Collapse in Hydrodynamics and the Kolmogorov Spectrum

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Recent numerical experiments in the framework of the Euler equations for two colliding Lamb vortex dipoles (P. Orlandi, S. Pirozzoli and G. F. Carnevale, J. Fluid Mech. (2012), vol. 690, pp. 288-320) testify to favor of the collapse appearance when the vorticity becomes infinite in a finite time according to the law $(t_0-t)^{-1}$, the collapse region vanishes like $(t_0-t)^{1/2}$, and the velocity component parallel to the vorticity blows up proportionally to $(t_0-t)^{-1/2}$. During the collapse the region of the maximal vorticity rep resents the pancake-like structure. In this paper it is shown that all these self-similarities can be obtained from the analysis of the singularity while breaking of vortex lines. In the collapse instant the vorticity Ω gets the singularity of the Kolmogorov type: $\Omega \sim x^{-2/3}$ where x coincides with the direction of the breaking.

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