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Negative Ion Systems Using Charge-Exchange in Sodium: Results and Comparison With Cesium Systems

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Abstract

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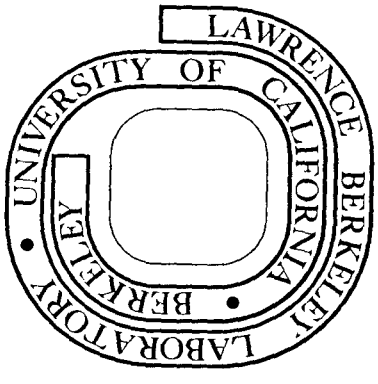

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Negative Ion Systems Using Charge-Exchange in Sodium: Results and Comparison with Cesium Systems.* E. B. HOOPER, JR.** and P. POULSEN** Lawrence Berkeley Laboratory Berkeley, Ca. 94720 -- Results of a new experiment producing intense beams of D^- by charge-exchange in sodium are presented. These and previous results in sodium[1] and cesium[2] are used to compare designs of high current, high voltage beam systems based upon charge-exchange. In the present experiment, a large aperture D^+ beam (7 cm by 35 cm) is passed through a sodium jet. The initial beam is generated by a standard LBL neutral beam source, operated in the range 5 kV to 20 kV, and has small angular divergences (0.7° x 2.5° at 10 keV). The sodium jet is formed by a nozzle designed to minimize the flow of sodium away from the charge-exchange region[3]. The results include total current and current density, conversion efficiency taking into account the break-up of molecular ions, angular divergence of the final D^- beam, measurements of electrons in the D^- beam, and measurements of plasma effects in the charge-exchange cell. Previous experiments have provided similar results for beams using charge-exchange in cesium. Systems to produce 10 A of D^- are designed using each charge-exchange medium. A comparison of the system is presented which includes power and gas efficiencies, current density, etc.

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[1] N. N. Semashko, V. V. Kusnetsov, and A. I. Krylov, Proc. Symp. Prod. and Neut. of Negative Hydrogen Ions and Beams, 1977, BNL Report 50727, p. 163.

[2] E. B. Hooper, Jr., O. A. Anderson, T. J. Orzechowski, and P. Poulsen, IBID, p. 170.

[3] P. Poulsen, G. H. Ratekin, and T. J. Duffy, Bull. Am. Phys. Soc. 23, 846 (1978).

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5. Neutral Beams

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