levitation of superconducting coils of galatea TRAPS in the field of the fixed central superconducting ring

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Under the development of magnetic systems of traps-Galateas [1] it has been shown the coil with the current of the opposite sign (so named “repulser”) located in the central cross-section of myxini (the trap coils immersed in plasma [2]) allows not only to attenuate myxini electromagnetic interaction, but also to optimize the configuration of the trap magnetic field. Therefore, coming to the system of three coaxial superconducting coils, in order to create necessary for the trap-Galateya magnetic field configuration it is appropriate to consider and to test for the stability next configuration: two superconducting coils-myxini levitate in the field of the fixed central superconducting coil (with the current direction opposite to the myxini current). The stability of the levitating rings of this system relative to the vertical shifts has been considered in [3], and the analytical dependence of the potential energy of such configuration from the coordinates of free rings along the system axis has been obtained in the homogeneous gravity field in thin rings approximation. In the given work for the search of myxini levitating states stable both to their vertical shifts and to the deflections of their axes from the common axis of the system, under the same assumptions, the analytical dependence of the potential energy *U*(*x*1,*x*3,*θ*1,*θ*3,*ϕ*) of the system of three coaxial superconducting rings having trapped the given magnetic fluxes from the coordinates of free rings *xi* along the system axis and deflection angles of their axis *θi* from the system common axis has been obtained. Besides it has been necessary to introduce into consideration one more variable – this is the angle *ϕ* between the projections of the normals  and  to the planes of levitating rings №1 and №2 onto the horizontal plane. Under all considerations it has been assumed superconductors conserve the trapped magnetic flux. The calculations in Mathcad system have shown that under the definite values of physical parameters (trapped magnetic fluxes, ring dimensions and masses) this dependence has local minimums which corresponds to the stable in *x* and *θ* equilibrium states of levitating rings, i.e. the existence of the solution for this system has been proved. Using defined from the calculations the current values in the coils-rings in the equilibrium state the simulation and analysis of the magnetic fields created by the levitating system has been carried out using the program FEMME in order to choose from the given set of equilibrium states those of them which provide the necessary for the trap-Galateya magnetic field configuration.

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References

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