Institut de Nanociència i Nanotecnologia

UNIVERSITAT DE BARCELONA

Birds, magnets, soap, and sandblasting: surprising connections in the theory of incompressible flocks

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July 2nd at 11:45h-Room V12 (Faculty of Physics)

In this talk I'll describe the hydrodynamic theory of the motion of incompressible flocks: that is, collections of self propelled entities ("birds") that are packed so tightly together that their density cannot change as they move. In two dimensions, this problem can be mapped onto an equilibrium magnet with a peculiar constraint. This problem, in turn, can be shown to be equivalent to a 2d smectic ("soap"), with the flow lines of the flock playing the role of the smectic layers. Finally, this smectic problem can be mapped onto the 1+1 dimensional KPZ equation, which describes the growth or corrosion ("sandblasting") of a one dimensional interface. The scaling properties of this last system, which have been known exactly for a long time, can thereby be used to determine those of incompressible 2d flocks. One important implication of the resulting scaling laws is that such flocks can exhibit long-ranged order in two dimensions, unlike their equilibrium counterparts.

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