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

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Publication Date

1979

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To be presented at the 1979 IEEE International
Conference on Plasma Science, Montreal,
Canada, June 4-6, 1979

UC-20
LBL-8697
Abstract

NEGATIVE ION SYSTEMS USING
CHARGE-EXCHANGE IN SODIUM:
RESULTS AND COMPARISON WITH CESIUM SYSTEMS

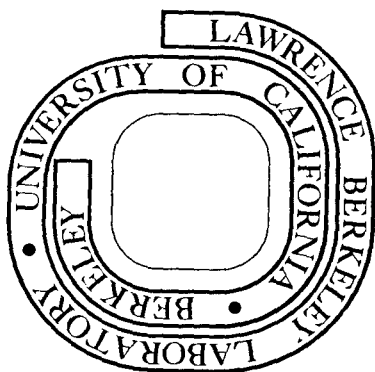
E. B. Hooper Jr. and P. Poulsen

January 1979

Prepared for the U. S. Department of Energy
under Contract W-7405-ENG-48

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Abstract submitted for the
1979 IEEE INTERNATIONAL CONFERENCE ON PLASMA SCIENCE
June 4-6, 1979

LBL-8697

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 sodium¹ and cesium² 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 ($0.7^\circ \times 2.5^\circ$ at 10 keV). The sodium jet is formed by a nozzle designed to minimize the flow of sodium away from the charge-exchange region³. 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.

*This work was supported by the Magnetic Fusion Energy Division of the U. S. Department of Energy under contract No. W-7405-ENG-48.

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¹N. 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.

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

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

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This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

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