Abstract Submitted
for the GEC19 Meeting of
The American Physical Society

Effects of long-lived electronically excited reactive oxygen and nitrogen species in non-equilibrium gas-discharge plasma of apokamp-type. VITALY DATSYUK, Taras Shevchenko National University of Kyiv, IGOR IZMAILOV, VADYM NAUMOV, Institute of Semiconductor Physics, National Academy of Sciences of Ukraine, VLADIMIR KHOMICH, VYACHESLAV TSIOLKO, Institute of Physics, National Academy of Sciences of Ukraine — Non-equilibrium plasma in high-voltage gas discharges of the so-called apokamp type (blue jets, red sprites) is of great interest for science and practice [1]. But, despite the advances in apokamp plasma physics, the mechanism of apokamp plasma chemistry is not very clear, in particular, concerning electronically excited reactive oxygen and nitrogen species (RONS). We tried to study this issue in more detail. Experiments were done in various oxygen-nitrogen mixtures employing electrical and optical diagnostics. Measurements showed that apokampic plasma processes are accompanied by the formation of long-lived RONS. Computational modeling by using 0D-kinetic and 1D-fluid models, including ionization, excitation, dissociation-recombination, vibrational relaxation, collisional quenching, and radiation, revealed the most probable mechanisms of plasma-chemical reactions in apokamp plasma jets. Effects of metastable RONS involving singlet oxygen $O_2^*(a,b)$, $O^*(^1D)$ and nitrogen $N_2^*(A)$, $N^*(^2D)$ were examined. The study confirms the role of long-lived RONS in apokamp plasma and indicated the way to a more efficient apokamp process. [1] E.A. Sosnin et al., JETP Lett. 103 (12):761 (2016).

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Date submitted: 04 Jun 2019 Electronic form version 1.4