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Kinetics of RNA translocation through a nanopore

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A nanopore is so small that only single-stranded but not double-stranded RNA molecules can pass through it. Thus, if an RNA molecule is driven through a nanopore its secondary structure has to be broken. This couples the dynamics of translocation through the pore to the dynamics of the secondary structure rearrangements of the molecule. Thus, translocation experiments of RNA molecules through nanopores give insight into secondary structure dynamics. In addition there are potential applications to the determination of RNA secondary structures and to the separation of RNA molecules according to their secondary structure features. We will present a theoretical framework in which to study this competition between translocation and structural dynamics. As a first application we study the crossover between a fast translocation regime in which the structure is easily destroyed and the translocation time is linear in the polymer length and a slow translocation regime in which the structure is in thermodynamic equilibrium at all times and the translocation time is dominated by the specific structural features.