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Going out of equilibrium and coming back: the case of active matter

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Abstract: Active matter is a fascinating realm of non-equilibrium physics that has been studied extensively over the past few years. This comprises all those entities, from living systems to synthetic microparticles, that harness energy from their surroundings, such as through chemical reactions or external power sources, to propel themselves. As a consequence, active systems exist inherently in a non-equilibrium state, displaying a variety of novel phenomena that have been investigated through the combined efforts of statistical theory, computer simulations, and experiments. After an introduction on active matter at the microscale, I will describe an example of active phase transition induced by the motility of the particles. An important result that I will discuss is how active systems sometimes behave, unexpectedly, almost indistinguishably from equilibrium matter.

Nicoletta Gnan is a researcher at the Institute for Complex Systems of the Italian National Research Council (CNR). She earned her Master's degree in Physics from the University of Rome "Sapienza" in 2006, followed by a three-year Ph.D. fellowship at Roskilde University in Denmark, where she investigated the structural and dynamical properties of liquids and glasses. After completing her Ph.D., Nicoletta joined the CNR in 2013, initially as a postdoc and later as a permanent researcher. Prior to her CNR position, she received a postdoctoral fellowship at the University of Rome "Sapienza," focusing on simulations of colloidal particles in critical solvents. Her research interests encompass numerical modeling of colloidal particles, investigating effective interactions in colloidal dispersions, and studying the collective behavior of both passive and active systems.

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