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H^- and D^- Production Efficiency in a Multi-Dipole ECR-Plasma Source

The ECR negative ion source “Prometheus I” is operated either with high purity H_2 ($> 99.999\%$) or D_2 ($> 99.8\%$) in order to probe H^- and D^- ions, respectively, and examine the effect of the isotope upon their production. These ions are predominantly formed in the plasma bulk by dissociative attachment of low-energy (cold) electrons to highly ro-vibrationally excited molecules which in turn result mainly from the EV process sustained by high-energy (hot) electrons confined in the ECR zones. Langmuir probe and laser photodetachment measurements, realized in the pressure range 1 to 20 mTorr and for deposited power up to 900 W, reveal briefly: (i) higher and only slightly increased cold electron density and temperature in deuterium; (ii) no pronounced difference in the hot electron density and temperature; and (iii) overall a similar negative ion yield (up to $6 \times 10^{15} m^{-3}$). Finally, the n_{H^-} / n_e ratio is constantly higher than the n_{D^-} / n_e one.

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