Quantum non-Gaussian coherence and correlation of light and atoms

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The talk will report recent theoretical and experimental achievements opening the door to highly non-Gaussian quantum states of photons and phonons. This territory is challenging for investigation, both theoretically and experimentally. We will present recent achievements, mainly the experimental tests of climbing the hierarchy of quantum non-Gaussian phononic and photonic states suitable for applications. Particular focus will be on new nonclassical and quantum non-Gaussian coherences, their experimental verification and applications in bosonic quantum sensing and error correction. 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 advancing and prospective field.