25e Congrès Général de la Société Française de Physique

ID de Contribution: **85** Type: **Poster**

Spectroscopic study of collisions in the 2^3P state of ^3He and ^4He in low pressure gas discharges

Spin-polarized ^3He gas has extensive applications*. Metastability exchange optical pumping (MEOP) can indirectly orient the nuclear spin with high efficiency in low pressure gas. A weak discharge excites a small fraction of the atoms to the 2^3S metastable state. OP operates on the 2^3S-2^3P transition and ME collisions transfer polarization to the ground state (gs). In practice MEOP performance is limited by OP-induced polarization loss, as systematically evidenced at high pump light power. Collision-induced population transfer between 2^3P sublevels and excitation transfer to the gs are suspected to contribute to the loss.

In this work, we use tunable single mode diode lasers (DL) for sensitized absorption measurements and polarization spectroscopy in ^4He, ^3He, or gas mixture cells in the mbar range. A 1083 nm DBR DL selectively pumps atoms from the 2^3S level and a 707 nm ECDL probes populations in the 2^3P sublevels (see Fig.). Probe absorption signals yield rate constants for velocity-, J-, and F-changing collisions, as well as for excitation transfer between 2^3P and gs atoms. Results will be reported and discussed with respect to MEOP efficiency.

*T.R. Gentile et al, Rev. Mod. Phys. 89 (2017) 045004.

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Choix de session parallèle

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Classification de Session: Séance Poster