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Smoothly breaking unitarity : studying spontaneous collapse using two entangled, tuneable, coherent amplifiers

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Stellingen

behorend bij het proefschrift

Smoothly breaking unitarity

1. To investigate the process of the collapse of the quantum mechanical wave function in a photodetector, a parametric amplifier can be used as a simplified version of the photodetector.
[Chapter 1 of this thesis]
2. The contribution to the gain coupling constant in the coupled-mode equations for a Josephson travelling-wave parametric amplifier that scales with Δk cannot follow from a quantum theory.
[Chapter 3 of this thesis]
3. If a parametric amplifier with tuneable gain collapses a quantum mechanical wave function at a certain amplification less than its maximum gain, this process is detectable using an interferometer, in which such an amplifier is added to each of the interferometer arms.
[Chapter 4 of this thesis]
4. Josephson junctions, evaporated by double-angle shadow evaporation using a mask defined by the junction electrodes, which are made out of a different material than the junction, are unsuited for the development of travelling-wave parametric amplifiers.
[Chapter 5 of this thesis]
5. The implementation of a topologically-protected travelling-wave parametric amplifier as proposed by Peano *et al.* does not yield more protection against internal losses than travelling-wave parametric amplifier implementations without topological protection.
[Peano *et al.*, *Phys. Rev. X* **6**:041026 (2016)].
6. Describing travelling-wave parametric amplifiers in terms of a momentum operator instead of a Hamiltonian, as suggested by J. Liñares, D. Barral en M.C. Nistal, is only allowed in dispersionless transmission lines and therefore not, as the authors suggest, the solution to describe such amplifiers in which dispersion plays a role.
[J. Liñares, D. Barral and M.C. Nistal, *J. Nonlinear Opt. Phys. Mater.* **21**:1250032 (2012)].

7. It is surprising that the dual derivation of the magnitude of the Josephson inductance, on the one hand via Faraday's law of induction and on the other via the concept of flux, which yields different descriptions of the magnitude at first sight, is underexposed in scientific literature.
8. Of all the current experimental endeavours to prove or disprove continuous spontaneous collapse theories, it is probable that cantilever experiments as described by Vinante *et al.*, will be successful first.
[Vinante *et al.*, *Phys. Rev. Lett.* **116**:090402 (2016);
Vinante *et al.*, *Phys. Rev. Lett.* **119**:110401 (2017)].
9. The Dutch saying 'Het leven is geven en nemen' (Life is giving and taking) is to be extended to 'Het leven is geven, ontvangen en nemen' (Life is giving, receiving and taking).
10. The best way to get to know someone's convictions is to consistently ask "Why?".
11. Negatively-phrased questions are always to be answered in full sentences.
12. It is not necessarily so that a PhD candidate agrees with his/her own propositions.

Tom van der Reep
Leiden, 13 juni 2019