

A hydrodynamic exercise in free probability: free Euler equations

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For the free probability analogue of Euclidean space endowed with the Gaussian measure we apply the approach of Arnold to derive Euler equations for a Lie algebra of noncommutative vector fields which preserve a trace. We extend the equations to vector fields satisfying non-commutative smoothness requirements. We also introduce a cyclic vorticity and show that it satisfies certain vorticity equations and that it produces a family of conserved quantities.

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