Abstract

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Guiding of highly charged ions through capillaries in insulating materials: milestones in experiments and simulations

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Abstract

After the first observation [1] that keV ions are guided through insulating nano¬capillaries, the topic has received consid¬erable attention during the past decade. These capillaries are nanotubes with a diameter of about 100 nm and a length of about 10 µm. The essential property of the capillary guiding is a self-organizing process, which governs the charge deposition inside the capillaries [1,2]. With increasing deposition of the ions, the charge patch increases until the electrostatic field is large enough to deflect the ions. At equilibrium, the ions are guided maintaining their incident charge state. Milestones of the field concerning experiments and simulations are presented in accordance with a recent review over the field of capillary guiding [3]. Experiments are described giving emphasis to the guiding of highly charged ions in the keV energy range. Recent experiments with a single straight macrocapillary are treated allowing for the control of conductivity by changing the temperature of the material [4]. Single tapered capillaries are discussed involving an enhance¬ment of the beam density and the production of a microbeam for biological applications. These studies have motivated several groups devoting efforts to the production of a beam with diameter of the submicron scale.

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Biography

Nikolaus Stolterfoht started his career in the 70's at the Hahn-Meitner Institute in Berlin, which is one of the National Laboratories of Germany. He was head of a research group working in the field of atomic collisions with gaseous atoms and solids. Simultaneously, he habilitated at the Free University in Berlin to become a Lecturer educating PhD students. In the late 80's he became a full professor at the University of Caen in France. There he started to study interaction of highly charged ions with surfaces. In the 90's he returned to the Helmholtz-Zentrum Berlin starting unprecedented studies of ion transmission through nanopores (capillaries). In the early 2000 the phenomenon of ion guiding was discovered which has received considerable attention at numerous laboratoriesworldwide.

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