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Study on Nonlinear Resonance of Electron Heating in Asymmetric Capacitive Discharges with a Time-Dependent Fluid Sheath Model¹ ZHONG-LING DAI, YOU-NIAN WANG, Dalian University of Technology — Recently, it has been found that a nonlinear electron resonance effect can effectively enhance not only the ohmic but also stochastic heating in asymmetric capacitive discharges. Some authors have studied the effects of the plasma series resonance by means of a nonlinear global model with a constant sheath thickness. In fact, the sheath boundary varies with time periodically in rf discharges. In the work, we adopt a time-dependent fluid sheath model to describe nonlinear series resonance effects. With the model, we can determine selfconsistently the relationship between the instantaneous potential drop across the sheath and the instantaneous sheath thickness. The numerical results demonstrate that the self-excitation of the plasma series resonance significantly enhances both Ohmic heating and stochastic heating. Also, we observe that the effects of nonlinear series resonance increase the total power dissipation by factors of 2–5 for low pressure plasmas.

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