M U N I

COMMENTARY TO HABILITATION THESIS[1]

Name of the habilitation thesis: Modelling of Non-Equilibrium Electrical Discharges: Streamers and Determination of Electric Field from Optical Emissions

Name and surname of the applicant: Zdeněk Bonaventura

The following list of selected publications is split into two topics. Within each of the topics, the publications are sorted by publication date. My estimated contribution to these publications is specified in the respective tables according to: work contribution, supervision of students, manuscript preparation, and research direction.

Topic A contains three selected works which are relevant for theoretical foundations of the electric-field determination in non-thermal transient discharges from optical emission spectroscopy, particularly through the method of intensity ratios. The publication A1 examines the influence of streamer geometry and various light-detection scenarios on the inferred electric fields. Works A2 and A3 aim to derive the ratio methods from detailed non-equilibrium kinetics and analyze the underlying uncertainties.

Topic B contains seven selected publications and addresses various aspects of streamer physics through numerical modelling. Papers B1–B3 arise from my collaboration with applied mathematicians on developing and applying advanced numerical methods with space–time adaptivity and a-priori error control to the modelling of streamer discharges in air. Publications B4–B5 emerged from our interest in the physics of runaway electrons. Publication B6 is a Topical Review on streamer breakdown, where my contribution mainly involves elaboration of Section 4: Streamer-cathode interaction as a bottleneck in computer simulations of the streamer breakdown. Publication B7 focuses on approximate methods for numerical solution of radiative transport equation for evaluation of photoionization term in streamer models in air. Note that selected parts of publications B6 and B7 serve as a ground for Chapter 1 of the habilitation thesis.

[A1][2] **Zdeněk Bonaventura,** Anne Bourdon, Sebastien Celestin, and Victor P Pasko. Electric field determination in streamer discharges in air at atmospheric pressure. *Plasma Sources Science and Technology*, 20(3):035012, 2011. doi: 10.1088/0963-0252/20/3/035012.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)

[1] The commentary must correspond to standard expectations in the field and must include a brief characteristic of the investigated matter, objectives of the work, employed methodologies, obtained results and, in case of co-authored works, a passage characterising the applicant's contribution in terms of both quality and content.
[2] Bibliographic record of a published scientific result, which is part of the habilitation thesis.

50	n/a	80	80

[A2] Adam Obrusník, Petr Bílek, Tomáš Hoder, Milan Šimek, and **Zdeněk Bonaventura.** Electric field determination in air plasmas from intensity ratio of nitrogen spectral bands: I. Sensitivity analysis and uncertainty quantification of dominant processes. *Plasma Sources Science and Technology*, 27(8):085013, 2018. doi: 10.1088/1361-6595/aad663.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
10	80	10	90

[A3] Petr Bílek, Adam Obrusník, Tomáš Hoder, Milan Šimek, and **Zdeněk Bonaventura**. Electric field determination in air plasmas from intensity ratio of nitrogen spectral bands: II. Reduction of the uncertainty and state-of-the-art model. *Plasma Sources Science and Technology*, 27(8):085012, 2018. doi: 10.1088/1361-6595/aad666.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
10	80	10	90

[B1] Max Duarte, **Zdeněk Bonaventura**, Marc Massot, Anne Bourdon, Stéphane Descombes, and Thierry Dumont. A new numerical strategy with space-time adaptivity and error control for multi-scale streamer discharge simulations. *Journal of Computational Physics*, 231(3):1002–1019, 2012. doi: 10.1016/j.jcp.2011.07.002.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	10	30	20

[B2] **Zdeněk Bonaventura**, Max Duarte, Anne Bourdon, and Marc Massot. Derivation of a merging condition for two interacting streamers in air.*Plasma Sources Science and Technology*, 21(5):052001, 2012. doi: 10.1088/0963-0252/21/5/052001.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
60	n/a	80	60

[B3] Max Duarte, **Zdeněk Bonaventura**, Marc Massot, and Anne Bourdon. A numerical strategy to discretize and solve the poisson equation on dynamically adapted multiresolution grids for time-dependent streamer discharge simulations. J*ournal of Computational Physics*, 289:129–148, 2015. doi: 10.1016/j.jcp.2015.02.038.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	n/a	30	20

[B4] Olivier Chanrion, **Zdeněk Bonaventura**, Deniz Çinar, Anne Bourdon, and Torsten Neubert. Runaway electrons from a 'beam-bulk' model of streamer: application to TGFs. *Environmental Research Letters*, 9(5):055003, 2014. doi: 10.1088/1748-9326/9/5/055003.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
35	n/a	20	20

[B5] Olivier Chanrion, **Zdeněk Bonaventura**, Anne Bourdon, and Torsten Neubert. Influence of the angular scattering of electrons on the runaway threshold in air. *Plasma Physics and Controlled Fusion*, 58(4):044001, 2016. doi: 10.1088/0741-3335/58/4/044001.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
35	n/a	20	20

[B6] Mirko Černák, Tomáš Hoder, and **Zdeněk Bonaventura**. Streamer breakdown: cathode spot formation, Trichel pulses and cathode-sheath instabilities. *Plasma Sources Science and Technology*, 29(1):013001, 2019. doi: 10.1088/1361-6595/ab5051.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
15	n/a	15	5

[B7] Jan Tungli, Miroslav Horký, Stanislav Kadlec, and **Zdeněk Bonaventura**. Capturing photoionization shadows in streamer simulations using the discrete ordinates method. *Plasma Sources Science and Technology*, 32(10):105009, 2023. doi: 10.1088/1361-6595/acfcd8.

Work contribution (%)	Supervision (%)	Manuscript (%)	Research direction (%)
10	80	20	50