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Charged Particle Flows in the Beam Extraction Region of a Negative Hydrogen Ion Source for NBI

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In order to investigate the extraction mechanism of the H^- ions in a negative hydrogen ion source for NBI, experiments by a directional Langmuir probe combined with photodetachment are carried out in the beam extraction region of the ion source. Using Langmuir-probe and photodetachement modes, flows of electron, positive and negative ions are separated. The angle electron flow becomes orienting to normal to surface plane of the plasma grid with approaching the grid. The positive ions have the same flow direction as electrons. The direction is insensitive to the structure of magnetic field, and the result suggests diffusion and drift motions could be dominant to the flows. On the other hand, H^- ion flow direction normal the plasma grid is opposite to those of electrons and positive ions. By comparing the recovery times of the photodetachment currents at four symmetric probe tips, H^- ion temperature is estimated to be 0.10 eV ~ 0.15 eV.