

L a u d a t i o

In recognition of his original and outstanding contributions
to the statistical physics of biomolecules and interfaces

Prof. Dr. Giancarlo Franzese

has been awarded the

Martin Gutzwiller Fellowship 2023/24

of the Max Planck Institute for the Physics of Complex Systems.

Giancarlo Franzese is a creative and versatile physicist who in the last decades made seminal contributions to our understanding of the statistical physics of water and its role for the behavior of macromolecules and the properties of interfaces. Cells and living organisms consist to 70% volume of water, but already to understand key properties of pure water and its many anomalies has posed enormous challenges. An important breakthrough was the realization by Giancarlo Franzese together with Gene Stanley that key features of the cooperativity of hydrogen bonds in water could be captured by discrete lattice models.

This approach, developed and refined in recent years, revealed key ingredients that are responsible for the emergence of the rich and unique properties of water and the effects that emerge when water interacts with macromolecules or interfaces. This approach also led to the development of efficient numerical techniques to simulate large systems containing aqueous solutions and opened the door to multi-scale approaches that take the structure, dynamics and entropy of water into account.

Based on such framework, Giancarlo Franzese and coworkers studied the thermodynamics and the stability of proteins that fold in specific configurations. He could show that proteins would unfold not only at high temperatures, but also at low temperatures as well as high and low pressure. The work of Giancarlo Franzese is also relevant for our understanding of the role of hydration in the condensation of proteins and nucleic acids in cells where cooperativity of many macromolecules as well as water play a key role.

There are many open problems that will require to take into account the effects of hydration water and of water cooperativity when exploring the physical chemistry of cells. Here the approaches pioneered by Giancarlo Franzese will be of high value. Giancarlo Franzese is a role model as a scientist with his dedication for science and his seemingly unlimited energy. He is an example of scientific excellence and we look forward to see him addressing new challenges in the future.