Fluctuoscopy of Superconductors and Dynamics of Abrikosov's Lattice Formation Close to $H_{c2}(0)$

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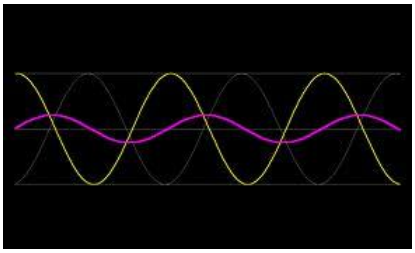
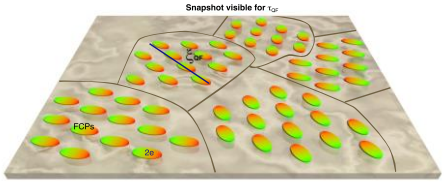
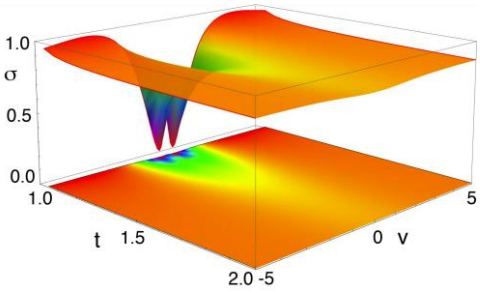
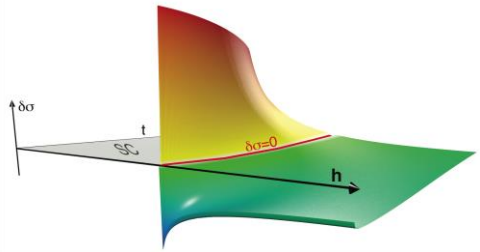
ABSTRACT

I start my lecture from the short historical review of the study of fluctuation phenomena in superconductors, mentioning of the main experimental facts, the Ginzburg-Landau method of fluctuations description, and the microscopic approach. Nevertheless, the further presentation will be based on a simple qualitative discussion (based on the Heisenberg principle) of the nature of thermal fluctuations in superconductor at temperatures above the critical one. Then the analogous consideration will be applied to the regime of quantum fluctuations at zero temperature above the field $H_{c2}(0)$. Basing both on microscopic and qualitative analysis I will demonstrate, that here, fluctuating Cooper pairs rotating in magnetic field present themselves precursor images of Abrikosov's vortices and form the clusters with specific superconducting features. I evaluate both the characteristic size $\xi_{QF}(H)$ and lifetime $\tau_{QF}(H)$ of such formations. When magnetic field reaches $H_{c2}(0)$ from above the size and lifetime of such clusters tend infinity and the order, corresponding Abrikosov's lattice is established. In second part of the lecture I will discuss ***fluctuoscopy*** - the method of investigation of intrinsic properties of superconductors by means of the detailed analysis of their fluctuation magneto-conductivity, tunneling characteristics, Nernst coefficient throughout the phase diagram.









References

1. Anatoly Larkin, Andrey Varlamov. "Theory of Fluctuations in Superconductors", Oxford University Press, 2009.