



The Lunar Wake Current Systems

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Direct impact of the solar wind plasma with the non-conductive body of the Moon, with no atmosphere and no global magnetic field, neutralizes the plasma in the lunar day-side, leaves a plasma void and forms an expanding rarefaction region, confined into a plasma Mach cone downstream. We show that in the transition regions between the plasma void, the rarefaction region, and the interplanetary plasma there are three main currents flowing around these regions in the lunar wake. The generated currents induce magnetic fields within these regions, perturb the field lines there and confine the field perturbations within the lunar Mach cone. We use a three-dimensional, self-consistent hybrid model of plasma (particle ions and fluid electrons) to show the flow of these three currents. First we identify the different plasma regions, separated by the currents, then we show how the currents depend on the interplanetary magnetic field direction. Finally we discuss the current closures in the lunar wake.