



Contribution ID: 83

Type: **Invited Talk**

## Advances on multi-fluid modeling of the solar atmosphere

*Monday, 27 February 2023 13:30 (21 minutes)*

Recent observational studies on abundances reveal the need to expand models by considering different fluids and/or species to be constrained with these observations and interpret them. Similarly, radiative MHD models fail to reproduce observations of the coldest parts of the chromosphere and some properties of the Mg II profiles. Mg II is formed where interactions between multiple ionized and neutral species prevent an accurate MHD representation. In addition, those regions are where MHD seems to break down, and microphysics may need to be considered, such as a meter-scale electrostatic plasma instability, the Thermal Farley-Buneman Instability (TFBI), which develops in these regions and efficiently converts kinetic energy into electron heating. In this presentation, I will summarize some of the advances in multi-fluid modeling, especially focusing on the multi-fluid Ebysus code and the need to validate and constrain those with existing and future observations.

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**Session Classification:** Chromosphere

**Track Classification:** Chromosphere