# Département de Physique Théorique

## SÉMINAIRE DE PHYSIQUE BIOLOGIQUE

**Sujet:** **Mean-first passage time of non-markovian random walkers in confinement**

**Orateur:** **Nicolas Levrenier, Laboratoire de Physique Théorique de la Matière Condensée a lUniversité Pierre et Marie Curie, Paris**

**Lieu:** **Salle 234**

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**Heure:** **14h00**

**Résumé:**

The first-passage time, defined as the time a random walker takes to reach a target point in a confining domain, is a key quantity in the theory of stochastic processes. Its importance comes from its crucial role in quantifying the efficiency of processes as varied as diffusion-limited reactions, target search processes or the spread of diseases. Most methods of determining the properties of first- passage time in confined domains have been limited to Markovian (memoryless) processes. However, as soon as the random walker interacts with its environment, memory effects cannot be neglected: that is, the future motion of the random walker does not depend only on its current position, but also on its past trajectory. Examples of non-Markovian dynamics include single-file diffusion in narrow channels, or the motion of a tracer particle either attached to a polymeric chain or diffusing in simple or complex fluids such as nematics, dense soft colloids or viscoelastic solutions. Here we introduce an analytical approach to calculate, in the limit of a large confining volume, the mean first-passage time of a Gaussian non-Markovian random walker to a target. The non-Markovian features of the dynamics are encompassed by determining the statistical properties of the fictitious trajectory that the random walker would follow after the first-passage event takes place, which are shown to govern the first-passage time kinetics. This analysis is applicable to a broad range of stochastic processes, which may be correlated at long times. Our theoretical predictions are confirmed by numerical simulations for several examples of non- Markovian processes, including the case of fractional Brownian motion in one and higher dimensions. These results reveal, on the basis of Gaussian processes, the importance of memory effects in first-passage statistics of non-Markovian random walkers in confinement.

*Karsten.Kruse@unige.ch*