Ghosts

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ABSTRACT: The known properties of objects called ghosts have been described. One has stated that the ghosts shouldn't be at any price removed from physical theories. One has explained the reason of the appearance of so called bad ghosts with the negative norm – described by the known numbers, so called generalized quaternions. The ghosts may possess this feature.
Moreover, the ghosts can locally obtain the negative value of the integral of square of modulus of their wave functions, because they are confined objects and their wave functions are only the part of the total wave function, whose integral of square of modules is already normalized to the number 1.

In the process of the scattering the loop confined states arise which shouldn't be removed from physical theories at any price. The ghosts are the confined states as the quarks. The scattering states are analogous to the confined states. The ghosts move around the loops. The ghosts don't appear in the asymptotic states and in the expressions describing the amplitudes appear only in the closed loops.
Exactly these closed loops of particles-ghosts determine in the quantum Yang-Mills theory this lacking element ensuring the unitary of the amplitudes of transition [1].
The ghosts have negative norm, because they are described by the generalized quaternions whose square of modulus (or the norms) may be negative (see [2] or the summary of it [3, 4]).
However, the ghosts aren't independent and they must be conjugated with other objects and then:

$$\int \Psi^{*}_{TOT} \ \Psi_{TOT} \ = \ 1$$

although $|\Psi|^2$ may be locally negative. The dualism loop-particle exists, naturally in the case of ghosts. The module signs denote the lengths of the vectors needn't to be real [5].

We have:

$$|k| = ik\ , \qquad |p| = i(2mB)^{1/2}\ , \qquad |p + k + q| = \ i(2mB)^{1/2}$$

So the modulus is a purely complex number.
It corresponds to the fact from a certain Russian book that the norm of the certain generalized quaternions, and so square of modulus is negative.
All this appears in the Feynman graphs in the processes in which the ghosts probably appear.
There are "good" ghosts with positive norm and "bad" ghosts with negative norm [6]. It corresponds to the fact that there are generalized quaternions (describing ghosts) both with positive and negative norm.
There are moreover infinite sets of ghosts, ghosts for ghosts etc. [7]. It means that higher order ghosts are an effect existing as the effect of existence of the ghosts in the amplitude of scattering on other ghosts and so on.

References:
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[4] Z. Morawski, "Number of Dimension of the Universe" – this website
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[6] Internet "Fadeev Popov Ghosts"
[7] E. A. Berghoeff, R. E. Kallosh, Nuclear Physics B 333 (1990), p. 605-634