DPP12-2012-000895

Abstract for an Invited Paper
for the DPP12 Meeting of
the American Physical Society

Lyman-alpha radiation of a probing metastable hydrogen beam to measure electric fields in diluted fluids and plasmas

FABRICE DOVEIL, CNRS

The interaction between a metastable H(2s) atomic hydrogen beam and an external electric field leads to the emission of the Lyman-α line. It originates in the Stark mixing of the near-degenerate $2s_{1/2}$ and $2p_{1/2}$ levels separated by the Lamb shift [1]. The quenched radiation proportional to the square of the electric field amplitude is recovered in vacuum by using such an atomic probe beam. For larger electric field, saturation is observed and related to the beam finite transit time. We also observe the strong enhancement of the signal when the field is oscillating at the Lamb shift frequency. This technique is applied in a plasma, offering an alternative way to measure weak electric fields by direct and non-intrusive means [2].

This work was inspired by late Prof. R.A. Stern to whom it is dedicated. It was done in collaboration with L. Chérigier-Kovacic. It was the subject of A. Lejeune's PhD thesis and was supported by a grant from Ministère de la Recherche. The author acknowledges the help of G. Bachet and G. Prasad for the conception and construction of the experimental set-up.

[1] W.E. Lamb, Jr., Rep. Prog. Phys. 14, 19 (1951)
[2] A. Lejeune, L. Chérigier-Kovacic, F. Doveil, Appl. Phys. Lett. 99, 181502 (2011)