

PK-4 Publications

Refereed publications:

S. Ratynskaia, M. Kretschmer, S. Khrapak, R. A. Quinn, M. H. Thoma, G. E. Morfill, A. Zobnin, A. Usachev, O. Petrov, and V. Fortov, *Dust mode in collisionally dominated complex plasmas with particle drift*, IEEE Trans. Plasma Sci. 32 (2004) 613

S. Ratynskaia, S. Khrapak, A. Zobnin, M. H. Thoma, M. Kretschmer, A. Usachev, V. Yaroshenko, R. A. Quinn, G. E. Morfill, O. Petrov, and V. Fortov, *Experimental determination of dust particle charge at elevated pressures*, Phys. Rev. Lett. 93 (2004) 085001

V. Yaroshenko, S. Ratynskaia, S. Khrapak, M.H. Thoma, M. Kretschmer, H. Höfner, G.E. Morfill, A. Zobnin, A. Usachev, O. Petrov, and V. Fortov, *Determination of the ion drag force in a complex plasma*, Phys. Plasmas 12 (2005) 093503

V. Yaroshenko, S. Ratynskaia, S. Khrapak, M.H. Thoma, M. Kretschmer, and G.E. Morfill, *Measurements of the dust-ion momentum transfer frequency and ion drag force in complex plasmas*, Contrib. Plasma Phys. 45 (2005) 223

S.A. Khrapak, S. Ratynskaia, A.V. Zobnin, V.V. Yaroshenko, M.H. Thoma, M. Kretschmer, A. D. Usachev, H. Höfner, G. E. Morfill, O.F. Petrov, and V.E. Fortov, *Particle charge in the bulk of gas discharges*, Phys. Rev. E 72 (2005) 016406

V.E. Fortov, A.V. Ivlev, S.A. Khrapak, A.G. Khrapak, and G.E. Morfill, *Complex (dusty) plasmas: Current status, open issues, perspectives*, Phys. Rep. 421 (2005) 1

A. Usachev, A. Zobnin, O. Petrov, V. Fortov, B. Annaratone, M. Thoma, H. Höfner, M. Kretschmer, M. Fink, and G. Morfill, *Formation of boundary-free clusters in a uniform low pressure gas discharge plasma*, submitted to Phys. Rev. Lett.

A.V. Ivlev, V. Steinberg, R. Kompaneets, H. Höfner, I. Sidorenko, and G.E. Morfill, *Non-Newtonian viscosity of complex plasma fluids*, Phys. Rev. Lett. 98 (2007) 145003

S. Mitic, R. Sütterlin, A.V. Ivlev, H. Höfner, M.H. Thoma, S. Zhdanov, and G.E. Morfill, *Convective dust clouds in a complex plasma*, submitted to Phys. Rev. Lett.

S. Mitic, B.A. Klumov, U. Konopka, M.H. Thoma, S. Zhdanov, and G.E. Morfill, *Local properties of complex plasma structures*, submitted to Phys. Rev. Lett.

V.V. Yaroshenko, M.H. Thoma, H.M. Thomas, and G.E. Morfill, *Double layer formation on the interface of complex plasmas*, in preparation

Refereed Proceedings:

A. Usachev, A. Zobnin, O. Petrov, V. Fortov, M.H. Thoma, M. Kretschmer, S. Ratynskaia, R. A. Quinn, H. Höfner, and G.E. Morfill, *The project «Plasmakristall – 4» - a dusty plasma experiment in a combined dc/rf(i) discharge plasma under microgravity conditions*, Proceedings of 21st Symposium on Plasma Physics and Technology (Prague, Czech Republic, June 14-17, 2004), Czech. J. Phys. Suppl. C 54 (2004) 639

M.H. Thoma, H. Höfner, S.A. Khrapak, M. Kretschmer, R.A. Quinn, S. Ratynskaia, G.E. Morfill, A. Usachev, A. Zobnin, O. Petrov, and V. Fortov, *Measurement of the ion drag force*

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S. Khrapak, S. Ratynskaia, A. Zobnin, M. Thoma, M. Kretschmer, A. Usachev, V. Yaroshenko, R. Quinn, G. Morfill, O. Petrov, and V. Fortov, *Measurement of dust grain charge in a weakly ionized plasma of a dc discharge*, Contributions to the International Conference on Dusty Plasmas in Applications, (Odessa, Ukraine, August 25-29, 2004), Ukrainian J. Phys. 50 (2005) 151

V. Fortov, G. Morfill, O. Petrov, M. Thoma, A. Usachev, H. Höfner, A. Zobnin, M. Kretschmer, S. Ratynskaia, M. Fink, K. Tarantik, Yu. Gerasimov, and V. Esenkov, *The project "Plasmakristall-4" (PK-4) - a new stage in investigations of dusty plasmas under microgravity conditions: first results and future plans*, 32nd EPS Plasma Physics Conference (Tarragona, Spain, June 27 – July 1, 2005), Plasma Phys. Control. Fusion 47 (2005) B537

M.H. Thoma, H. Höfner, M. Kretschmer, S. Ratynskaia, G.E. Morfill, A. Usachev, A. Zobnin, O. Petrov, and V. Fortov, *Parabolic Flight Experiments with PK-4*, ELGRA Biennial Meeting (Santorini, Greece, September 21 – 23, 2005), Microgravity Sci. Technol. 18 (2006) 47

M. H. Thoma, M. A. Fink, H. Höfner, M. Kretschmer, S. A. Khrapak, S. V. Ratynskaia, V. V. Yaroshenko, G. E. Morfill, O. F. Petrov, A. D. Usachev, A. V. Zobnin, and V. E. Fortov, *PK-4: Complex Plasmas in Space - the next Generation*, 11th Workshop on the Physics of Dusty Plasmas (Williamsburg, USA, June 28 – July 1, 2006), IEEE Trans. Plasma Sci. 35 (2007) 255

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M.H. Thoma, H. Höfner, S.A. Khrapak, M. Kretschmer, R.A. Quinn, S. Ratynskaia, G.E. Morfill, A. Usachev, A. Zobnin, O. Petrov, and V. Fortov, *Measurement of the ion drag force in a complex dc plasma using the PK-4 experiment*, Contributions to the International Conference on Dusty Plasmas in Applications, (Odessa, Ukraine, August 25-29, 2004), p.90

S. Khrapak, S. Ratynskaia, A. Zobnin, M. Thoma, M. Kretschmer, A. Usachev, V. Yaroshenko, R. Quinn, G. Morfill, O. Petrov, and V. Fortov, *Measurement of dust particle charge in a weakly ionized plasma of a dc discharge*, Contributions to the International Conference on Dusty Plasmas in Applications, (Odessa, Ukraine, August 25-29, 2004), p. 153

V.E. Fortov, O.F. Petrov, A.D. Usachev, A.V. Zobnin, Yu.V. Gerasimov, G. Morfill, M. Thoma, H. Hoefner, M. Kretschmer, S. Ratynskaia, K. Tarantik, and M. Fink, *The project "PLASMAKRISTALL - 4" (PK-4). A dusty plasma experiment in a combined dc/rf(i) discharge plasma under microgravity conditions*, Annual Moscow Workshop on the Physics of Nonideal Plasmas (NPP-2004) (Moscow, December 1-2, 2004)

V. Yaroshenko, S. Ratynskaia, S.A. Khrapak, M.H. Thoma, M. Kretschmer, H. Höfner, G.E. Morfill, A. Zobnin, A. Usachev, O. Petrov, and V. Fortov, *Experimental Determination of the Ion Drag Force in a Complex Plasma*, 4th International Conference on the Physics of Dusty Plasmas (Orleans, France, 2005), AIP Conf. Proc. 799 (2005) 243

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M. Kretschmer, H. Höfner, M. Thoma, M. Fink, S. Ratynskaia, G. Morfill, K. Tarantik, V. Fortov, O. Petrov, A. Usachev, A. Zobnin, and Yu. Gerasimov, *'PK-4' - Laser-Driven Shear*

Flow in a DC Discharge Complex Plasma, 4th International Conference on the Physics of Dusty Plasmas (Orleans, France, 2005), AIP Conf. Proc. 799 (2005) 235

M.A. Fink, M. Kretschmer, V. Fortov, H. Höfner, U. Konopka, G.E. Morfill, O. Petrov, S. Ratynskaia, A. Usachev, and A. Zobnin, *Cooperative phenomena in laminar fluids: observation of streamlines*, 4th Int. Conf. on the Physics of Dusty Plasmas (Orleans, France, 2005), AIP Conf. Proc. 799 (2005) 295

O.F. Petrov, A.D. Usachev, A.V. Zobnin, and Y.V. Gerasimov, *Laboratory predevelopment of a DC-chamber for investigating complex plasmas under microgravity conditions on board of the ISS (PK-4)*, 1st Milestone Status Report (Moscow, January 2003)

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O.F. Petrov, A.D. Usachev, A.V. Zobnin, and Y.V. Gerasimov, *Laboratory predevelopment of a DC-chamber for investigating complex plasmas under microgravity conditions on board of the ISS (PK-4)*, 5th Milestone Status Report (Moscow, June 2004)

O.F. Petrov, A.D. Usachev, A.V. Zobnin, Y.V. Gerasimov, A.V. Gavrikov, and V.E. Esenkov, *Laboratory predevelopment of a DC-chamber for investigating complex plasmas under microgravity conditions on board of the ISS (PK-4)*, 6th Milestone Status Report (Moscow, December 2004)

R.A. Quinn, M.H. Thoma, and G.E. Morfill, *Laborvorentwicklung für eine DC-Kammer zur Untersuchung komplexer Plasmen unter Schwerelosigkeitsbedingungen an Bord der ISS (PK4)*, Vorhabensbeschreibung für DLR (Garching, July 2002)

H. Höfner, M.H. Thoma, and G.E. Morfill, *Laborvorentwicklung für eine DC-Kammer zur Untersuchung komplexer Plasmen unter Schwerelosigkeitsbedingungen an Bord der ISS (PK-4)*, Schlussbericht für DLR (Garching, March 2005)

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A.V. Zobnin, O.F. Petrov, A.D. Usachev, M. Kretschmer, G. Morfill, M. Thoma, H. Höfner, *Nonlinear Waves in Dusty Plasma*, In TRANSACTIONS of Institute for High Energy Densities of AIHT of RAS. Volume 7 -2004. Eds: V.E. Fortov, A.P. Likhachev. (Moscow, RAS JIHT Publ. 2006) p.251 (*full text in Russian*) p.433 (*abstract in English*)

V.E. Fortov, G.E. Morfill, O.F. Petrov, H. Höfner, M. Thoma, A.D. Usachev, A.V. Zobnin, *International space experiment "Plasmakristall – 4"*, 5-th International Conference Aviation and Cosmonautic – 2006 (Moscow, Russia 2006) Book of abstracts p.165 (*in Russian*)

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P. Hofmann, R. Seurig, A. Stettner, J. Burfeindt, G. Morfill, H. Thomas, M. Thoma, H. Höfner, W. Fortov, W. Molotkov, O. Petrov, and A. Lipaev, *Complex plasma research on ISS: PK-3 Plus, PK-4 and impact/plasmlab*, IAC Congress (Hyderabad, India, 2007), to be published in Acta Astronautica (2008)

Talks:

R.A. Quinn, *Overview of the PK-4 Project*, Workshop "Complex Plasmas", (Ringberg, Germany, April 7-9, 2003)

R.A. Quinn, *Review of the PK-4 Project*, 10th Workshop on Physics of Dusty Plasmas (St. Thomas, US Virgin Islands, June 18-21, 2003)

S. Khrapak, *Experimental determination of dust particle charge in a dc discharge plasma (PK4)*, Workshop "Complex Plasmas", (Ringberg, Germany, March 15-17, 2004)

M.H. Thoma, *PK4 project and ion drag force measurements*, Workshop "Complex Plasmas", (Ringberg, Germany, March 15-17, 2004)

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S. Khrapak, *Measurement of dust particle charge in a weakly ionized plasma of a dc discharge*, International Conference on Dusty Plasmas in Applications, (Odessa, Ukraine, August 25-29, 2004)

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- A. Zobnin, *Particle Charging in a Cloud*, PKE-Nefedov Symposium (Garching, September 20-24, 2004), www.mpe.mpg.de/pk4/PK4-FPDM.html
- S. Ratynskaia, *Experimental Determination of Dust Particle Charge at Elevated Pressures*, PKE-Nefedov Symposium (Garching, September 20-24), 2004, www.mpe.mpg.de/pk4/PK4-FPDM.html
- M.H. Thoma, *Ion Drag Force Measurements with PK4 at MPE*, PKE-Nefedov Symposium (Garching, September 20-24), 2004, www.mpe.mpg.de/pk4/PK4-FPDM.html
- M. Fink, *Dust Fluids*, PKE-Nefedov Symposium (Garching, September 20-24, 2004), www.mpe.mpg.de/pk4/PK4-FPDM.html
- M. Kretschmer, *PK4 @ Parabolic Flight Campaigns PF35 & PF36*, PKE-Nefedov Symposium (Garching, September 20-24, 2004), www.mpe.mpg.de/pk4/PK4-FPDM.html
- H. Höfner, *PK4 Dust Manipulation Laser*, PKE-Nefedov Symposium (Garching, September 20-24, 2004), www.mpe.mpg.de/pk4/PK4-FPDM.html
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- A. Usachev, *IHED Activities in the PK-4 Project – recent and plans for future*, PK-4 Coordination Meeting (ESTEC, Noordwijk, March 18, 2005)
- S. Khrapak, *Particle Charges in a Bulk of Gas Discharges*, 4th Int. Conf. on the Physics of Dusty Plasmas (Orleans, June 13-17, 2005)
- A. Usachev, *The project "Plasmakristall-4" (PK-4) - a new stage in investigations of dusty plasmas under microgravity conditions: first results and future plans*, 32nd EPS Plasma Physics Conference (Tarragona, Spain, June 27 – July 1, 2005)
- M.H. Thoma, *Parabolic Flight Experiments with PK-4*, ELGRA Biennial Meeting (Santorini, Greece, September 21 – 23, 2005)
- A. Usachev, *New Experiments "Plasma Crystal – 4" under Microgravity Conditions*, Annual Moscow Workshop on Non-Ideal Plasma Physics (NPP-2005) (Moscow, Russia, November 30 – December 1, 2005)
- M. Kretschmer, *Observation of Lane Formation at ESA Parabolic Flight Campaign #41*, PK-4 Science Meeting (Moscow, December 2005)
- M.H. Thoma, *Das Plasmakristallexperiment PK-4*, DPG Frühjahrstagung (Augsburg, March 27 – 30, 2006)
- M.H. Thoma, *PK-4 and its Scope for the Critical Point Study*, Critical Point Meeting (Orleans, May 15 - 16, 2006)
- M.H. Thoma, *PK-4: Complex Plasmas in Space – the next Generation*, 11th Workshop on the Physics of Dusty Plasmas (Williamsburg, USA, June 28 – July 1, 2006)

M.H. Thoma, *PK-4: Complex Plasmas in Space – the next Generation*, PK-3 Plus Symposium (MPE, Garching, October 4 – 5, 2006)

M.H. Thoma, *Critical Point Experiments with PK-4 at the 45th ESA Parabolic Flight Campaign*, Critical Point Meeting (ESTEC, Noordwijk, October 30 - 31, 2006)

A.D. Usachev *EM-manipulation for Laval nozzle, solitons, mach cones, interference of self-excited and induced waves*, (Ringberg, Germany, January 24-26, 2007)

A.D. Usachev *Rods showing direction of electric field, future PFC: smaller grids, less rods*, (Ringberg, Germany, January 24-26, 2007)

A.V. Zobnin *Cluster formation by plasma flux (next PFC with cloud of small particles and single large ones)*, (Ringberg, Germany, January 24-26, 2007)

M. Kretschmer, *Self-organisation in complex plasmas: Lane formation* (Ringberg, Germany, January 2007)

M.H. Thoma, *Scientific experiments and prospects of the complex plasma project PK-4*, Fourth Capri Workshop on Dusty Plasmas (Capri, Italy, May 30 – June 2, 2007)

M. Kretschmer, *Complex plasmas – A new state of matter*, 9th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (Cairns, Australia, August 2007)

M. Kretschmer, *PK-4 – The next-generation complex plasma experiment on the ISS*, Workshop on physics of complex multi-component plasma systems (University of Sydney, August 2007)

M.H. Thoma, *Plasmakristallexperimente auf der ISS*, DLR Oberpfaffenhofen (October 2007)

M.H. Thoma, *Critical Point Investigations with PK-4*, Critical Point Meeting (Nara, Japan, October 21, 2007)

M.H. Thoma, *PK-4: Complex Plasmas in Space – the Next Generation*, 3rd Int. Symposium on Physical Sciences in Space (Nara, Japan, October 22 – 26, 2007)

M.H. Thoma, *PK-4: Complex Plasmas in Space – the Next Generation*, 2nd PK-3 Plus Symposium (Garching, Germany, December 17 - 18, 2007)

M.H. Thoma, *Complex Plasmas under Microgravity*, Crystallization and Jamming in Soft Matter under Driving - Colloidal Suspensions, Granular Media, Foams, and Complex Plasmas (Leiden, Netherlands, February 11 – 22, 2008)

Poster:

R.A. Quinn, M. Kretschmer, S. Khrapak, S. Ratynskaia, M. H. Thoma, G. E. Morfill, A. Zobnin, A. Usachev, O. Petrov, and V. Fortov, *The PK-4 experimental apparatus*, 10th Workshop on Physics of Dusty Plasmas (St. Thomas, US Virgin Islands, June 18-21, 2003)

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M. Kretschmer, S. Ratynskaia, B. Klumov, G.E. Morfill, R.A. Quinn, K. Tarantik, M.H. Thoma, A. Usachev, A. Zobnin, *Shear flow and other observations in a complex plasma with 'PK-4'*, 10th Workshop on the Physics of Dusty Plasmas (St. Thomas, US Virgin Islands, June 18-21, 2003)

M. Kretschmer, S. Ratynskaia, M. Rubin-Zuzic, G. Morfill, R.A. Quinn, K. Tarantik, M.H. Thoma, A. Usachev, A. Zobnin, *PK-4 - a complex plasma experiment for the new millennium*, Complex Plasmas in the New Millennium (ITCPP 2003), (Santorini Island, Greece, September 8-12, 2003)

S. Ratynskaia, S. Khrapak, M. Kretschmer, R. A. Quinn, M. H. Thoma, G. E. Morfill, A. Zobnin, A. Usachev, O. Petrov, and V. Fortov, *Particle charge determination from dust mode in collisionally dominated complex plasmas with particle drift*, APS 45th meeting of the division of plasma physics (Albuquerque, New Mexico, US, October 27-31, 2003)

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V. Yaroshenko, S. Ratynskaia, S. Khrapak, M.H. Thoma, H. Höfner, M. Kretschmer, G.E. Morfill, A. Usachev, A. Zobnin, O. Petrov, and V. Fortov, *Experimental determination of the ion drag force in a complex plasma*, 4th Int. Conf. on the Physics of Dusty Plasmas (Orleans, June 13-17, 2005)

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