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A collisional-radiative model for low-pressure weakly magnetized Ar plasmas XI-MING ZHU, TSANKO TSANKOV, UWE CZARNETZKI, Institute for Plasma and Atomic Physics, Ruhr University Bochum, Bochum 44780, Germany, OLEKSANDR MARCHUK, Institut fr Energie- und Klimaforschung, Plasmaphysik, Forschungszentrum Jlich GmbH, Jlich 52425, Germany
— Collisional-radiative (CR) models are widely investigated in plasma physics for describing the kinetics of reactive species and for optical emission spectroscopy. This work reports a new Ar CR model used in low-pressure (0.01–10 Pa) weakly magnetized (<0.1 Tesla) plasmas, including ECR, helicon, and NLD discharges. In this model 108 realistic levels are individually studied, i.e. 51 lowest levels of the Ar atom and 57 lowest levels of the Ar ion. We abandon the concept of an "effective level" usually adopted in previous models for glow discharges. Only in this way the model can correctly predict the non-equilibrium population distribution of close energy levels. In addition to studying atomic metastable and radiative levels, this model describes the kinetic processes of ionic metastable and radiative levels in detail for the first time. This is important for investigation of plasma-surface interaction and for optical diagnostics using atomic and ionic line-ratios. This model could also be used for studying Ar impurities in tokamaks and astrophysical plasmas.

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