Kosterlitz-Thouless type transtion in Topologically Massive QED$_3$
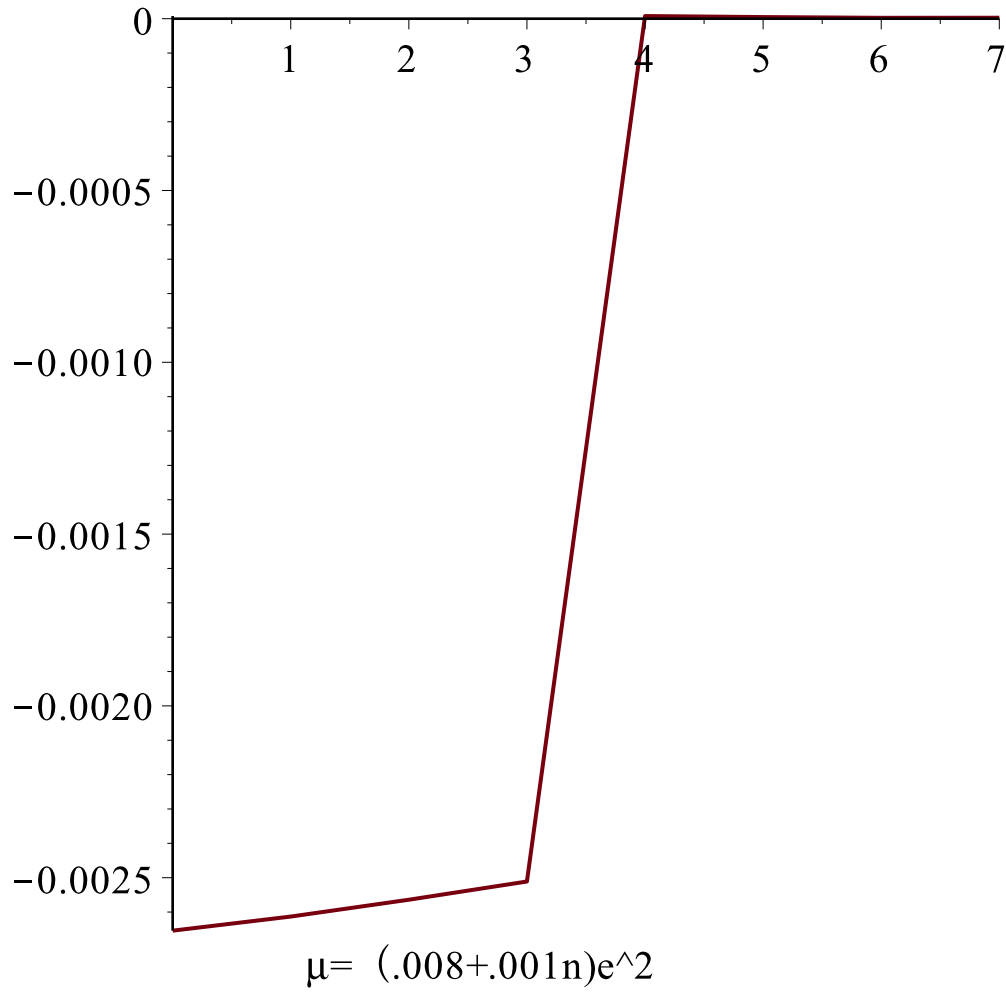
Yuichi Hoshino
Kushiro National College of Technology

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Abstract

Topologically Massive QED in (2+1) at T=0 is similar to XY model with finite chemical potential of vortex at finite-temperature and exhbits Kosterlitz-Thouless type transition.

VEV with BC vertex

$\mu= (.008+.001n)e\text{\textasciicircum}2$

1 XY model or condensed matter physics with Kosterlitz-Thouless transition

(2+1)-d

flucutation effects are large

low temperature ;vortex pair are nuetral and there exists condensate

high temperature;single voretx excitation lower the energy

→ washaway condensate

2 Topologically Massive QED$_3$ with 4-component fermion

$$\mathcal{L} = \mathcal{L}_{QED} - \frac{\mu}{4}\epsilon^{\mu\nu\rho}A_\mu F_{\mu\nu}$$

$$\mathbf{A}(x)_{|x|\to\infty} \to \frac{-Q}{2\pi\mu}\nabla\arctan(\frac{y}{x}). \qquad (1)$$

$$M = \int dk a^+(k)\frac{1}{i}\frac{\partial}{\partial\theta}a(k) + \frac{\mu}{|\mu|}\int dk a^+(k)a(k). \quad (2)$$

There is a 2-spin degree of freedom.($\mu < 0, \mu > 0$):neutral parity conserving theory.(low temperature phase)

one degree:chiral (parity violating) theory,Topologically Massive QED.(high temperature phase)

Vortex is a degree of freedom of singular gauge transformation

$$\triangle_x\phi(x) = \delta^{(2)}(x), \phi(x) = \mu\pi\arctan(y/x) \qquad (3)$$

$\psi(r) \rightarrow \exp(i\phi(x))\psi(r)$, μ is related to Hall conductance.

∘Chiral symmetry, Parity symmetry for massless fermion.

Finite T ;not yet finished.