Geophysical Research Abstracts
Vol. 21, EGU2019-8013, 2019
EGU General Assembly 2019

Origins of density fluctuations in the solar corona explored with time-dependent MHD simulations

Léa Griton (1,2), Rui Pinto (1), Rouillard Alexis (1), and Michael Lavarra (1)
(1) IRAP CNRS - Université Paul Sabatier, Toulouse, France, (2) LESIA CNRS - Observatoire de Paris, Meudon, France

Quasi-periodic density fluctuations appear ubiquitous in the regions where the solar wind forms and accelerates. The origin of these fluctuations is still debated and could result from a number of physical processes including rising MHD waves, periodic impulsive heating or continual magnetic reconnection. The recent analysis of deep field imaging campaigns carried out with the STEREO COR-2 instrument highlight the omnipresence of density fluctuations with periodicities around 40 minutes in both fast and slow solar winds. We use the time-dependent model of the solar wind MULTI-VP already tested against observations for a steady-state corona, to explore the mechanisms at play in the low corona that could produce such density fluctuations higher up in the atmosphere. We first test the idea that impulsive and periodic heating near the transition region could lead to density fluctuations higher up in the atmosphere. We investigate how such density fluctuations can be transmitted out in the solar wind beyond the sonic point. We test the viability of such impulsive heating cycles by computing the charge-state of heavy ions that freezes low in the corona. We compare our results with recent observations that have found evidence for significant variations in the charge states of heavy ions inside density structures measured in situ. We also consider mechanisms such as wave mode conversion, for example Alfvén waves converted to compressive modes as they rise through the complex magnetic fields of the solar atmosphere. This study provides a modeling framework for the future analysis that can be carry out with the remote-sensing and in situ data that will be acquired by the Parker Solar Probe and the Solar Orbiter over the next decade. This work is funded by the ANR Tremplin ERC SLOW_SOURCE project.