Meteoroids and dust are constantly bombarding spacecraft while on orbit. These hypervelocity particles may cause electrical anomalies in satellites through plasma-induced electromagnetic pulse (EMP) or electrostatic discharge (ESD). Such effects may potentially interfere with communication, remote sensing, and solar cell or gyro-stability equipment. More importantly, impact generated plasma could end the life of a satellite by mechanisms that are not well understood and not normally taken into account in satellite design. Plasma production scales exponentially with impact velocity, thus even for small meteoroid or dust impacts, these effects approach levels that could be dangerous to spacecraft electronics.

Ground based tests were performed at the Max-Planck-Institute für Kernphysik Van de Graaff accelerator in Heidelberg, Germany to further explore charge production scaling by measuring radiofrequency (RF) emission associated with hypervelocity particle impact induced plasma. Ground tests were conducted by accelerating iron dust particles to speeds in excess of 11 km/s and impacting on target materials situated in a 1m diameter vacuum chamber. Included in our experiment are a set of narrowband patch antenna, low frequency electric field sensors, retarding potential plasma analyzers, and an optical flash photomultiplier tube in order to detect the plasma emission energetics. The signals are dissected in order to determine the charge production velocity-scaling exponent in question. Our results reveal a strong exponential dependence on impact velocity, with strong correlation near $v^4$. For RF production, the case of hypervelocity impact onto a biased target in discussed in detail. The likelihood of RF emission suggests plasma turbulence instability may be responsible for the RF production. Finally, mitigation strategies for space weather anomalies are explored.