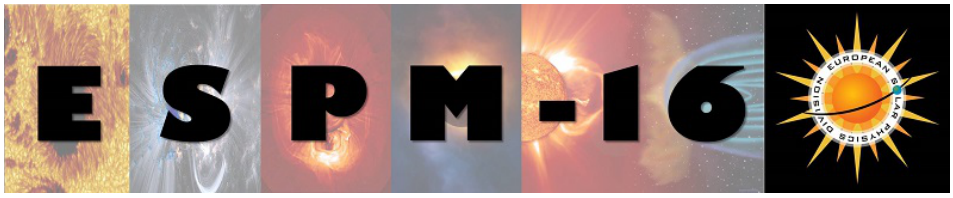

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Magnetic Perturbations in a Sunpot Chromosphere Linked to Plasma Fractionation in the Corona

Thursday, 9 September 2021 09:52 (13 minutes)

Element abundance signatures have long been used as tracers of physical processes throughout astrophysics. Understanding the spatial and temporal variations in the composition of the solar corona provides insight into how matter and energy flow from the solar chromosphere out into the heliosphere. In this work, we investigate the spatial distribution of highly varying plasma composition around one of the largest sunspots of solar cycle 24. Observations of the photosphere, chromosphere, and corona are brought together with magnetic field modeling of the sunspot in order to probe the conditions that regulate the degree of plasma fractionation within loop populations of differing connectivities. Loops above the umbra contain unfractionated plasma, i.e. photospheric composition, while coronal loops rooted in the penumbra contain fractionated plasma with the highest levels observed in the loops that connect within the active region. The distribution of the highly fractionated plasma appears to be correlated with the spatial locations at which intrinsic magnetic perturbations are identified in high spatial resolution spectropolarimetric observations of the solar chromosphere. Tracing field lines from regions of highly fractionated plasma in the corona to locations of magnetic perturbations detected in the chromosphere shows that they are magnetically linked. These results indicate a direct connection between sunspot chromospheric activity and observable changes in coronal plasma composition. We interpret our findings in the wider context of coronal heating and the ponderomotive force model of elemental fractionation.

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