Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

WITHDRAWN: On the Taylor-Couette problem in the continuum limit ITZCHAK FRANKEL, AVSHALOM MANELA, Faculty of Aerospace Engineering, Technion-Israel Institute of Technology, Haifa 32000, Israel — We study the Taylor-Couette problem for a perfect gas which is situated between a rotating inner cylinder and a concentric stationary cylinder, both of which are maintained at the same temperature. A linear temporal stability analysis is carried for small Knudsen numbers using a "slip-flow" model assuming axisymmetric perturbations. At small Mach numbers (Ma) the resulting neutral curve initially coincides with the critical-Reynolds-number (Re) curve ($Re \propto Ma/Kn$) obtained in the corresponding incompressible-flow problem. With increasing Ma, the neutral curve deviates to larger values of Re demonstrating that, contrary to some statements in the literature, compressibility effects are stabilizing. Furthermore, our results indicate that there is an upper bound for the Knudsen number, Kn_m, above which the system is stable for all Mach numbers. Thus, owing to compressibility there also exists (for all $Kn < Kn_m$) an *upper* critical Mach number beyond which system stability is recovered. Occurrence of this upper bound is related to increasing viscous dissipation with increasing Ma. These predictions of the linear analysis are in agreement with results obtained from the direct simulation Monte Carlo method.

Ehud Yariv
Faculty of Mechanical Engineering
Technion-Israel Institute of Technology, Haifa 32000, Israel

Date submitted: 07 Nov 2005 Electronic form version 1.4