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Singular probability distribution of a parametric oscillator driven by Poisson noise PAVEL M. POLUNIN, Michigan State University, PANPAN ZHOU, Hong Kong University of Science and Technology, STEVEN W. SHAW, Michigan State University, HO BUN CHAN, Hong Kong University of Science and Technology, MARK I. DYKMAN, Michigan State University — We provide the results of the theoretical and experimental studies of the probability distribution of a parametric oscillator, which is additionally driven by a Poisson-like noise. The noise consists of pulses at the vibration frequency with duration small compared to the oscillator relaxation time but long compared to the vibration period. We find that the stationary probability distribution of an oscillator quadrature can display a self-similar structure of sharp peaks, almost symmetrical with respect to the maximum, or can have a strongly asymmetric two-peak structure. The form of the distribution depends on the oscillator dynamics in the rotating frame and the rate of the noise pulses. In particular, the self-similar multi-peak structure emerges if the oscillator dynamics in the rotating frame is underdamped. The peaks have a singular power-law shape. We show that the singularity is smeared by thermal noise, which makes the peaks Gaussian near the maxima. We also discuss the frequently encountered situation where the Poisson noise describes fluctuations of the oscillator eigenfrequency. The theoretical and experimental results are in excellent agreement.

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