2d Turbulence, percolation and SLE

GREGORY FALKOVICH, Weizmann Institute of Science

We analyze isolines of scalar fields (vorticity, temperature) in different cases of 2d turbulence and found that they belong to the SLE class, i.e. to curves that can be mapped to 1d Brownian motion. Such curves have conformal invariant statistics. We find that vorticity isolines in 2d turbulence are equivalent (within our 5% accuracy) to SLE_6 i.e. to percolation despite the fact that the vorticity field is long-correlated and does not satisfy Harris criterium. We find that the temperature isolines in surface quasi-geostrophic turbulence belong to SLE_4i.e. statistically equivalent to isolines of a Gaussian free field despite the fact that the temperature is non-Gaussian. Link with SLE allows one to obtain a variety of quantitative results going well beyond all we knew about turbulence before and hints about some deep analogy between turbulence and critical phenomena.