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Measuring the momentum of a nanomechanical oscillator using tunnel junctions CHARLES DOIRON, Universitaet Basel, BJOERN TRAUZETTEL, Universitaet Wuerzburg, CHRISTOPH BRUDER, Universitaet Basel — We present a way to measure the momentum p of a nanomechanical oscillator¹. The momentum detector is based on two tunnel junctions in an Aharonov-Bohm-type setup, where one of the tunneling amplitudes depends on the motion of the oscillator and the other one does not. The coupling between the first tunnel junction and the oscillator is assumed to be linear in the position x of the oscillator $t(x) = t_0 + t_1\hat{x}$. However, the presence of two junctions can, under certain conditions, lead to an effective imaginary coupling $t(x) = t_0 + it_1\hat{x}$. By calculating the equation-of-motion for the density matrix of the coupled (oscillator+tunnel junction) system², we show that in this case the finite-frequency current noise of the detector is proportional to the momentum spectrum of the oscillator.

¹C. B. Doiron, B. Trauzettel, C. Bruder. arXiv:0707.2709.

²A.A Clerk, S. Girvin. Phys. Rev. B **70**, 121303 (2004).

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