Contribution ID: **33** Type: **Invited Lecturer**

Erasing of lasing effect from singly ionized Nitrogen molecules

Friday, 12 November 2021 16:10 (25 minutes)

Filamentation of femtosecond laser pulses leads to a variety of spectacular nonlinear phenomena like broadband THz generation, pulse self-compression, guiding of electric discharges and lasing effects. In particular, a coherent emission at 391.4 nm is observed from plasma filaments corresponding to a transition between levels B and X of the singly ionized Nitrogen molecule. To explain the optical gain at 391.4 nm we have developed a model of laser without population inversion in a V-arrangement. This quantum effect may appear when two electronic levels in atoms or molecules are simultaneously coupled by two coherent light fields to the third common level, so the corresponding amplitudes of transition probabilities can interfere. In the case of singly ionized Nitrogen molecule this coupling can take place between B, X and intermediate state A. It was experimentally confirmed that long-lived coherent polarizations A-X and B-X are established, as required by the V-scheme. We show that the temporal shape of the lasing emission and its dependence with gas pressure can be well restituted theoretically. To confirm further this model experimentally, we present the measurements using consecutive twin femtosecond 800 nm pump pulses. A reduction of the global lasing signal at 391.4. nm by a factor ~ 1000 is observed when the gas is pumped with the delayed twin pulses. This erasing effect is observed over the delay range of several ps and can be interpreted and reproduced theoretically in the frame of the V-scheme of laser without inversion.

Topics

Session B. Laser physics and modern optoelectronics

Primary authors: Dr DANYLO, Rostyslav (Laboratoire d'Optique Appliquée); Dr LAMBERT, Guillaume (Laboratoire d'Optique Appliquée); Prof. TIKHONCHUK, Vladimir (Université de Bordeaux); Prof. LIU, Yi (University of Shanghai for Science and Technology); Dr HOUARD, Aurélien (Laboratoire d'Optique Appliquée); Prof. MYSYROWICZ, André (Laboratoire d'Optique Appliquée)

Presenter: Dr DANYLO, Rostyslav (Laboratoire d'Optique Appliquée)

Session Classification: Evening Session