plasma expansion

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High-velocity impacts on the Moon and other airless bodies deliver energy and material to the lunar surface and exosphere. The target and impactor material may become vaporized and ionized to form a collisional plasma that expands outward and eventually becomes collisionless. In the present work, kinetic simulations of the later collisionless stage of impact plasma expansion are performed. Attention is paid to characterizing "ambipolar oscillations" in which thermodynamic disturbances propagate outward to generate "ringing" within the expanding electron cloud, which could radiate an electromagnetic signature of local plasma conditions. The process is not unlike a beam-plasma interaction, with the perturbing electron population in the present case acting as a highly thermal "beam" that resonates along the expanding density gradient. Understanding the electromagnetic aspects of impact plasma expansion could provide insight into the lasting effects of natural, impact-generated currents on airless surfaces and charging hazards to human exploration infrastructure and instrumentation.