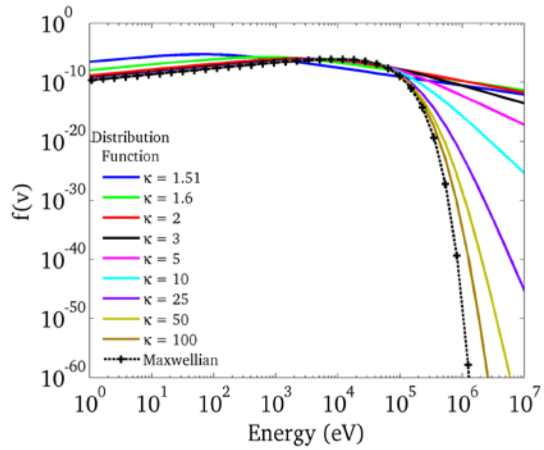

Figure 1 Comparison between the Kappa Distributions and the Maxwellian Distribution for a 10 keV plasma.

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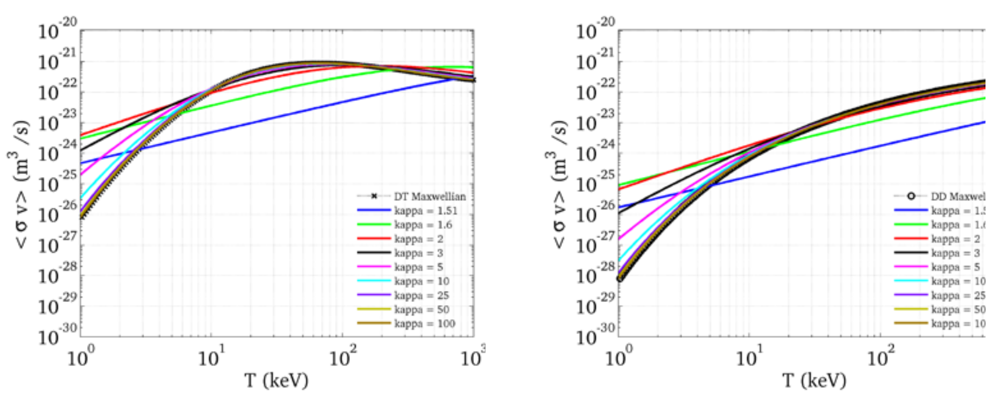

Figure 2 Comparison of fusion reactivities for Maxwellian and nonequilibrium (kappa) distrubribrutions for DT (left) and DD (right) fusion reactions.