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Understanding solar atmospheric dynamics through MHD simulations

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The extremely dynamic solar atmosphere presents us with several grand challenge problems in the area of Plasma physics. We will focus on two of those through the lens of MHD simulations guided suitably by observations, namely - 1) The million degree Kelvin kinetic temperature of the solar coronal plasma and, 2) Prediction of eruptive phenomena on the Sun like the solar flares and the coronal mass ejections. We will elaborate on the intricacies of such radiative-MHD models including LTE radiative transfer, anisotropic Spitzer conductivity along magnetic field lines and semirelativistic Boris correction to account for large Alfven speeds and the physical processes behind the scene.

In relation to (1), some estimates and energetics on Chromospheric jets and MHD wave driven reconnections and heating seen for the first time in numerical simulations of the solar corona will be provided. In relation to (2), for the physical understanding of eruptive events, we initiate solar atmospheric models with the simplest of the initial conditions possible (data-inspired) where as, to actually match the observations in terms of eruptive event timing, strength and emission, we drive or force such models with observed data (data driven) which has its own challenges since, obviously, not all physical variables can be measured in the solar atmosphere.