RAPPORTEUR's REPORT ON ATOMIC SOURCE WORKING GROUP SESSIONS III AND IV

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Discussions were concentrated on methods of ionizing thermal polarized neutral beams. Five methods were listed:

1. $\vec{H}^0+H^+ \rightarrow \vec{H}^++H^0$

There has been no progress since the Bonn attempt, and this method is considered to be dead.

2. $\vec{H}^0+Cs^0 \rightarrow \vec{H}^-+Cs^+$

With present sources (Wisconsin and BNL) production beams of 10-20 μA are believed to be within reasonably easy reach, as described in the general sessions by W. Gruebler and T. Sluyters.

H.F. Glavish pointed out that other types of Cs^+ sources (Freeman source), especially with magnetic focusing, may produce more intense useful beams than the present porous tungsten button ionizers.

3. $\vec{H}^0+e \rightarrow \vec{H}^++2e$ (internal e- beam)

Discussion of present electron-bombardment ionizers was deferred until after the ECR discussion.

4. $\vec{H}^0+e \rightarrow \vec{H}^++2e$ (external e^- beam)

K. Prelec suggested that a hollow cathode discharge (HCD) ion source might be used to provide an electron beam of density 10 A/cm^2, compared to the 2 A/cm^2 estimated for present "internal e^- beam" ionizers. The electron energy could also be more easily chosen to maximize the ionization cross section.

5. $\vec{H}^0+D^- \rightarrow \vec{H}^-+D^0$

J. Alessi proposed use of a ring magnetron, around the $\vec{H}^0$ beam (see Fig. 1) to produce D^- ions to ionize the $\vec{H}^0$ beam. Such an arrangement produces not only large amounts of low-energy D^- (perhaps 0.5 A, 200 eV) but also D^+ ions. These D^+ ions might neutralize the space charge of the D^- ions, which has plagued previous attempts to use this reaction for sources. Using present atomic beam densities, 1.4 mA of $\vec{H}^-$ might be produced. Estimates of loss processes ($H+D^+ \rightarrow \vec{H}^0+D^0$, etc.) indicate a reduction of output beam by 1/3. A further reduction of probably a factor of 10 might be caused by scattering from background D atoms. A beam of 100 μA may still be possible, and this approach certainly deserves more work.

0094-243X/1170053-02 $3.00

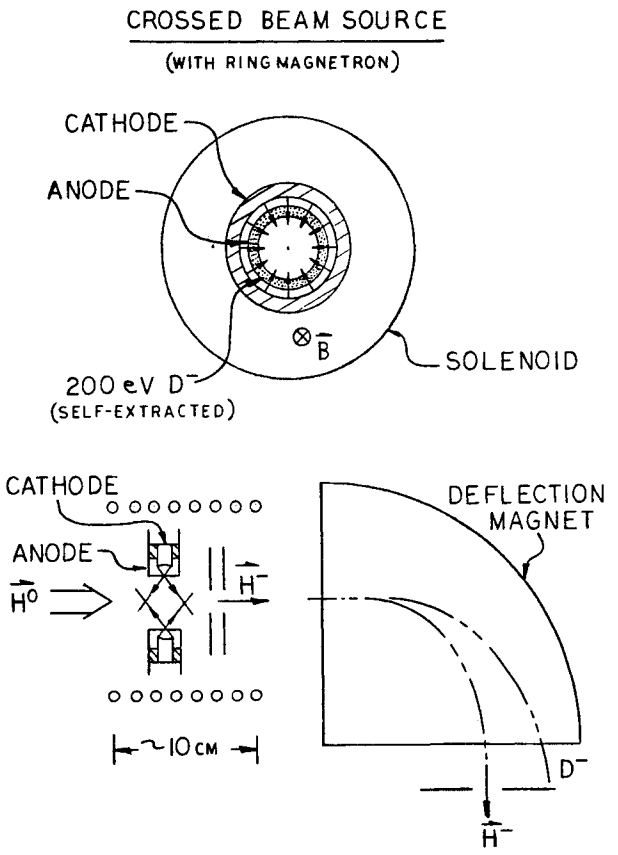
CROSSED BEAM SOURCE
(WITH RING MAGNETRON)
CATHODE
ANODE
⊗B
SOLENOID
200 eV D⁻
(SELF-EXTRACTED)
CATHODE
ANODE
H⁰
H⁻
~10 cm
DEFLECTION
MAGNET
D⁻
H⁻

Fig. 1.