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Discharge physics of an helium nanopulse discharge at atmospheric pressure JEAN-SEBASTIEN BOISVERT, FLORENCE MONTPETIT, PIERRE-GABRIEL ROZON, JACOPO PROFILI, LUC STAFFORD, Universite de Montreal — A nanopulse discharge is generated in atmospheric pressure helium inside a dielectric tube (id 2 mm) using two long linear electrodes painted on diametrically opposed sides of the tube. Applying a voltage of 3 kV with a pulse width of 340 ns at a repetition rate of 1 kHz allows to sustain a weak and diffuse discharge. Time and space-resolved He(3^3S $\rightarrow$ 2^3P) (706.4 nm) light emission distribution suggests a Townsend breakdown that last about 10 ns. The helium light distribution then quickly turns into the shape of a glow discharge and vanishes in about 50 ns. During the fall of the applied voltage, a glow discharge light emission pattern is again observed but no transition through a Townsend discharge is detected. In fact, with only 340 ns between the two discharge current peaks, memory effect should strongly impact the second discharge. In order to quantify the memory effect, the electron temperature (T_e) is determined from a collisional-radiative model coupled with optical emission spectroscopy of He ($n = 3$) lines. With the help of a camera equipped with bandpass filters (around 667 and 728 nm), the time and spatially-resolved T_e is obtained . While T_e rises up to 8 eV during the first discharge it increases only up to about 2.5 eV during the second one.

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