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Plasma Heating and Current Drive by Stochastic Acceleration of Relativistic Electrons at the WEGA Stellarator HEINRICH LAQUA, Max Planck Institute for Plasma Physics, EURATOM Association, 17491 Greifswald, Germany, ENRICO CHLECHOWITZ, HSX Plasma Laboratory, University of Wisconsin, Madison, VLADIMIR FUCHS, Institute of Plasma Physics AS CR, v.v.i., Prague, CZ, Association EURATOM/IPP.CR, MATTHIAS OTTE, TORSTEN STANGE, Max Planck Institute for Plasma Physics, EURATOM Association, 17491 Greifswald, Germany — Relativistic electrons with parallel energies of up to 2 MeV have been continuously (10 s) generated by a stochastic interaction with the rf-field (6-26kW) of a 2.45 GHz open waveguide antenna without any loop voltage. These "run-away" electrons have been detected by their synchrotron, x- and γ-ray emission and have also generated a toroidal plasma current in the kA range. They are perfectly confined in the stellarator magnetic field of 0.5 T. The particle trajectories form their own nested drift surfaces which are shrunken inward and shifted outward with respect to the magnetic flux surfaces. This geometrical effect connects the antenna region, where the electrons are accelerated, with the plasma core, where a low temperature (20eV, 0.2-5 10^{18} m^3) bulk plasma is generated. The acceleration process was modelled by a random walk diffusion model and a Fermi Ulan map Monte-Carlo simulation. Both calculations show similar results for the heating and current drive efficiencies. They also reproduce the temporal behaviour of the plasma current and the synchrotron radiation, when the RF-power is modulated and show the need for a random phase interaction between the relativistic electrons and the antenna field.

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