

Examen final

Name: _____ First Name: _____ Mark: _____

Turbulence Colloquium Marseille (TCM 2011)

CIRM, 26-30 September 2011

Junior: ☐

Senior: ☐

Exam: Mathematics for Turbulence

Professors C. Bardos, C. Doering and E. Titi

(18 minutes, max 3 lines per answer)

1. What is your understanding of the claim: Turbulent Flows have finite degrees of freedom? What are these degrees of freedom?
2. What is your understanding of an average?
3. Do you think that any notion of solution of Euler or Navier-Stokes should conserve the energy, or satisfy an energy balance? What if a solution does not conserve energy?
4. What is your understanding of dissipation anomaly? Can you formulate the problem as precisely as possible?
5. Do you think that Navier-Stokes or Euler solutions develop a finite time singularity? Is this consistent with the physical observations? If a singularity is proven to be formed, what is the mechanism? How should we modify the models?
6. Do you think the project of searching for singularity computationally makes sense? In which geometry? Do you think that a smooth physical boundary could be the real source of singularity formation? Or should we stick to periodic boundary conditions?
7. Is atmospheric turbulence 3d or 2d? How should we test this matter? What are the right mathematical quantifiers in this case?
8. Is the range of applications of the incompressible Navier-Stokes equations restricted to incompressible fluids?
9. Does triad wavenumber interaction have much to do with fluid motion? What is the equivalent picture in the physical domain?

The exam was graded with a maximum of 90 points by the TCT mathematicians (see page 490), composed of Claude Bardos, Charlie Doering and Edriss Titi. The honorary presidents, Tomomasa Tatsumi and Bryan Taylor, awarded the prices in the senior and junior category, respectively, during the banquet on Thursday September 29th, 2011 (see page 496).

The winners in the senior category were:

- | | |
|--------------------------|-------|
| 1. Bérèngere Dubrulle | 85/90 |
| 2. Katepalli Sreenivasan | 84/90 |
| 3. Javier Jimenez | 83/90 |

and in the junior category:

- | | |
|---------------------------------------|-------|
| 1. Romain Nguyen van yen | 84/90 |
| 2. Philip Schäfer | 80/90 |
| 3. Samriddhi Ray / Dmitry Kolomenskiy | 70/90 |