Nomination of Henri Orland to the American Academy of Arts and Sciences

The election to the American Academy of Arts and Sciences of our friend and colleague Henri Orland (Institute of Theoretical Physics) crowns an outstanding scientific career dedicated to fundamental research. Henri Orland's work in statistical physics has led to essential advances in our understanding of disordered systems, combinatorial optimization, and the study of soft matter, while also giving rise to original applications to the biophysics of nucleic acid and protein folding and to the problem of sequence alignment in molecular biology.

Henri Orland joined the *Service de Physique Théorique* in 1976 to prepare a thesis under the supervision of Richard Schaeffer and Cirano de Dominicis. First analyzing transport equations for heavy ion collisions, he became familiar with systems with a large number of constituents and strong interactions (the N-body problem) and with the techniques of functional integration and field theory, which became his preferred methods for analyzing and solving problems in a wide variety of fields. His exchanges with C. de Dominicis led him to questions concerning disordered systems (spin glasses, magnetic models in random field, fluctuating interfaces...) for which field theory is particularly efficient. The analogy between protein folding and phase transitions in presence of disorder lead him naturally to soft matter physics, coulombic systems, electrolytes and biophysics. In this field, he has developed theoretical tools and algorithms to determine transition paths in a complex energy landscape in order to model configuration changes of biological molecules; with Tony Zee (KITP), he has classified RNA pseudonodes by random matrix methods and has developed, with Michael Bon, one of the most powerful algorithms to date; more recently, with Patrice Koehl (UC Davies) and Marc Delarue (Institut Pasteur), Henri Orland has applied mathematical methods of optimal transport to pattern recognition and sequence alignment in molecular biology. These examples bear his hallmark: the use of theoretical concepts - sometimes sophisticated - to provide concrete, algorithmic solutions to fundamental questions, in a wide variety of fields at the intersection of physics, chemistry and biology.

The quality of Henri Orland's work has been celebrated by numerous awards, from the CNRS Bronze Medal in 1981 to the Légion d'Honneur in 2011, as well as by numerous visiting professorships at the most prestigious foreign institutions, including MIT (1981-1983), the Weizmann Institute (1987), the KITP in Santa Barbara (1983, 1994), Tel Aviv University (2011-) or the Beijing Computational Science Research Center (2012-).

Henri Orland has written more than 200 research papers published in major journals; he holds the patent for an algorithm simulating protein folding and is the author of two books, Quantum Many-Particle Systems (Addison-Wesley, 1987) with John W. Negele and Molecular Kinetics in Condensed Phases: Theory, Simulation, and Analysis (Wiley, 2020) with Ron Elber and Dmitri Makarov. His first book has become a world-famous classic in the physics of the N-body problem.

Finally, Henri Orland has never been shy of giving his energy and time to the administration of research in various forms, by participating in the CNRS commission (1999-2004), then by directing the Institute of Theoretical Physics from 2004 to 2011. He was also vice-president of the International Union of Pure and Applied Physics (IUPAP) and president of the statistical physics section.

The American Academy of Arts and Sciences has thus welcomed into its ranks an outstanding, inspiring, solar and generous scientific personality.