

L a u d a t i o

In recognition of his seminal contributions to active matter
and non-equilibrium statistical physics

Prof. Dr. John Toner

has been awarded the
Martin Gutzwiller Fellowship 2019/2020
of the Max Planck Institute for the Physics of Complex Systems.

John Toner is a very creative and unusually broad theorist with interests in the statistical physics and the hydrodynamics of systems ranging from hard to soft condensed matter and from passive to active systems. His work is characterized by innovative and elegant approaches to explore the collective dynamics of complex systems that typically are far from equilibrium. Using generic symmetry arguments, conservation laws and approaches such as the renormalization group he characterizes phases and dynamic states of various types of emergent order, their statistical and topological properties, relevant dynamic modes and transitions between phases.

John Toner is most famous for the pioneering work he did with Yuhai Tu on the hydrodynamic theory of flocking and the collective motion of self-propelled objects. This work showed that in active systems true long range order can occur in two dimensions despite a continuous broken symmetry. Furthermore, he discovered unconventional density fluctuations and anisotropic behaviors of sound modes. This work revealed that a novel class of non-equilibrium systems could be understood in the language of statistical physics, field theory and hydrodynamics, which triggered the emergence of active matter physics as a new field. This field is now evolving rapidly, driven by a large and still growing community in statistical physics, and it also has a stimulating impact on biophysics.

John Toner has made strong and lasting contributions to numerous other problems including nematic and smectic liquid crystals, glasses, quasicrystals, superconductors, active and passive membranes, and biological systems. His work is characterized by reducing complex problems to their essence which often allows him to make big leaps forward. He regularly identifies surprising mappings of new and hard problems to seemingly unrelated systems that are tractable. In this way John Toner has been able to obtain rigorous results for systems that seemed out of reach for standard approaches.

John Toner is a role model as a scientist with his independent thinking, his sharp mind, his dedication for science and his engaging personality. He is an example of outstanding achievement and we look forward to see him moving towards new challenges in the coming years.