Abstract Submitted
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Experimental and Numerical Modeling of Spark Discharges in Dusty Supersonic Flow.[1] CHRISTOPHER KUENY, JENS VON DER LINDEN, JASON SEARS, ALLEN KUHL, DAVE GROTE, MARK CONVERSE, Lawrence Livermore National Laboratory, CLARE KIMBLIN, IAN MCKENNA, Special Technologies Laboratory, RYAN HOUIM, SKYLER BAGLEY, University of Florida — Supersonic particle-laden gas emerging from a nozzle produces radio frequency (RF) emanations, a scenario found at the exhaust of shock tubes and in other applications. A likely source of the RF is streamer or coronae discharge between triboelectrically charged dust particles. The phenomenon has been investigated using burst disks to rapidly expel argon gas entraining various particle compositions. Measured electrical discharges appear to be associated with a standing shock wave known as the Mach disk, characterized by a high density gradient that could provide favorable conditions for spark generation. Hydrodynamic modeling with the HyBurn code shows excellent agreement with experimental measurements. Calculation of ionization rates with the Bolsig+ Boltzmann solver and application of the Raether-Meek breakdown criterion allows us to place bounds on the particle charging necessary to support the observed discharges. This combination of multiphysics experiment and modeling is helping to validate theoretical models of particle electrification and discharge in supersonic flows.

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