Plasma-Neutral Coupling in the Solar Chromosphere and Ionosphere/Thermosphere

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The physics of plasma-neutral coupling adds another layer of complexity to problems that previously have been addressed by assuming a fully-ionized plasma or some other single-fluid approximation. Plasma-neutral interactions modulate momentum and energy exchange among the neutral gas, electrons, and ions, and between the ionized plasma and electromagnetic fields. Plasma-neutral coupling is important in both the solar chromosphere and terrestrial ionosphere/thermosphere.

The solar chromosphere is the highly dynamic, complex region above the relatively cool visible surface of the Sun and beneath the very hot corona. It is characterized by several transitions that occur with increasing altitude: e.g. from predominantly neutral to ionized hydrogen. The chromosphere modulates the flow of mass and energy into the corona.

The ionosphere/thermosphere is a similarly transitional region in the Earth's upper atmosphere, in which the gas is ionized to varying degrees by incident solar radiation. It encompasses the same physical transitions as those occurring in the chromosphere.

In this review, we highlight the commonalities and differences between the chromosphere and I/T in order to develop cross-disciplinary collaboration between the two communities, which typically use different approaches to the same fundamental physics. We conclude with thoughts about current challenges to our understanding of plasma-neutral coupling on the Sun and at the Earth.

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