Quantum 1/f noise

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Quantum 1/f noise is claimed to be an intrinsic part of quantum mechanics (see the debate section below). The model is based on the scattering of different particles off one another in solid state physics. Quantum 1/f noise is also claimed to be a source of "chaos" in such systems.

Contents

Other noise data sets

It has also recently been claimed that 1/f noise has been seen in higher ordered self constructing functions, as well as complex systems, both biological, chemical, and physical.

The theory

The basic derivation of quantum 1/f was made by Dr. Peter Handel, a theoretical physicist at the University of Missouri - St. Louis, and published in *Physical Review A*, in August 1980.

Several hundreds of papers have been published by many authors on Handel's quantum theory on 1/f noise, which is a new aspect of quantum mechanics. They verified, applied, and further developed the quantum 1/f noise formulas. See the "General Quantum 1/f Bibliography" at http://www.umsl.edu/~handel. Aldert van der Ziel, the nestor of the electronic noise field, verified and applied it in many devices and systems, together with dozens of his PhD students. It is described in the last of his 12 books: "Noise in electronic devices and circuits" published by Wiley in 1986. He also updated and generalized many verifications, practical applications, etc., in his authoritative 1988 review "Unified Description of 1/f Noise" in Proceedings of IEEE.[1] For more on Quantum 1/f noise, see: P.H. Handel: Phys. Rev. Letters of June 16, 1975 (2 papers), and also "1/f Macroscopic Quantum Fluctuations of Electric Currents Due to Bremsstrahlung with Infrared Radiative Corrections", Zeitschrift fuer Naturforschung 30a, p. 1201 (1975). For the coherent quantum 1/f effect, see the Physica Status Solidi paper of 1996, the Transactions in Electron Devices paper of 1994, and the Proceedings of IEEE paper with graduate student Adam Tournier of 2005, all shown in the above-mentioned quantum 1/f bibliography.

Denials of the theory

In 1986 and 1987, two independent groups of theorists of the field, Group-1: Theo Nieuwenhuizen [4] (http://staff.science.uva.nl/~nieuwenh/), Daan Frenkel [5] (http://www.ch.cam.ac.uk/staff/df.html) and Nico G. van Kampen [6] (http://books.google.com/books?as_auth=NG+van+Kampen&cad=author-navigational) ; Group-2: Laszlo B. Kish and Peter Heszler; concluded that Handel's theory explaining the quantum 1/f effect was incorrect for both physical and mathematical reasons.[2][3] Shortly thereafter an independent set of arguments showing that the "quantum 1/f noise" explanation of electronic 1/f noise was certainly incorrect was included in a standard review article on 1/f noise by Michael Weissman.[4] Nieuwenhuizen, et al., state in the conclusion of their paper, "As the theoretical basis for Handel's quantum theory of 1/f noise appears to be lacking, we must conclude that the agreement with experiments is fortuitous"[2] and, in this way, they are indicating that some of the published experimental results are suspicious. Though there have been attempts to answer some of the objections to Handel's theory, quantum 1/f noise is considered to be a non-existent effect by the majority of scientists that are familiar with its theory. The difficulty is that here a judgment based on fundamental science requires the knowledge of quantum electrodynamics however most of noise scientists are solid state physicists or engineers. Science citation index shows over 20 thousand papers annually with "noise" and/or "fluctuation"(s) keywords. The opinion of the above-mentioned relevant experts in the field of noise is that, until the publication rate on the non-existent quantum 1/f noise effect stays around 1 paper/year, it is more economical to refer to the old denials[2][3] than to write up new refusals.

See also

- shot noise
- 1/f noise
- white noise
- Johnson-Nyquist noise
- signal-to-noise ratio
- noise level
- noise power

- noise-equivalent power
- phase noise
- thermal noise
- list of noise topics
- audio system measurements
- Colors of noise

References

1. Van Der Ziel, A. (1988). "Unified presentation of 1/f noise in electron devices: Fundamental 1/f noise sources". *Proceedings of the IEEE* **76** (3): 233–258. doi:10.1109/5.4401.
2. Th.M. Nieuwenhuizen, D. Frenkel, and N.G. van Kampen: "Objections to Handel's quantum theory of 1/f-noise", Phys. Rev. A 35 (1987) 2750-2753 [1] (http://prola.aps.org/abstract/PRA/v35/i6/p2750_1)
3. L. B. Kiss and P. Heszler: *An exact proof of the invalidity of "Handel's quantum 1/f noise model"*, based on Quantum Electrodynamics, *J. Phys. C: Solid State Phys. 19, L631 (1986) [2] (http://www.iop.org/EJ/abstract/0022-3719/19/27/005/)*
4. Weissman, M. B. (1988). "1/*f* Noise and other slow non-exponential kinetics in condensed matter". *Reviews of Modern Physics* **60**: 537–571. Bibcode:1988RvMP...60..537W. doi:10.1103/RevModPhys.60.537.[3] (http://rmp.aps.org/abstract/RMP/v60/i2/p537_1)

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