

# Influence of photon-neutrino processes on the magnetar cooling

M. V. Chistyakov\*, D. A. Rumyantsev<sup>†</sup>

Yaroslavl State (P.G. Demidov) University

The photon-neutrino processes  $\gamma e^\pm \rightarrow e^\pm \nu \bar{\nu}$ ,  $\gamma \rightarrow \nu \bar{\nu}$  and  $\gamma\gamma \rightarrow \nu \bar{\nu}$  are investigated in the presence of a strongly magnetized dense electron-positron plasma. The amplitudes of the reactions  $\gamma e^\pm \rightarrow e^\pm \nu \bar{\nu}$  and  $\gamma\gamma \rightarrow \nu \bar{\nu}$  are obtained for the first time. In the case of a cold degenerate plasma, contributions of these processes to the neutrino emissivity are calculated. It is shown, that the contribution of the process  $\gamma\gamma \rightarrow \nu \bar{\nu}$  to the neutrino emissivity is suppressed in comparison with the contributions of the processes  $\gamma e^\pm \rightarrow e^\pm \nu \bar{\nu}$  and  $\gamma \rightarrow \nu \bar{\nu}$ . The constraint on the magnetic field strength in the magnetar outer crust is obtained.

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\*E-mail: mch@uniyar.ac.ru

<sup>†</sup>E-mail: rda@uniyar.ac.ru