# Hall effect at the Superconductor-Insulator transition

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I would like to discuss recent Hall effect studies close to the Superconductor-Insulator transition in thin films [1,2]. The results found in this works are very similar to the old data on High Temperature Superconductors, [3,4]. In both cases one observes vanishing of the Hall resistivity and the Hall angle in superconducting state.In particular it was predicted in Ref. [5] and experimentally confirmed [3,4] that vortex pinning doesn't effect the Hall conductivity. Since longitudinal conductivity vanishes due to pinning the Hall resistivity goes to zero as a square of the longitudinal one, $\rho_{xy}=\sigma_{xy}\rho_{xx}^2$ . This result is dual to that for the Hall effect in normal metals. There Hall resistivity $\rho_{xy}=B/nec$ doesn't depend on scattering time. Simple picture of it is that transfer of momentum in scattering is along the average electron velocity and thus scattering doesn't contribute to transverse current and to the Hall resistivity. Vortices are dual to electrons. They move under the action of current and their motion produces voltage. Average pinning force (analog of scattering of electrons) is opposite to the vortex velocity and has no transverse to it component. As a result it is Hall conductivity that is not renormalised by pinning. In this sense superconducting phase is dual to the Hall insulator. I argue that the spatial inhomogeneities have no effect on Hall conductivity in superconducting state.

**References**

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