Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

An analytical model of heat transfer in sheared flows of dilute nanofluids[1] OLEKSII RUDENKO, Eindhoven University of Technology, VICTOR L'VOV, ITAMAR PROCACCIA, Weizmann Institute of Science, FEDERICO TOSCHI, Eindhoven University of Technology — We discuss a model for the enhancement of the heat flux by spherical and elongated (spheroidal) nanoparticles in sheared laminar flows of dilute nanofluids in the presence of a constant temperature gradient. Besides the heat flux carried by the nanoparticles, the model accounts for the contribution of their rotation to the heat flux inside and outside the particles. The rotation of the nanoparticles has a twofold effect: it induces a fluid advection around the particle and it strongly influences the statistical distribution of particle orientations. These dynamical effects are responsible for changing the thermal properties of flowing fluids as compared to quiescent fluids. The proposed model demonstrates a potential increase of the heat flux far beyond the Maxwell-Garnett limit for the spherical nanoparticles, while the spheroidal nanoparticles may either enhance or suppress the heat flux comparing to the spherical nanoparticles.

[1]We acknowledge financial support from the EU FP7 project "Enhanced nano-fluid heat exchange" (HENIX), Contract No. 228882

Oleksii Rudenko
Eindhoven University of Technology

Date submitted: 30 Jul 2012 Electronic form version 1.4