Platform-dependent advantages and challenges of laboratory stellar-opacity measurements

Taisuke Nagayama[1*], Jim Bailey[1], Greg Dunham[1], Eric Dutra[4], Bob Heeter[2], Matthias Hohenberger[2], Heather Johns[3], Guillaume Loisel[1], Dan Mayes[1], Kathy Opachich[2], Ted Perry[3], Matthew Wallace[2]

[1]Sandia National Laboratories
[2]Lawrence Livermore National Laboratory
[3]Los Alamos National Laboratory
[4]Nevada National Security Site

The accuracy of iron and oxygen opacity calculations is crucial for solar and stellar modeling, as well as numerous high-energy-density (HED) plasma simulations. The lack of benchmark opacity experiments introduces uncertainties into these simulations. The first iron opacity measurement at solar interior temperatures, conducted at the Z-machine at Sandia National Laboratories [1,2], revealed a larger-than-expected discrepancy between measured and modeled iron opacities. While this finding could help resolve discrepancies between solar models and observations, it also sparked controversy within the HED community. An alternative experimental method developed at the National Ignition Facility (NIF) [3,4] aims to independently verify these findings. The Z-machine uses an area backlight approach, whereas NIF employs point-projection. Each method offers unique advantages and challenges due to platform-specific characteristics. This poster summarizes how these approaches complement each other, and how they, when combined, provide unbiased experimental constraints for testing the accuracy of iron and oxygen opacity models.

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References

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* E-mail: tnnagay@sandia.gov