levitation of superconducting MYXINE in field of two fixed coils with constant current [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2020.47.1.044

1Kozintseva M., 1Bishaev A., 1Bush A., 2Gavrikov M., 1Desyatskov A., 1Kamentsev K., 2,3Savelyev V.

1MIREA – Russian Technological University, Moscow, Russia, kozintseva@mirea.ru
2Keldysh Institute of Applied Mathematics RAS, Moscow, Russia, ssvvvv@rambler.ru
3National Research Nuclear University MEPhI, Moscow, Russia, ssvvvv@rambler.ru

The papers [1,2] are devoted to the theoretical and experimental investigations which the authors have carried out on the development of the magnetic systems of Galathea plasma traps on the basis of levitating superconducting magnetic coils. Theoretical consideration consists in the derivation of an analytical dependence of the potential energy of the proposed configurations on the corresponding variables and search, using the Mathcad software, for local minima of this dependence corresponding to stable equilibrium states. Experimental realization of the stable equilibrium configurations is carried out according to calculations, performed with the use of specific physical parameters of superconducting (single- or multiturn HTSC) rings [3] manufactured for experiments on levitation (the values of magnetic fluxes trapped by the rings, the dimensions of the nonsuperconducting and superconducting coils-rings, levitating ring masses, etc.).

As preliminary experiments [2] have shown, in order to successfully realize obtained from the calculations stable levitating states of short-circuited coils-rings from HTSC tape, it is necessary to carry out more in-depth study of their properties. One can carry out the investigation of the features of short-circuited HTSC coils levitation varying the configuration of the supporting magnetic field (or varying the configuration of HTSC coils and configuration of the field trapped by them).

For this purpose the problem on the equilibrium of the superconducting coil-ring (playing the role of myxine, if Galathea-trap is concerned) in the field of two fixed coils-rings with the constant current. These latter are placed above and below from the levitating superconducting coil. Assuming that the flux trapped by the superconducting coil-ring is conserved, the gravity field is uniform and coils-rings are thin, following [1], the potential energy of a system U(x,θ) has been obtained as an analytical function of the coordinate x of the free ring along the system axis and angular deviation θ of its axis from the common axis of the system. The obtained earlier formulas for the mutual inductances Lik(x, θ) [2] have been written in view of new arrangement of the rings-coils. Calculations using Mathcad software have demonstrated that, under certain values of the parameters, the equilibrium states of this system exist. Obtained with the help of calculations levitating states of short-circuited HTSC coils-rings have been experimentally investigated.

The work has been carried out in the frames of state task of the Ministry of Education and Science of RF onto the carrying out of scientific researches, the project №3.5160.2017/BP.

References

1. Bishaev A.M., Bush A.A., Kozintseva M.V. et al. Tech. Phys. 2014y., v. 59, №6, p.p. 940-943.
2. Kozintseva M.V., Bishaev A.M., Bush A.A.et al. Plasma Phys. Rep. 2019y., v.45, №1, p.p. 21-27.
3. Kozintseva M.V., Bishaev A.M., Bush A.A., et al. Tech. Phys. 2017y., v. 62, №6, p.p. 890-894.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/BA-Kozintseva.docx) [↑](#footnote-ref-1)