

## **On some effects in the ultraslow light phenomenon in Bose-Einstein condensates of alkali-metal atoms**

Yu. Slyusarenko and A. Sotnikov

*Akhiezer Institute for Theoretical Physics, NSC KIPT, 1 Akademichna Street, 61108 Kharkiv, Ukraine, E-mail: a\_sotnikov@kipt.kharkov.ua*

We propose a microscopic approach for a description of processes of interaction of the ideal gas of alkali-metal atoms with a weak electromagnetic radiation. The description is constructed in the framework of the Green-function formalism that is based on a new formulation of the second quantization method in case of the presence of bound states of particles (atoms). For a gas with the Bose-Einstein condensate (BEC) the dependencies of the propagation velocity and damping rate on the microscopic characteristics of the system are studied [1].

On the basis of the proposed approach the influence of the external homogeneous and static magnetic field on the slowing of electromagnetic waves in the condensate is studied. It is shown that the velocity of the pulses can be effectively controlled by the bias field [2].

The approach is generalized on the case on nonzero temperatures. We analyze the influence of the temperature effects on the slowing and absorption parameters of a BEC. It is shown that in the present experimental conditions the group velocity of pulses practically do not depend on the temperature in the region from the absolute zero to the critical temperature. We find the cases when the temperature effects in a BEC can play a significant role.

1. Y. Slyusarenko and A. Sotnikov, Phys. Rev. A 78, 053622 (2008).
2. Y. Slyusarenko and A. Sotnikov, Phys. Lett. A 373, 1392 (2009).