Dynamics of Self-Organization in Physical and Social Systems

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Talk Abstract

In this talk, we discuss experiments and theory of self-organization in some physical and social dissipative systems. The examples treated here range from fluid flow, pattern selection in fluid–solid systems to chemical-reaction-induced aggregation in fluid systems. We also present some new ongoing work related to self-organization in sports, specifically futbol; which shows parallels with our observations in physico-chemical systems. In each case, self-organization can be seen to be a function of a persistent internal gradient. One goal of this talk is to hint at a common theory to explain such phenomena, which often takes the form of the extremum of some thermodynamic quantity, for instance the rate of entropy production, such as the ones proposed by the Nobel-prize winning work of Lars Onsager and Ilya Prigogine. The arguments have evolved since then to include systems of higher complexity and for nonlinear systems, though a comprehensive theory remains elusive. Our larger attempt, in this research program, is to bring out examples from various disciplines that reveal deep connections between variational principles in physics and biological, or living systems.

Keywords: Self-Organization, Dynamical systems, Networks, Modularity.