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Effective Langevin equations leading to large deviation function of time-averaged velocity for a nonequilibrium Rayleigh piston

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We study fluctuating dynamics of a freely movable piston that separates an infinite cylinder into two regions filled with ideal gas particles at the same pressure but different temperatures. To investigate statistical properties of the time-averaged velocity of the piston in the long-time limit, we perturbatively calculate the large deviation function of the time-averaged velocity. Then, we derive an infinite number of effective Langevin equations yielding the same large deviation function as in the original model. Finally, we provide two possibilities for uniquely determining the form of the effective model.

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