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# Theoretical investigation of the magnetic asymmetry effect by using a lumped element model

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Latest experimental results have proven the existence of the magnetic asymmetry effect (MAE) in radio frequency capacitively coupled magnetron discharges [1]. Like the electrical asymmetry effect, the MAE allows to control the symmetry of a capacitive discharge. This contribution presents a lumped element model for such an RF driven magnetron which is an extension of a previously published lumped circuit description of unmagnetized RF discharges [2]. As its predecessor, the model represents the discharge by separate bulk and sheath zones which communicate via Kirchhoff relations. The extension accounts for the presence of a magnetized region with reduced electric conductivity [3,4]. The model provides short computation time and may be used for the purpose of model based control.
Similar to the experiment [1] a nearly geometric symmetric discharge is set up with the model. Due to a variation of the applied magnetic field strength, the sheath and bias voltage become significantly affected. The theoretical model and the experimental results show very good qualitative agreement. The main goal of this work is to theoretically investigate the influence of the MAE to capacitively coupled discharges and the non-linear electron resonance heating.

[1] M Oberberg et al., PSST 27, 105018 (2018)
[2] T. Mussenbrock et al., PSST 16, 377385 (2007)
[3] D. Bohm, The characteristics of Electrical Discharges in magnetic fields (1949)
[4] S.M. Rossnagel, H.R. Kaufman, Journal of Vacuum Science and Technology A 5, 88 (1987)

**Author:** Mr ENGEL, Dennis (Ruhr University Bochum)

**Co-authors:** Mr OBERBERG, Moritz (Ruhr University Bochum); Mr BIRK, Berger (Ruhr University Bochum); Mrs KROLL, Laura (Ruhr University Bochum); Dr SCHULZE, Julian (Ruhr University Bochum); Prof. AWAKOWICZ, Peter (Ruhr-Universität Bochum); Prof. BRINKMANN, Ralf Peter (Ruhr University Bochum)

**Presenter:** Mr ENGEL, Dennis (Ruhr University Bochum)

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