

## GFD Newsletter 2002

### Faculty of Walsh College



*The 2002 GFD Photograph, some old faces, some new, but still the same old cottage, and still in need of a coat of paint.*

### *A Sketch of the Summer*

In 2002, the Principal Lectures explored bounds on turbulent transport. These bounds can be constructed via variational techniques applied to integrals of the governing fluid equations. The methods have classical roots, but owe their modern origins to studies of convection initiated decades ago at the GFD program. Following suggestions by Malkus that convection might optimize the transport of heat, Howard and others derived methods to estimate upper bounds to heat transport, based on the global energy methods developed by Orr at the beginning of the 20th century. For several years following, studies using this “Howard–Busse” approach determined a variety of upper bounds for the transport of heat by convection and of momentum by shear flow. In recent years, a slightly different version of the problem was formulated, the “Doering–Constantin approach,” which expedited the construction of upper bounds and opened up some new avenues for progress. In 2002, the GFD Program revisited Upper Bound Theory in the light of all the new developments; our main lecturer was Fritz Busse, who was assisted by Colmille Caulfield, Peter Constantin, Charlie Doering, Lou

Howard and Rich Kerswell. This theoretical topic was complemented with a mini-symposium on rotating convection in early July, which included presentations of experimental, ocean, atmospheric and planetary observations. The summer closed with the seminars of the Fellows, a mix of theory and experiment, and was notable in the unusual concentration of projects on the summer theme, perhaps a testament to the presentation of the Principal Lecturers.

Jack Whitehead was our illustrious leader throughout the summer; Janet Fields and the Academic Programs Office provided the administrative backbone to the Program. As always, Woods Hole Oceanographic Institution offered the perfect setting for the program – Walsh Cottage.

### *Schedule of Principal Lectures*

*Monday* Fritz Busse, “Introduction to Hydrodynamic Stability Theory.”

*Tuesday* Fritz Busse, “Applications of Energy Methods and Linear Theory.”

*Wednesday* Fritz Busse, “The Sequence-of-Bifurcations Approach for the Transition to Turbulence,” and Louis Howard, “Simple Approaches to Some Bounding Problems.”

*Thursday* Fritz Busse, “Upper Bounds for Turbulent Transports,” and Charles Doering, “Bounds on Turbulent Transport: Introduction to the Background Method.”

*Friday* Fritz Busse, “Multi-alpha-Solutions,” and Peter Constantin, “Bounds for Rotating Fluids.”

*Monday* Colm Caulfield, “Bounds on Mixing in Stratified Shear Flows,” and Richard Kerswell, “Unification of Variational Approaches.”

## Fellows Reports

The 2002 Fellows and the titles of their reports are as follows:

Alexandros Alexakis, University of Chicago  
*Bounds in MHD Turbulence, II: Magnetic Couette Flow and Hartmann Flow*

Evstati Evstatiev, Univ. of Texas at Austin  
*Boundary Layer Theory for the Fixed Heat Flux Problem*

Lu Lu, University of Michigan  
*Upper Bounds for Convection in an Internally Heated Fluid Layer*

François Pétrelis, Ecole Normale Supérieure de Paris  
*Bounds in MHD Turbulence, I: Tearing Modes*

Stephen Plasting, University of Bristol  
*Infinite Prandtl Number Convection: Bound to Disprove*

Ulrike Riemenschneider, Univ. of Southampton  
*Ball Release Experiment in a Centrifuge*

Jennifer Siggers, Cambridge University  
*Bounds for Horizontal Convection*

Radostin Simitev, University of Bayreuth  
*Inertia Wave Convection in Rotating Spherical Fluid Shells*

Tomoki Tozuka, University of Tokyo  
*On Cyclic and Oscillatory Convection in a Simplified Box Model with Entrainment*

Huiqun Wang, CalTech  
*Rearrangement of Annular Rings of High Vorticity*

## Softball Report



The GFD fellows team: Back row: Stephen Plasting, François Petrelis, Alexandros Alexakis, Tomoki Tozuka (softball captain), Huiqun Wang, Radostin Simitev. Front row: Jennifer Siggers, Ulrike Riemenschneider, Lu Lu, Evstati Evstatiev.



The staff team, with groupies: Jie Yu, Lou Howard, Phil Morrison, Kim Veronis, Rich Kerswell, Jean-Luc Thiffeault, Ed Spiegel, Barbara Spiegel, Neil Balmforth, Joe Keller. Front row: George Veronis (softball coach), Fritz Busse, Charlie Doering. Pictures thanks to Tomoki.

## The GFD Website

The lectures and reports above will appear on the GFD official website:

[www.who.i.edu/education/gfd](http://www.who.i.edu/education/gfd)

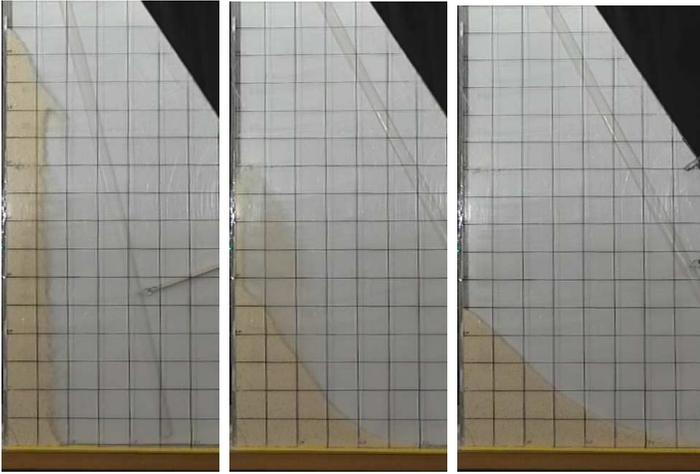
Containing

- announcements of summer themes,
- lecture schedules,
- electronic copies of the GFD proceedings,
- lists of alumni and visitors,
- application materials,
- gallery of photographs,
- useful information and links,

the GFD website is the one-stop resource for all your GFD needs.

In the three years leading up to 2002, GFD had not won a single league game. However, even though only two of the fellows in 2002 had even seen a softball before, the team won three games, including a satisfying win over an incomplete PO team, in a tribute to the masterful coaching of George Veronis. Unsurprisingly, success bred a certain enthusiasm in the fellows, and they practiced each day during the final two weeks in anticipation of the traditional season closer. And captained by a resilient Tomoki Tozuka, the hopeful fellows did battle valiantly with a seasoned, grizzled, veteran staff

team. To counter the enthusiasm and raw ability of the fellows, the staff had drafted Ed Spiegel from retirement in anticipation of a close game (bringing back fond memories of 1993, when an understrength staff team pulled off a victory with the assistance of some unusual interpretations of the rules). In the end, the correct rules were used and the staff's score marginally exceeded that of the fellows as time ran out.



*Granular slumping in the lab: Neil Balmforth and Rich Kerswell performing dam-break experiments with granular material. (A gate, suddenly drawn back, releases a pile of grit that cascades down and sweeps to the right in a sliding granular current. The mass eventually comes to rest leaving a slumped deposit.) Picture courtesy of Glenn Jerley.*

## **The GFD Faculty**

For 2003 we announce a new body of people to handle the scientific and administrative duties of the school, the GFD Faculty. This group is made up of members of the scientific community, across several disciplines, united by their interest in GFD. These are the faces that

you will see at GFD over the coming summers, and who will help run the Program. They will also serve as contact people and “ambassadors” of GFD. The research interests of the Faculty help to define the scientific direction and flavor of the Program. The current faculty is listed below, and we envisage that this group of multidisciplinary experts will evolve continually.

Neil Balmforth  
*University California at Santa Cruz*

Eric Chassignet  
*University of Miami*

Charles Doering  
*University of Michigan*

Glenn Flierl  
*Massachusetts Institute of Technology*

Karl Helfrich  
*Woods Hole Oceanographic Institution*

Lou Howard  
*MIT and Florida State University*

Joe Keller  
*Stanford University*

Rich Kerswell  
*University of Bristol*

Norm Lebovitz  
*University of Chicago*

Willem Malkus  
*Massachusetts Institute of Technology*

Philip Morrison  
*University of Texas at Austin*

Michael Proctor  
*Cambridge University*

Antonello Provenzale  
*ISAC-CNR, Torino*

Richard Salmon  
*Scripps Institution of Oceanography, UCSD*

Edward Spiegel  
*Columbia University*

Melvin Stern  
*Florida State University*

Jean-Luc Thiffeault  
*Imperial College, London*

George Veronis  
*Yale University*

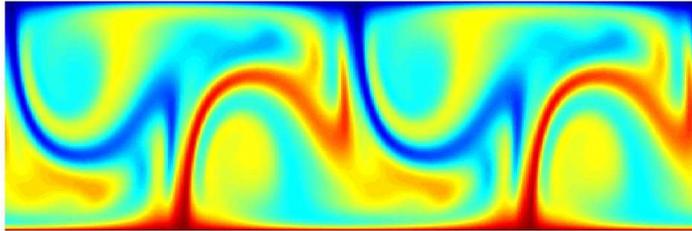
John Wettlaufer  
*Yale University*

Jack Whitehead  
*Woods Hole Oceanographic Institution*

William Young  
*Scripps Institution of Oceanography, UCSD*



*Rotating convection on the porch at Walsh Cottage; an idyllic setting for science. . . . Even the computer trailer looks attractive in this photograph.*



*Stirring and mixing by convection rolls.*

---

### *Special GFD Lectureship*

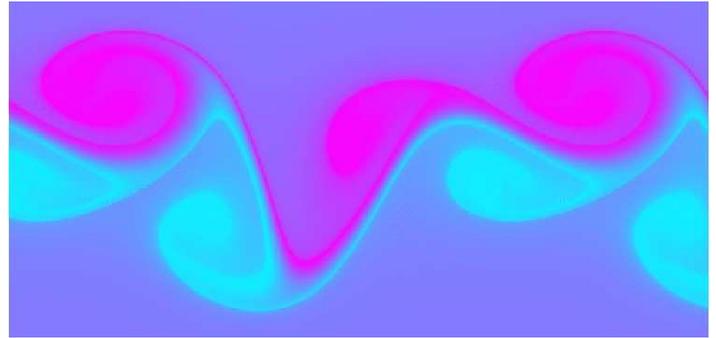
In 2003, we will establish a *Special GFD Lectureship* at Walsh College. This will be a specially funded position at the GFD Program intended to support the extended visit of a participant, such as the summer's Principal Lecturer. The first participant to hold this position will be Professor John Hinch (Department of Applied Mathematics and Theoretical Physics, Cambridge University).

In order to finance the Lectureship, we are asking

previous participants and alumni to make donations to a special GFD fund. The fund is to be administered by W.H.O.I., under the guidance of George Veronis. We would greatly appreciate donations to be sent to the program itself, at Walsh Cottage:

GFD Summer Study Program  
Walsh Cottage, Mail Stop 42  
Woods Hole Oceanographic Institution  
Woods Hole Road  
Woods Hole, MA 02543

Checks should be made payable to W.H.O.I.-G.F.D. Contributors making larger donations will be thanked with gifts such as a framed reproduction of the GFD group photograph from a year of their choice (for example, their year as a fellow).



*Breakup of a jet into a chain of vortices.*

---

Please send comments to [njb@ams.ucsc.edu](mailto:njb@ams.ucsc.edu) or [jeanluc@mailaps.org](mailto:jeanluc@mailaps.org) if you have any suggestions regarding this newsletter or the GFD Program.

The GFD Program is funded by the National Science Foundation and the Office of Naval Research.