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Ionization waves in the PK-4 direct current neon discharge[1] PETER HARTMANN, Baylor University, Wigner RCP, MARLENE ROSENBERG, UCSD, LORIN MATTHEWS, DUSTIN SANFORD, JORGE REYES, TRUELL HYDE, Baylor University — The PK-4 system is a microgravity dusty plasma experiments currently in operation onboard the International Space Station. The experiment utilizes a long DC discharge in neon or argon gases. We apply our 2D particle-in-cell with Monte Carlo collisions (PIC/MCC) discharge simulation to compute local plasma parameters that serve as input data for future dust dynamics models. The simulation includes electrons, Ne^+ ions, and Ne metastable atoms in neon gas and their collisions at solid surfaces including secondary electron emission and glass wall charging. On the time-scale of the onboard optical imaging, the positive column appears stable and homogeneous. On the other hand, our simulations show that on microsecond time-scales the positive column is highly inhomogeneous, ionization waves with phase velocities in the range between 500 m/s and 1200 m/s dominate the structure. In these waves, the electric field and charged particle densities can reach amplitudes up to 10 times of their average value. Our experiments on a ground-based PK-4 replica system fully support the numerical findings. In the experiment, the direction of the DC current can be alternated. We show, that during the polarity switching an ionization tsunami swipes along the whole discharge towards the new cathode.

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