Complex Aspects of Electric Charge

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ABSTRACT: It has been proved that the charge of the charged tachyons is expressed by a complex number.
Next, one has shown that the charge and the vector potential in the Bohm-Aharonov effect can be described by a real number or by complex conjugated numbers.
Next one proved that the equality of two electric potentials of the static electric field of the resting charges implicated two solutions; the first of which gave real numbers and the second complex values - so the doubling of the dimensions.

1. The dependence [1]:

$$m^2 \sim Q^2 \tag{1}$$

for $m = i|M|$
and the positive factor of proportionality means $m^2 < 0$
and $Q = \pm i|Q|$.
So the charge of the tachyons is expressed by complex mass in the case of the charged tachyons fulfilling (1).

2. The Bohm-Aharonov effect described by the fields connected with interactions with the number of the poles n > 2 is expressed by the formula [2]:

$$\delta = \frac{q}{\hbar} \int_s \vec{A} \cdot d\vec{s}$$

where q and A are complex numbers (q - charge, A - field) while δ is a real number, so we have

im qA = 0

because s is a real number.

So qA is a real number. It implicates that q and A must be complex conjugated numbers. We must analyze the most general case.

3. The equality of two potentials arising from two electric charges with the same sign, placed at the points A and B, is expressed by the formula:

$$\frac{Q_A}{\sqrt{\sum_{i=1}^{n}(x_i - x_{Ai})^2}} = \frac{Q_B}{\sqrt{\sum_{i=1}^{n}(x_i - x_{Bi})^2}}$$

If we consider a Euclidean n-dimensional space and the charges are equal, we have:

$$\sum_{i=1}^{n}(x_i - x_{Ai})^2 = \sum_{i=1}^{n}(x_i - x_{Bi})^2$$

or:

$$\left[\sum_{i=1}^{n}(x_i - x_{Ai})^2\right] = -\left[\sum_{i=1}^{n}(x_i - x_{Bi})^2\right]$$

We can't neglect the latter case and then we have the complex space and the duplication of dimensions (for $x_{Ai} \neq x_{Bi}$) [4].

References:

[1] M. J. Duff, Nuclear Physics B 459, 1996, p. 125
[2] R. P. Feynman, R. B. Leighton, M. Sands, "Feynman Lectures on Physics", vol. II part I
[3] Z. Morawski, "An Attempt at Unification of Interactions and Quantization of Gravitation ", this website
[4] Z. Morawski, "Implications of Complex Mass", this website