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Spectra of mesoscopic oscillators with dispersive mode-mode coupling YAXING ZHANG, MARK DYKMAN, Michigan State University — Mesoscopic vibrational systems typically have several nonlinearly coupled modes with different frequencies and with long lifetime. Examples are provided by flexural modes of carbon nanotubes, graphene sheets, and nanobeams. We consider the power spectrum of one of these modes, which we call an oscillator. Thermal fluctuations of the amplitudes of the modes coupled to the oscillator lead to fluctuations of its frequency and thus to the broadening of its spectrum. However, the coupling-induced broadening is partly masked by the broadening due to the oscillator decay. We show that the mode coupling can be easily identified from the change of the spectrum due to weak resonant driving. Despite the coupling-induced frequency fluctuations being non-Gaussian, it is possible to average over them in a path-integral formulation and thus to find the power spectrum. The shape of the spectrum depends on the interrelation between the nonlinear coupling strength and the decay rates of the modes. The characteristic features of the spectrum are analyzed in the limiting cases. We also find that the spectral effect of the internal nonlinearity of the oscillator differs substantially from the effect of mode-mode coupling.

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