Relaxation of kiloampere REB in plasma - 50 years of research [[1]](#footnote-1)\*)

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For the first time, an experiment on the relaxation of a relativistic (~ 1 MeV) electron beam (REB) with a kiloampere current in a magnetized plasma column was carried out at the INP SB AS USSR at the suggestion of D.D. Ryutov by a group led by R.Kh. Kurtmulaev [1]. Further, the first detailed experimental studies of the plasma heating process during REB relaxation with a current of 10 kA and a pulse duration of 100 ns were carried out at this institute using a specially designed INAR facility [2]. The results of these experiments were explained in [3], where a theoretical basis was also laid for the development of studies of processes in a beam-plasma system. A significant contribution to the development of these studies was made by the results of subsequent experiments at the INAR setup [4]. In the same time, groups from the USA [5] and Czechoslovakia [6] joined the research in this direction. However, the highest result in terms of the heated plasma parameters during REB relaxation was achieved in the Russian Federation at the GOL-3 facility at a beam current of 20 kA and a pulse duration of about 10 μs [7].

Along with collisionless plasma heating, an important effect of intense beam-plasma interaction is the generation of radiation at plasma frequencies. The mechanisms of radiation generation during the relaxation of a beam of nonrelativistic electrons in a plasma were first proposed to explain radio emission fluxes from the solar corona [8–10]. Consideration of the corresponding problems under conditions of high-current REB injection into a plasma was carried out in [11–12]. Experiments in this direction were started at GOL-3 [13] using the REB, which was used in [7] for plasma heating. Further, as a result of studies of the radiation generation process carried out at the GOL-PET facility, a power level of 10 MW was achieved at a microsecond duration at the frequency of upper hybrid oscillations (0.2–0.3 THz) in a directed flux extracted into free space [14].

The above stages of research into plasma heating and generation of radiation in it during the relaxation of kiloampere REBs will be described in detail and analyzed in the proposed review paper.

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