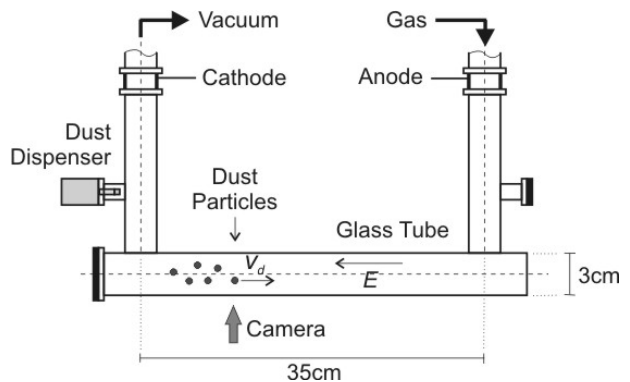


PK-4 is a complex plasma experiment in a combined dc/rf discharge. As plasma chamber a glass tube with dc electrodes is used. This set-up is in particular suited to investigate the liquid phase of complex plasmas. PK-4 shall be operated on board of the International Space Station from 2007 on to study complex dc plasmas under microgravity.

Complex plasmas are low-temperature plasmas containing microparticles with a diameter of a few microns. Due to the high electron mobility in the plasma the microparticles collect up to 100.000 electron charges on their surface. Therefore they interact strongly with each other, leading to liquid and even crystal phases [1]. So far, complex plasmas are mostly studied in rf plasma chambers. PK-4 uses a dc or combined dc/rf discharge produced in a glass tube of 40 cm length and 3 cm diameter (see Fig.1 and 2). In this way, the microparticles streaming through the glass tube can be observed, allowing in particular to study the fluid phase of a complex plasma.



Since 2002 we perform experiments with PK-4 within a laboratory predevelopment phase, funded by DLR, in collaboration between MPE and IHED (Moscow). So far we have investigated dust waves and charging of the microparticles [2], the ion drag force acting on the microparticles, microparticle cloud collisions, and the simulation of a Laval nozzle. In addition measurements of the plasma conditions in the PK-4 plasma chamber were performed. These experiments were conducted in the laboratories at MPE and IHED as well as in two ESA parabolic flight campaigns. The final aim of PK-4 is the investigation of a complex dc plasma under microgravity on board of the International Space Station following the successful complex rf plasma experiments PKE-Nefedov and its successor PK3-Plus. The preparations of the space experiment PK-4, scheduled for 2007, will start with the next phase in 2005.

References:

- [1] H.M. Thomas et. al, Phys. Rev. Lett. 73 (1994) 652
- [2] S. Ratynskaia et al., Phys. Rev. Lett. 93 (2004) 085001

MPE: M. Fink, H. Höfner, S. Khrapak, M. Kretschmer, G.E. Morfill, R. A. Quinn, S. Ratynskaia, K. Tarantik, M.H. Thoma
IHED: V. Fortov, Y. Gerasimov, O. Petrov, A. Usachev, A. Zobnin