Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

From large scales energy injection to small scales heat dissipation in a modulated turbulent flow. OLIVIER CADOT, UME-Ecole Nationale Superieure de Techniques Avancees, France, FREDERIC PLAZA, LMFA-Ecole Centrale de Lyon, France — The turbulence is forced between two counter-rotating disks enclosed in a cylindrical cell. The injected power that fed the motion of the large scales is directly measured through the torques driving the disks. The cell is thermally isolated. Simultaneously to the injected power measurements, a temperature measurement is performed in the center of the flow. In order to study the time delay between injection and dissipation, the rotation frequencies of the forcing devices are modulated with a given modulation frequency. First, the synchronized averaging of the temperature measurements allows to detects temperature variation as small as 10^{-4}K. Second, during a cycle of modulation of energy injection, the temperature is found to globally increase but displays a modulation too. The temperature modulation encompasses 2 differents phases : a small temperature decrease followed by a large temperature increase. The first phase corresponds to the mixing of the temperature, the second to the energy dissipation due to the turbulence. A delay is found between the peaks of power injection and dissipation. The variation of this time delay is measured for different modulation frequencies of the energy injection in order to extract the turbulent cascade time. The cascade time corresponds to the duration of kinetic energy transfer from the large scales to small scales.

Olivier Cadot
UME-Ecole Nationale Superieure de Techniques Avancees

Date submitted: 27 Jul 2005 Electronic form version 1.4