Institute of Atomic Physics, Institute of Physics and Nuclear Engineering, Theoretical Physics

SEMINAR

Extensive Light Investigations, Seminars Series, III

Spontaneous Emission of Nuclear Particles in Ultra-Intense Lasers

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Nuclear decay processes in strong laser fields are investigated by solving the time-dependent Schrödinger equation in a manner analogous to the case of atom ionization subjected to a periodic electromagnetic field.

We first discuss the various representations of the Schrödinger equation describing two charged nuclei perturbed by a time-varying external field in the dipole approximation : length gauge, velocity gauge and Kramers-Henneberger representation. The numerical integration is carried out by resorting to a modified Crank-Nicolson scheme where, in contrast to the field-free case, an additional first-order time derivative appears.

We mainly refer to the modification of alpha-decay rates in a linearly polarized laser pulse and in the approximation that the direction of the electric field is taken along the α-daughter radius. In this case we are left to solve the one-dimensional time-dependent Schrödinger equation in the length gauge. Relevant quantities for this tunneling process are then readliy calculated : tunneling probability (analogous to the probability ionization in the corresponding atomic case), decay rate, total flux. An extension of the above method to the multi-dimensional case is considered for the proton decay from spherical and deformed nuclei. Preliminary results (in collaboration with M. Rizea) point out to a reduction of the effect induced by the laser on the tunneling in the two-dimensional case.

Thursday, February 8th, 2018, 12am,
Seminar Room, Department of Theoretical Physics