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Photon Emission Dynamics during Low-Temperature Plasma Formation[1] ANDREW FIERRO, GEORGE LAITY, ANDREAS NEUBER, LYNN HATFIELD, Texas Tech University — This paper discusses the experimentally observed dynamics of photon emission in the vacuum ultraviolet (VUV) and ultraviolet (UV) spectral regions during the early formation phase of pulsed atmospheric plasma with nanosecond resolution. A 40 kV high voltage pulse with 100 ns risetime is utilized to breakdown a variable millimeter sized gap in various gases at atmospheric pressure. Spatially-resolved PMT measurements reveal that early photon emission originates near the anode and that the source of VUV emission travels from anode to cathode at a velocity on the order of 10^7 cm/s, which is consistent with streamer velocities in volume breakdown reported elsewhere. It is also found, for instance, in pure nitrogen that the second positive system is the main contributor to the emitted light spectrum between 200 to 800 nm during the plasma formation phase while atomic nitrogen dominates the wavelength range between 115 to 200 nm. Under the investigated conditions, it is further elucidated that excited atomic nitrogen is formed in a two-step process rather than in a single electron collision with molecular nitrogen. Current observations in H_2 discharges demonstrate strong self-absorption for the Lyman-alpha transition coupled with appreciable Stark line broadening.

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