

Statistical physics of molecular sorting in living cells

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Molecular sorting is a sophisticated mechanism exploited by eukaryotic cells to maintain their inner order and guarantee proper physiological functioning. By means of this mechanism, specific biomolecules dwelling on the outer plasma membrane and on the internal membranes are selectively concentrated into spatially localized domains and engulfed into submicrometric lipid vesicles, that are actively delivered to their right destinations. A similar sorting process is also involved in the assembly and budding of enveloped viruses. This thesis is devoted to the study of the statistical properties of molecular sorting investigated by means of an abstract model, that assumes that this non-equilibrium process emerges from the coupling of two main physical principles: (a) molecule phase separation into domains and (b) domain-induced membrane bending, leading to vesicle nucleation.