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Variance reduction by coupling of stochastic processes and canalization in biology

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In this talk we show that the higher precision of the negative self-regulating gene is due to negative correlation caused by the coupling of two stochastic variables: the gene state and the protein number. Our results are obtained in the framework of a master equation, for discrete variables and, hence, are useful to the analysis of low copy number systems. For a comparison, the external regulating gene is analyzed and we show that it cannot access the negative correlation condition. Our results suggest that negative correlation is the theoretical mechanism underlying the coupling of multiple stochastic chemical reactions necessary to ensure the precision of developmental processes in living organisms.