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Revisiting iron opacity discrepancies at stellar interior conditions
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Iron opacities measured at stellar interior conditions were significantly higher than calculated [Bailey, Nature 517, 56 (2015)]. While this helps resolve a decade old solar problem, the question remains: What is responsible for the model-data discrepancy? This question is difficult to answer due to complex nature of the discrepancies; The calculated iron opacities have (1) narrower spectral lines, (2) deeper opacity windows, and (3) weaker quasi-continuum at short wavelength than the measurements. Recent systematic study of chromium, iron, and nickel opacities [Nagayama, PRL 122, 235001 (2019)] suggested possible model refinements for the two of the discrepancies but deepened the mystery on the quasi-continuum discrepancy; significant quasi-continuum discrepancy was observed only from iron and only at the higher temperatures and densities. For the last three years, we have been revisiting the iron results by performing more experiments and refining the data-analysis method. We will summarize the new iron opacity results and discuss its implication for the solar problem. Sandia National Laboratories is a multimission laboratory managed and operated by NTESS LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. DOE's NNSA under contract DE-NA0003525.

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