Abstract Submitted
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Universal constants and equations of turbulent motion[1] HELMUT BAUMERT, IAMARIS — For turbulence at high Reynolds number we present an analogy with the kinetic theory of gases, with dipoles made of vortex tubes as frictionless, incompressible but deformable quasi-particles. Their movements are governed by Helmholtz' elementary vortex rules applied locally. A contact interaction or "collision" leads either to random scatter of a trajectory or to the formation of two likewise rotating, fundamentally unstable whirls forming a dissipative patch slowly rotating around its center of mass, the latter almost at rest. This approach predicts von Karman's constant as 1/sqrt(2 pi) = 0.399 and the spatio-temporal dynamics of energy-containing time and length scales controlling turbulent mixing [Baumert 2005, 2009]. A link to turbulence spectra was missing so far. In the present contribution it is shown that the above image of dipole movements is compatible with Kolmogorov's spectra if dissipative patches, beginning as two likewise rotating eddies, evolve locally into a space-filling bearing in the sense of Herrmann [1990], i.e. into an "Apollonian gear." Its parts and pieces are are frictionless, excepting the dissipative scale of size zero. Our approach predicts the dimensionless pre-factor in the 3D Eulerian wavenumber spectrum (in terms of pi) as 1.8 , and in the Lagrangian frequency spectrum as the integer number 2. Our derivations are free of empirical relations and rest on geometry, methods from many-particle physics, and on elementary conservation laws only.

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