

Massachusetts Institute of Technology  
Department of Physics

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## Condensed Matter Theory Seminar

"Why solid people may need fluid mechanics"

**Gregory Falkovich, Weizmann Institute**

**Abstract:** Quantum-critical strongly correlated electron systems are predicted to feature universal collision-dominated transport resembling that of viscous fluids. Investigation of these phenomena has been hampered by the lack of known macroscopic signatures of electron viscosity. Here we identify vorticity as such a signature and link it with a readily verifiable striking macroscopic DC transport behavior. Produced by the viscous flow, vorticity can drive electric current against an applied field, resulting in a negative nonlocal voltage. The latter may play the same role for the viscous regime as zero electrical resistance does for superconductivity. Besides offering a diagnostic which distinguishes viscous transport from ohmic currents, the sign-changing electrical response affords a robust tool for directly measuring the viscosity-to-resistivity ratio. Strongly interacting electron-hole plasma in high-mobility graphene affords a unique link between quantum-critical electron transport and the wealth of fluid mechanics phenomena.

**12:00PM**  
**Friday, April 29, 2016**  
**Duboc Room (4-331)**