

An introduction to the mathematics of superoscillations

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1 Abstract

Superoscillations are band-limited functions that oscillate faster than their fastest Fourier component. Superoscillations appear for example in Aharonov's weak measurements in quantum mechanics, in antenna theory, in optics and in signal processing.

Some of the research directions that we will consider in this talk are: the study of the evolution of superoscillations using Schrödinger equation and the function theory of one and of several variables. The class of superoscillatory functions that we consider are not square integrable, but they are analytic functions of a real variable that can be extended to entire holomorphic functions. This fact leads us to introduce, as main tools for our research, a class of convolution operators acting on suitable spaces of entire functions with growth conditions. Some of the results presented in this talk can be found in the papers [1, 2, 3, 4, 5].

References

- [1] Y. Aharonov, F. Colombo, I. Sabadini, D.C. Struppa, J. Tollaksen, *The mathematics of superoscillations*, Memoirs of the American Mathematical Society, **247** (2017), no. 1174, v+107 pp.
- [2] Y. Aharonov, F. Colombo, I. Sabadini, D.C. Struppa, J. Tollaksen, *Superoscillating sequences in several variables*, J. Fourier Anal. Appl., **22** (2016), 751–767.
- [3] Y. Aharonov, I. Sabadini, J. Tollaksen, A. Yger, *Classes of superoscillating functions*, Quantum Stud. Math. Found., **5** (2018), 439–454.
- [4] T. Aoki, F. Colombo, I. Sabadini, D.C. Struppa, *Continuity theorems for a class of convolution operators and applications to superoscillations*, Ann. Mat. Pura Appl., **197** (2018), 1533–1545.
- [5] J. Behrndt, F. Colombo, P. Schlosser, *Evolution of Aharonov–Berry superoscillations in Dirac δ -potential*, Quantum Stud. Math. Found., <https://doi.org/10.1007/s40509-019-00188-4>.