# Inertial particles do not always concentrate on a wall in turbulence

Gregory Falkovich[1], Sergei Belan[2]
[1]*Weizmann Institute of Science, Israel*
[2]*Landau Institute for Theoretical Physics, Russian Federation*

**Small aerosols drift down temperature or turbulence gradient since faster particles fly longer distances before equilibration. That fundamental phenomenon, called thermophoresis or turbophoresis, is widely encountered in nature and used in industry. It is universally believed that particles moving down the kinetic energy gradient must concentrate in minima (say, on walls in turbulence). Here we show that this is incorrect: escaping minima is possible for inertial particles whose time of equilibration is longer than the time to reach the minimum. The best way out is always through: particles escape by flying through minima or reflecting from walls. We solve the problem analytically and find the phase transition as a sign change of the mean velocity. That means separation: light particles concentrate in a minimum while heavy particles spread away from it (gravity can reverse the effect). We also solved analytically the problem for inelastic collisions and derive the phase diagram for the transition in the inertia-inelasticity plane. We also present direct numerical simulations which support the theory and in addition reveal the dependence of the transition of the flow correlation time, characterized by the Stokes number. That discovery changes understanding of that fundamental phenomenon and may find numerous applications.**

## References

Belan, S., Fouxon, I& Falkovich, G., Localization-delocalization transition in turbophoresis of inertial particles. *Phys. Rev. Lett.* **112**, 234502 (2014)