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# Radiative properties measurements for stellar interiors and accretion powered objects

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Laboratory plasma conditions that address outstanding astrophysical puzzles are generated using x-rays from the MJ-class Z facility at Sandia National Laboratories. Plasmas conditions span $10^{16}$-$10^{23}$ $e^-/cm^3$ electron densities, and 1-200eV temperatures, in LTE or radiation-dominated non-LTE conditions. The long-lived duration, uniformity, and large volumes ($mm^3$ to $100cm^3$) of these plasmas allows us to perform benchmark quality experiments. The copious x-rays can simultaneously drive separate physics experiments on each Z shot. The presentation will focus on the recent investigations of stellar interior opacities and spectral line emission from photoionized plasmas near accretion-powered objects.

The opacity of Cr (Z=24), Fe (Z=26) and Ni (Z=28) at conditions approaching the base of the solar convection zone (CZB), i.e. Te~190eV, ne~4e22 $e^-/cm^3$, were measured. Models are significantly underestimating the opacity of Fe at these conditions [1]. If this difference would persist for a range of plasmas conditions and elements, this would have significant impact on stellar interiors modeling and could help shed light on the solar CZB problem [2]. Shifting the atomic number of the probed sample will help our understanding of the origin of this opacity discrepancy.

Physical descriptions of accretion-powered objects such as black holes, x-ray binaries, or AGN are informed through the interpretation of emergent spectra from the photoionized plasmas that surround them. Line formation in photoionized plasmas is dependent on the details of the radiation transport treatment and the so-called Resonant Auger Destruction hypothesis typically required to interpret the relativistically broadened Fe Kα emitted from near the black hole event horizon. Accurate and high-resolution emergent intensity was observed from a photoionized silicon plasma for a discrete set of column densities that will help us evaluate understanding for radiation transport in accretion powered objects.

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[1] J. E. Bailey et al., *Nature*, **517**, (2015)
[2] S. Basu & H. Antia, Physics Reports, **457**, (2008)