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Enhanced metastable population through evaporation cooling and recombination in the argon afterglow UWE CZARNETZKI, YUSUF CELIK, TSANKO TSANKOV, Ruhr-University Bochum, Faculty for Physics and Astronomy, MITSUTOSHI ARAMAKI, Nagoya University, Department of Electrical Engineering and Computer Science, SHINJI YOSHIMURA, National Institute for Fusion Science, DIRK LUGGENHOLSCHER, Ruhr-University Bochum, Faculty for Physics and Astronomy — Measurements, modelling and numerical simulations performed in a pulsed inductively coupled argon plasma at low pressures (1—5 Pa) show that very low electron temperatures are achieved on a characteristic time scale of a few tens of micro seconds through evaporation cooling. This allows for recombination resulting in the observed increase of the metastable density in the afterglow phase. The previously observed super-linear scaling with the electron density of the electron decay time is well reproduced analytically by assuming that microfield limited electron-stabilized three-body recombination into highly excited Rydberg states takes place. This hypothesis is strongly supported by experimental results from various diagnostic techniques.

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