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Thermally-induced resonance in folding-unfolding transition of a stretched RNA WON KYU KIM, Department of Physics and PCTP, Pohang University of Science and Technology, Pohang 790-784, South Korea, CHANGBONG HYEON, School of Computational Sciences, Korea Institute for Advanced Study, Seoul 130-722, South Korea, WOKYUNG SUNG, Department of Physics and PCTP, Pohang University of Science and Technology, Pohang 790-784, South Korea — The biopolymers are often situated in constrained, thermally fluctuating environment in the cell. To understand how they respond to a minute but temporally varying signal, we study folding-unfolding dynamics of a stretched RNA under a small oscillatory force. We find via numerical simulations that the small oscillation enhances the folding (unfolding) dynamics, even at a high (low) stretching condition where the folding (unfolding) is improbable, leading to a minimum mean transition time at an optimal frequency, a phenomenon dubbed as Resonant Activation (RA). In addition, the folding-unfolding transition can be maximally synchronous to the oscillation at another optimal frequency, characteristics of the Stochastic Resonance (SR). These noise-assisted resonance phenomena, RA and SR, which can also be largely modulated by the polymer parameters, provide a glimpse of how a biopolymer self-organizes in response to the environmental fluctuation in the cell.

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