Quantization of conductance in neutral matter as evidence for many-sheeted space-time?

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Abstract

The quantization of conductance in neutral matter is reported in the recent article in Nature. In quantum Hall effect conductances is quantized in multiples of e^2/h. Now the however is in multiples of $1/h$ This is due to the fact that voltage is not present now: particles are neutral and electric field is replaced with the gradient of chemical potential and electric current with particle current. Hence elementary charge e is replaced with the unit for particle number which is just 1 rather than e. Hence the quantisation as multiples of $1/h$ but in complete analogy with Quantum Hall Effect (QHE). In this article the possibility that the effect could indeed be QHE for classical Z^0 field, which is long ranged at given sheet of many-sheeted space-time. The effect could be seen as a result of probing single sheet of many-sheeted space-time, where doherence does not destroy the long range nature of classical Z^0 field. This requires large value of Planck constant $h_{eff} = n \times h$.

We are living really interesting times. Experimental sciences are producing with accelerating pace new discoveries challenging the existing theories and it is difficult to avoid the impression that a revolution is going on in physics and also in biology and neuroscience. It is a pity that colleagues do not seem to even realize what is going on. One example of fascinating experimental findings is described in an article published in Nature (http://www.nature.com/nature/journal/v517/n7532/full/nature14049.html) [D1].

The article reports quantization of conductance in neutral matter. In quantum Hall effect conductances is quantized in multiples of e^2/h. Now the however is in multiples of $1/h$. Looks strange! This is due to the fact that voltage is not present now: particles are neutral and electric field is replaced with the gradient of chemical potential and electric current with particle current. Hence elementary charge e is replaced with the unit for particle number which is just 1 rather than e. Hence the quantisation as multiples of $1/h$ but in complete analogy with Quantum Hall Effect (QHE).

What comes to my innocent in mind is that the effect is mathematically like QHE and that there is also fractional variant of it as in the case of QHE. In QHE magnetic field and cyclotron states at flux quanta of this field are in key role. But in the situation considered they are not present if we live in the standard model world.

What is the situation in TGD?

1. In many-sheeted space-time all classical electroweak fields are present as long range fields at given sheet. This has been one of they key interpretational problems of TGD from the beginning. In particular, Kähler electric and magnetic fields are always associated with non-vacuum extremals although ordinary electric field can vanish. Note that classical electro-weak fields affect the dynamics indirectly by forcing fermions to the string world sheets! They are clever power holders!

2. This has inspired the hypothesis that induced spinor fields describing fundamental fermions are localized at string world sheets at which only em fields are non-vanishing [K2]. This assumption guarantees that electromagnetic charge is well-defined quantum number for the modes of spinor field and thus also conserved. Classical Z^0 fields could be present below weak scale also at string world sheets. Weak scale is scaled up to macroscopic scale for large values of $h_eff = n \times h$ and this could explain the large parity breaking effects in living matter but also just the fact that fermionic fields are not where weak fields are, could explain the parity breaking effects.

3. At GRT-gauge theory limit the sheets of many-sheeted space-time are replaced with single one and interpreted as region of Minkowski space slightly curved and carrying gauge fields: now space-time is not regarded as a surface anymore. Only classical em field effectively present above weak scale since other electroweak gauge potentials associated with space-time sheets sum up to something which is zero on average at GRT limit.

These observations lead to ask whether the quantization of conductivity for neutral particles be a direct signature of many-sheeted space-time? Could the experiments probe physics at single sheet of many sheeted space-time? Could the needed magnetic and electric fields correspond to classical Z^0 fields, which can be present at string world sheets below weak scale now scaled up by h_{eff}/h.

If this approach is on the correct track then the thermodynamical description in terms of chemical potential cannot be fundamental (the gradient of the chemical potential replaces that of electric potential in this description). Leaving the realm of standard model, one could however wonder whether the thermodynamical description using chemical potentials (chemistry is by definition effective theory!) is really fundamental in quantum regime and whether it could reduce to something more fundamental which standard model can describe only phenomenologically.

1. I have considered two alternative models of cell membrane in zero energy ontology [K1] as a generalisation of thermodynamics as square root of thermodynamics with probability densities interpreted as square roots of thermodynamical weights which are exponentials of thermal energies. These models can be also combined. Both are characterized by a large value of $h_{eff} = h_{gr}$.

2. In the first model of the cell membrane Josephson energy determined by the voltage over the cell membrane is generalized by adding to it the difference of cyclotron energies at flux tubes at the two different sides of the membrane and the magnetic fields at flux tubes appear in the formula. This difference of cyclotron energies corresponds to chemical potential and affects the frequency associated with the Josephson current and corresponding energy proportional to h_{eff} and therefore above thermal energy.

3. For the second model classical Z^0 fields explaining the large parity breaking effects in living matter are assumed to be present. Chemical potential corresponds to the difference of Z^0 potential over the cell membrane. Could this phase be the phase in which "chemical" conductivity is quantized?

4. For the hybrid of the two models the theory of QHE would generalize by replacing em fields with combinations of em and Z^0 fields. This framework could be used to model also the observed quantization of neutral conductivity as an analog of QHE.

The most obvious objection that the quantum of conductivity for neutral particles is $1/h$ rather than g^2/h, where g is appropriate weak coupling strength does not bite. Experimentalists measure particle currents rather than Z^0 currents ($j = j_Z/g_Z$) and use gradient of chemical potential instead of Z^0 potentials $\mu = g_Z E_Z$). $j_Z = \sigma E_Z$ implies that the quantization of the conductance is in multiples of $1/h$.

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