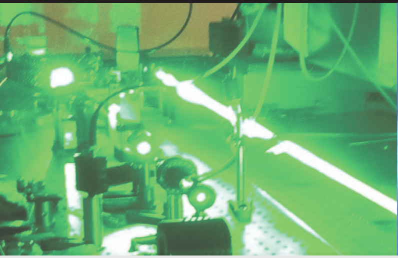
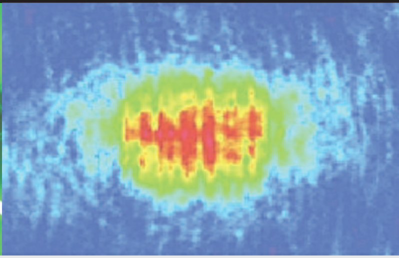
Joint UoC/FORTH AMO Seminar





Spin-polarized nuclear fusion: possible via optical excitation of molecules ?

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It is known theoretically and from scattering experiments that nuclear spin polarization increases the cross sections of the D-T and D-^{3}He reactions by ~50%, while also spatially aligning the recoil directions of the reactions products, which can be used to improve the efficiency of reactors. However, the lack of a sufficiently intense source of spin-polarized deuterium (SPD) has not yet allowed the observation of spin-polarized fusion in a plasma, which has left three important questions unanswered:

(1) Does nuclear spin-polarization survive long enough in the plasma to benefit fusion?
(2) What is the effect of spin-polarization on the D-D reaction (which occurs as a side reaction in both D-T and D-^{3}He), as numerous theoretical predictions range from prediction of enhancement to suppression?
(3) Can a source of SPD be found with a production rate of ~10^{22} SPD/s, necessary for a nuclear reactor, such as ITER (as traditional methods, e.g. Stern-Gerlach spin separation or spin-exchange optical pumping, have production rates about 4-5 order s lower)?

We review the field of spin-polarized nuclear fusion, and describe our proposals, based on optical excitation molecules, to answer these three questions.

December 18 2017, 17:00, Physics Department 3rd Floor Seminar Room