# Quantum non-Gaussian optics and mechanics

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The talk will report recent theoretical and experimental achievements opening the door to highly non-Gaussian quantum optics and mechanics with single atoms and macroscopic mechanical systems. This territory is challenging for investigation, both theoretically and experimentally. We will briefly present recent theoretical and laboratory activities, mainly the experimental tests of the faithful hierarchy of quantum non-Gaussianity beyond the limits of optical methods [1,2], for multiphonon states of a single atom and their sensing capabilities [3]. The talk will conclude with other related results and the following challenges in theory and experiments with atoms, mechanical oscillators and superconducting circuits to stimulate discussion and further development of this field.

[1] Lukáš Lachman, Ivo Straka, Josef Hloušek, Miroslav Ježek, and Radim Filip, Phys. Rev. Lett. 123, 043601 (2019)

[2] Lukáš Lachman and Radim Filip, Phys. Rev. Lett. 126, 213604 (2021)

[3] Lukáš Podhora, Lukáš Lachman, Tuan Pham, Adam Lešundák, Ondřej Čip, Lukáš Slodička, and Radim Filip, Quantum-Gaussianity of multi-phonon states of a single atom, arXiv:2111.10129