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High order fluid model of streamer discharge in molecular nitrogen SASA DUJKO, Institute of Physics, University of Belgrade, PO Box 68, Zemun 11080, Belgrade, Serbia, ARAM MARKOSYAN, Centrum Wiskunde & Informatica (CWI), P.O.Box 94079, 1090 GB Amsterdam, The Netherlands, RON WHITE, ARC Centre for Antimatter-Matter Studies, School of Engineering and Physical Sciences, James Cook University, Townsville 4810, Australia, ZORAN PETROVIC, Institute of Physics, University of Belgrade, PO Box 68, Zemun 11080, Belgrade, Serbia, UTE EBERT, Centrum Wiskunde & Informatica (CWI), P.O.Box 94079, 1090 GB Amsterdam, The Netherlands — In this work, we present the basic elements of a theory developed for high order fluid modeling of streamer discharges. Using a momentum transfer theory, the first four moments of the Boltzmann equation are closed in the local mean energy approximation and coupled to the Poisson equation for space charge electric field. The high order pressure tensor appearing in the heat flux equation is specified in terms of previous moments. The average collision frequencies for momentum and energy relaxation and the average energy loses in inelastic collisions are calculated using the cross sections for electron scattering as input into a multi term Boltzmann equation solution. Negative streamer ionization fronts in nitrogen under normal conditions are investigated and it is shown that the high order fluid model involving the solution of the energy flux equation with the local mean energy approximation must be used in order to accurately simulate the streamer dynamics.

Sasa Dujko
Institute of Physics, University of Belgrade,
PO Box 68, Zemun 11080, Belgrade, Serbia

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