



Laboratory Experiments Simulating Sprites on Earth, Venus and Jupiter.

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Large sprite discharges at high atmospheric altitudes have been found to be physically similar to small streamer discharges in air at sea level density. Based on this understanding, we investigate sprite discharges on Earth and possible sprite discharges on Venus or Jupiter-like planets through laboratory experiments on streamers in artificial air and appropriate CO₂-N₂ and H₂-He mixtures.

From ICCD images, we have determined general streamer morphology, minimal streamer diameters and propagation velocities. We have found that for all three gas mixtures, the reduced minimal diameter ($n \times d_{min}$, density times diameter) is constant as a function of pressure, although the exact number varies with a factor of 5, depending on the gas composition. This confirms the similarity laws for streamers.

Morphology and velocities of sprites on Venus and Jupiter are also quite similar to those on earth, but light emissions in the visible range are much fainter, by two orders of magnitude.

Spectra emitted by streamer and glow discharges in the three different gas mixtures are measured as well; they are dominated by the minority species N₂ on Venus and Earth, while signatures of both main species (H₂-He) are found on Jupiter-like planets. We also show that the spectra of short repetitive glow discharges and streamer discharges are very similar.