Contribution ID: **23** Type: **not specified**

Radiation burn-through measurements to infer opacity at conditions close to the solar radiative zone-convective zone boundary

Wednesday, 17 May 2023 15:40 (30 minutes)

Recent measurements at the Sandia National Laboratory of the x-ray transmission of iron plasma much higher than predicted by theory have cast doubt on modelling of iron x-ray radiative opacity at conditions close to the solar convective zone-radiative zone boundary. An increased radiative opacity of the solar mixture, in particular iron, is a possible explanation for the disagreement in the position of the solar convection zone-radiative zone boundary as measured by helioseismology and predicted by modelling using the currently accepted elemental composition based on photosphere analysis. Here we present data from radiation burn-through experiments which do not support a large increase in the opacity of iron at conditions close to the base of the solar convection zone and provide a constraint on the possible values of both the mean opacity and the opacity in the x-ray range of the Sandia experiments. the data agree with opacity values from current state-of-the-art opacity modelling and hence do not support an increase in iron opacity as a partial explanation for the discrepancy in the predicted solar convective-radiative zone boundary position.

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Session Classification: Astrophysical Plasmas

Track Classification: Astrophysical Plasmas