



MHD models for Sun-grazing comets

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Sun-grazing comets have high orbital eccentricities and low perihelia. They travel between the outer solar system and the lower corona. Recent advances in spacecraft imaging capabilities have enabled us to observe these comets with high resolution both in time and space. These comets exhibit rich tail activity in the lower corona, even multiple tails.

Sun-grazing comets interact with the coronal plasma in a very different way, than in the conventional models of comet-solar wind interactions. The parameters, scales, and chemistry are very different. In this study, we have simplified the interaction into two different baseline models. In the first model we show the comet appearance in sub-Alfvenic solar wind. A single-fluid MHD model is applied to comet C2012 S1 (ISON) conditions. In the second model we adopt the chemical reactions with extreme ionization rates around the perihelion of comet C/2011 W3 (Lovejoy). We use our multi-fluid model to track all charge states of oxygen, from O⁺ to O⁶⁺. These steady-state models can be used to explain the chronicle of comet tail appearance as it approaches perihelion.