UNIVERSITÀ
DEGLI STUDI
DI PADOVA

DOMYNOS - Diffusion in polymer matrices: a quantitative mapping between matrix heterogeneity and non-Gaussian statistics

At the heart of this project is the study of transport phenomena in soft matter systems, a field that has seen large and fast development over the last decades due to its fundamental role for many biological, industrial and technological applications. The combined effort of experimentalists, theorists and computational physicists has unveiled recurring deviations from the so-called Brownian Motion (BM). The latter dates back to the 19th century and represents the canonical model for the study of diffusion in fluids. The two central properties of BM are the linear growth with time of the mean squared displacement and the Gaussian distribution of displacements. The main motivation behind this project is the fact that more and more studies have proved that nonGaussian diffusion appears to be the standard rather than the exception when dealing with disordered soft matter systems. Analytical and numerical works have demonstrated that non-Gaussian diffusion emerges due to the presence of different kind of heterogeneities in the systems. Then, this project aims at providing a quantitative description of the spatio-temporal environment heterogeneities leading to non-Gaussian statistics in soft matter systems. More specifically, the research will focus on the diffusion of colloidal nanoparticles through polymer matrices. At first, a detailed study to quantify and characterise the polymer matrix heterogeneities will be carried out. Then, state-of-the-art data analysis technique will be employed to provide a full characterisation of the tracers diffusive dynamics in polymer matrices. Finally, a direct mapping will be established between matrix heterogeneity and the emergence of non-Gaussian statistics in the tracers dynamics. By bringing together concepts from polymer physics, transport theory and computational physics, this project is meant to finally clarify the role of non-Gaussian diffusion in soft matter systems and beyond.

UNIPD Supervisor: Enzo Orlandini
MSCA Fellow: Vittoria Sposini
Department: Department of Physics and Astronomy
Coordinator: Università degli Studi di Padova (Italy)
Total EU Contribution: Euro 172.750,08
Call ID: HORIZON-MSCA-2023-PF-01
Project Duration in months: 24
Find out more: https://cordis.europa.eu/projects/en