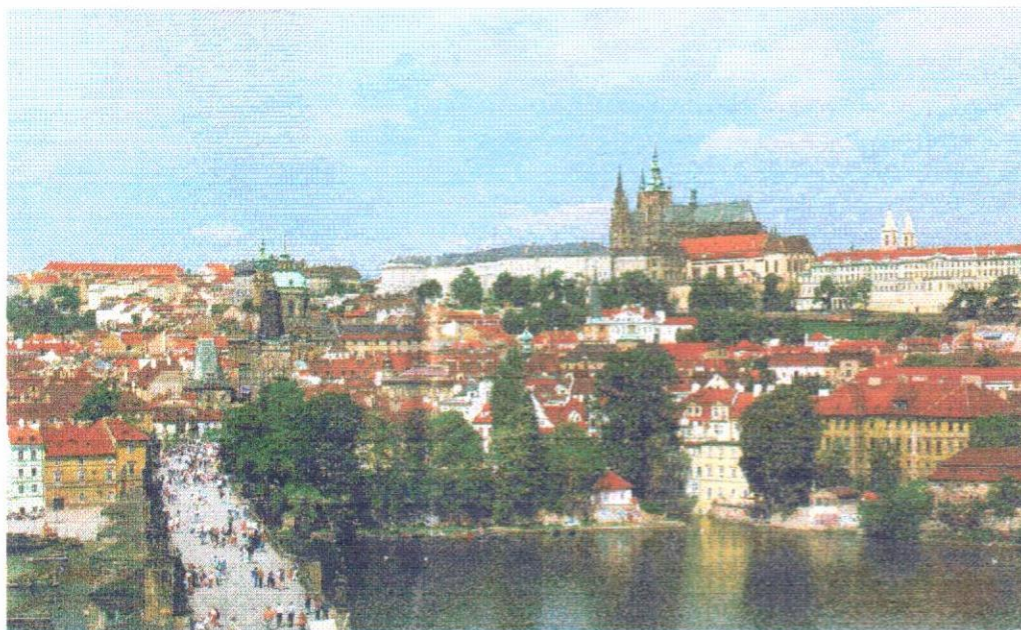


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Dynamics of Potentials of a Plasma Jet Heated by Neutral Beams

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In experiments on plasma heating by neutral beams at a mirror system, an interesting and unexpected phenomenon was observed: the trapping of high-energy hydrogen atoms by the jet-plasma target accompanied by the production of a hot-ion population results in a substantial decrease in the plasma density [1]. In this paper experimental results are given. Time-dependent problem of plasma flow is considered by the two-fluid magnetohydrodynamic approach with allowance for the population of hot ions in a mirror system, a numerical modeling is carried out, an adequacy between the model and the phenomenon is shown, and an explanation of the phenomenon is given. The dynamics of the potentials of an electric field, thermal force, ion pressure, and viscous force are considered in detail [2].

Observations and calculations concerning this phenomenon can be concluded in the following way. 1). Injected hot ions heat effectively plasma jet ions not directly but through electrons. 2). Heating leads to the increase of flow velocity of a plasma jet and accordingly the decrease of plasma density. Work produced by ion-pressure forces exerts primary influence on decrease of the plasma density. 3). In order to confine the heated electrons in a mirror system, the ambipolar potential increases. An increase in the gradient of this potential causes an increase in the acceleration rate of ions that escape from a mirror cell. The ion escape occurs mainly under the action of the electric field. At the initial moment of hot ion accumulation the increase of the ambipolar potential leads to the brake of input ions, a reduction of plasma flow, and a decrease in plasma density. 4). To study the processes under consideration, it is important to take into account the longitudinal thermal force.

- [1] A.A.Kabantsev, V.G.Sokolov and S.Yu.Taskaev. Decrease in the target-plasma density during neutral-beam injection into a tandem mirror. *Plasma Phys. Reports* **21** (1995) 735.
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