Friday, December 1st (at 4.00pm, UK time)

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Title: Integrability and complexity in statistical mechanics: thermodynamic limit vs viscous/dispersive regularisation.

ABSTRACT

The theory of integrable nonlinear conservation laws arises as a 'universal' paradigm for the description and classification of phase transitions, cooperative and catastrophic behaviours in many body systems at the crossroad of integrable systems, statistical mechanics and random matrix theory. A key element of this paradigm is the construction of suitable differential identities for the partition functions from which one can deduce nonlinear partial differential equations, typically a hierarchy of hydrodynamic conservation laws, for the order parameters of the theory.

Critical phenomena and phase transitions are therefore understood in terms of asymptotic properties of the solutions in the low viscosity/weak dispersion regime for these equations. We illustrate, via specific examples, how viscosity underpins the occurrence of phase transitions in "simple" systems while dispersion arises as a possible mechanism for the description of emergent complex behaviours and out of equilibrium thermodynamics.
