Instanton effects in spin quantum Hall effect

M. V. Parfenov[1,*]**, I. S. Burmistrov**[1]

[1]*L. D. Landau Institute for Theoretical Physics, Semenova 1-a, 142432, Chernogolovka, Russia*
*email: *maksimqwery@gmail.com*

Recently, studing of criticality in quantum systems has attracted a great interest. There are some theoretical evidences of SQHE in two dimensional superconducting system with $d_{x^2-y^2} + id_{xy}$ pairing [1]. In this study we develop the theory of the spin quantum Hall transition, using the generalization of Pruisken replica NLσM with θ-term [2] on superconducting class C [3,4]. Using NLσM action, we show presence of the non-trivial topological configurations of Q-matrix field, called instantons. To find the analytical form of such configurations with topological charge equals to one, we construct solutions of self-duality (anti-self-duality) equations, using the symmetries of target coset space $G/K = \text{Sp}(2N)/\text{U}(N)$. In Gaussian approximation we find action for small fluctuactions around the instanton. We find whole instanton manifold and identify eight instanton eigenparameters as zero modes of kinetic operators for fluctuations. Our aim is to compute instanton contribution to the partition function, density of states, longitudinal and transverse spin conductivities.

Bibliography

[1] Senthil, T., and M. P. A. Fisher, Phys. Rev. B 60 (1999)

[2] A. M. M. Pruisken, Nucl. Phys. B 285, 719 (1987).

[3] Ferdinand Evers and Alexander D. Mirlin "Anderson transitions". Rev. Mod. Phys. 80 (2008)

[4] Babkin, S. S., and I. S. Burmistrov, Physical Review B 106.12 (2022).