

Gordon Conference on Physics Research and Education: Thermal and Statistical Physics

June 11-16, 2000

Plymouth State College

Jan Tobochnik, Kalamazoo College and Harvey Gould, Clark University, co-chairs

Beth Ann Thacker, Texas Tech University, vice-chair

Schedule of Talks and Events

Sunday, June 11

2:00 pm – 11:00 pm, Arrival and Registration

3:00 pm – 4:30 pm, Meet the Conferees

4:30 pm – 6:00 pm, Informal Reception, Light Refreshments

6:00 pm, Dinner

Sunday Evening Session, 7:30 pm – 10:00 pm, **Student Conceptual Difficulties in Thermodynamics**, Discussion Leader: Beth Ann Thacker, Texas Tech University

- Paula Heron, University of Washington, “Research on student understanding of thermal physics.” (50 min)
- Chris Kautz, Syracuse University, “Identifying student difficulties with the ideal gas law.” (50 min)
- Mike Loverude, California State University, Fullerton, “Student understanding of the first law of thermodynamics.” (50 min)

Monday, June 12

7:30 am – 8:30 am, Breakfast

Monday Morning Session, 9:00 am – 12:30 pm, **Statistical and Thermal Physics in the Introductory Course**, Discussion Leader: Norman Chonacky, Columbia University

- Bruce Sherwood and Ruth Chabay, Carnegie-Mellon University, “Atoms and matter: integrating mechanics and thermal physics in the introductory course.” (50 min)

10:00 am – 10:30 am, Conference photo session and coffee break

- Tom Moore, Pomona College, “Teaching statistical physics in the introductory course: A progress report.” (40 min)
- Wolfgang Christian, Davidson College, “Programming and internet technologies for undergraduate statistical mechanics.” (40 min)
- Priscilla Laws, Dickinson College, “Combining observations of macroscopic thermal phenomena with molecular simulation analysis.” (40 min)

12:30 pm - 1:30 pm, Lunch

2:00 pm, Informal Discussion Groups

6:00 pm, Dinner

Monday Evening Session, 7:30 pm – 9:30 pm, **Teaching Probability and Statistical Physics**, Discussion Leader: Royce Zia, Virginia Tech

- Giulio D'Agostini, University of Rome, "A maieutic(al) approach to teaching probability theory." (50 min)
- George Stell, SUNY, Stony Brook, "Teaching thermal and statistical physics: A personal odyssey thru several departments." (50 min)
- Peter T. Landsberg, University of Southampton, "From probability via entropy to statistical mechanics." (50 min)

Tuesday, June 13

7:30 am – 8:30 am, Breakfast

Tuesday Morning Session, 9:00 am – 12:30 pm, **Effective Teaching Strategies**, Discussion Leader: Lillian McDermott, University of Washington

- Harvey Leff, California State Polytechnic Institute, Pomona, "The physics of an 'empty' box: The photon gas as a teaching/learning tool." (45 min)
- Robert Hardy, University of Nebraska, "Why not use 'ordinary' mathematics when teaching thermodynamics?" (45 min)

10:30 am – 11:00 am, Coffee break

- Dan Schroeder, Weber State University, "The undergraduate thermal physics course: Who should take it and why?" (45 min)
- Jeffrey Prentis, University of Michigan, Dearborn, "Undergraduate experiments in statistical mechanics." (45 min)

12:30 pm - 1:30 pm, Lunch

2:00 pm, Informal Discussion Groups

4:30 pm - 6:00 pm, Poster Session

6 pm, Dinner

Tuesday Evening Session, 7:30 pm – 10:30 pm, **Broadening the Focus of Statistical Physics**, Discussion Leader: Jon Machta, University of Massachusetts, Amherst

- Michael Creutz, Brookhaven National Laboratory, "From path integrals to lattice gauge theory." (50 min)
- Beatte Schmittmann, Virginia Tech, "Contrasts between equilibrium and nonequilibrium steady states: What we can learn from simple model systems." (40 min)
- Daniel ben-Avraham, Clarkson University, "A simple model for teaching nonequilibrium kinetics and diffusion-limited reactions." (30 min)
- Craig Bohren, Pennsylvania State University, "Thermodynamics: A tragicomedy in several acts." (50 min)

Wednesday, June 14

7:30 am – 8:30 am, Breakfast

Wednesday Morning Session, 9:00 am – 12:30 pm, **Computational Statistical Mechanics**, Discussion Leader: Bulbul Chakraborty, Brandeis University

- Bruce Boghosian, Boston University, "Lattice-gas models of fluid flow." (45 min)
- Bill Hoover, University of California, Davis, "The smooth particle method." (45 min)

10:30 am – 11:00 am, Coffee break

- Alej Garcia, San Jose State University, “A numerical approach to teaching kinetic theory.” (45 min)
- Franz J. Vesely, University of Vienna, “Statistical physics for the sophomores.” (45 min)

12:30 pm - 1:30 pm, Lunch

2:00 pm, Informal Discussion Groups

5:00 pm - 6:00 pm, Planning session for next Gordon conference

6:00 pm, Dinner

Wednesday Evening Session, 7:30 pm – 10:00 pm, **Teaching of Statistical and Thermal Physics in Chemistry**, Discussion Leader: Irwin Oppenheim, MIT

- David Chandler, University of California, Berkeley, “Teaching statistical mechanics and thermodynamics in a modern physical chemistry course.” (50 min)
- David Meltzer, Iowa State University, “Conceptual problems with free energies in physics and chemistry.” (50 min)
- Brian B. Laird, University of Kansas, “Entropy, Disorder and Freezing.” (50 min)

Thursday, June 15

7:30 am – 8:30 am, Breakfast

Thursday Morning Session, 9:00 am – 12:30 pm, **Research of Interest in Undergraduate Statistical and Thermal Physics Courses**, Discussion Leader: Marcel den Nijs, University of Washington

- Debashish Chowdhury, I.I.T. Kanpur, India, “Use of models of vehicular traffic in teaching non-equilibrium statistical mechanics.” (60 min)

10:00 am – 10:30 am, Coffee break

- Andrea Liu and Doug Durian, UCLA, “Fluctuations in flowing foam.” (60 min)
- John Rundle, University of Colorado, “Statistical mechanics of earthquakes.” (60 min)

12:30 pm - 1:30 pm, Lunch

2:00 pm, Informal Discussion Groups

6:00 pm, Dinner

Thursday Evening Session, 7:30 pm – 9:30 pm, **Topics in Statistical and Thermal Physics**, Discussion Leader: Bill Klein, Boston University

- Ralph Baierlein, Northern Arizona University, “The Elusive Chemical Potential.” (50 min)
- Raj Pathria, University of Waterloo, “Phase transitions in finite-sized systems.” (50 min)
- Manuel G. Velarde, Facultad de Ciencias, UNED, Spain, “Summary Remarks.” (50 min)

Poster session, Tuesday, June 13, 4:30 pm – 6:00 pm

- Stephen Addison, University of Central Arkansas, “A method to illustrate the extensive and intensive properties of thermodynamic variables.”
- Martina Belz Arndt, University of New Hampshire, “The PFF Program: Preparing the next generation of physics faculty.”
- Joel Cannon, Washington and Jefferson College, “Non-thermodynamic thermodynamics calculations: Connecting calculus knowledge to thermodynamics.”
- E. Roger Cowley, Rutgers University, Camden, “Undergraduate projects using computer simulations.”
- Charles Cunningham, Grinnell College, “Low temperature experiments for teaching statistical mechanics.”
- Pal Fekete, University of Sydney, “Thermal Concept Inventory.”
- Nicholas A. Gross, Boston University, “Lecture as Story Telling.”
- Roy Jacobs, Imperial College, “Correlation functions for glass-forming systems.”
- Ken Jolls, Iowa State University, “Visualization in classical thermodynamics.”
- Miron Kaufman, Cleveland State University, “Thermal and statistical physics with Mathcad.”
- Jay Lowell, United State Air Force Academy, “Watching ice melt: a classroom investigation of phase change.”
- Bruce N. Miller (in collaboration with V. Paige Youngkins), Texas Christian University, “Gravitational phase transitions in a one-dimensional spherical system.”
- Jonathan Mitschele, Saint Joseph’s College (Maine), “Demonstrating conservation of mechanical energy where friction is involved.”
- Donald B. Mountcastle, University of Maine, “Are all two-state reactions the same?”
- Muhammad Numan, Indiana University of Pennsylvania, “Effective Interaction Through Bulletin Board in a Web-Based Thermal Physics Course.”
- Mark Peterson, Mt. Holyoke College, “Turbulence on a desktop.”
- Per Arne Rikvold (in collaboration with C. S. Soh), Florida State University, “Building ‘steam engines’ with LEGO.”
- Shubha Tewari, University of Massachusetts, Amherst, “Teaching statistical mechanics with Java applets.”
- Rodney Varley, Hunter College, “An Ideal Gas Teaching Module and Poster Exam.”
- Michael Vollmer, University of Applied Sciences, Brandenburg, “Visualization of energy transfer processes and the laws of radiation for physics education.”

Informal Discussion Groups

To encourage informal discussions, we have tentatively scheduled the following discussion groups. Feel free to suggest additional topics.

Monday afternoon. How should the term heat be defined? Should it be used? Power efficiency of heat engines.

Tuesday afternoon. Authors of recent texts, Baierlein, Carter, and Schroeder, discuss the goals of their respective texts.

Wednesday afternoon. (1) Kinds of probability and what do physics students need to know. (2) Entropy: role of microscopics, discussion of Lieb and Yngvason argument for keeping the second law independent from microscopic justification.

Thursday afternoon. (1) How much should the grand canonical ensemble be used in undergraduate courses? (2) Ideas for experiments and simulations in thermal physics courses.

Other suggestions for afternoon activities

Waterville Valley has many trails for day hikes plus mountain bikes and roller blades are available for rent. It is a few miles off 93. The exit is just north of Plymouth (2 exits - Campton). Along the road to Waterville, during the last half of Waterville Road, follow the Mad River. Many trails and picnic sights are marked from the road plus you can take a dip in a cool clear river. One of the markers should be for Dicke Mountain off River Road. A great afternoon hike, not too difficult. Pick blueberries at the top of the mountain with a great view of the valley.

There are many nice eating places in the area. In Plymouth there are a couple of pubs with beer and deli sandwiches. There is a nice deli pub attached to a mom and pop grocery downtown. Jigger Johnson's is a good place downtown. Fancier eats - Common Man in Ashland. Swiss restaurant on the way to Waterville. You might want to get reservations for these two. Also, several nice places in Waterville.

Go toward Rumney west of Plymouth on 25 to the Polar Bear Caves.

East of Plymouth are the Squam lakes.

There are many little towns next to Plymouth. It is worth just driving around with the idea that you plan to stop and maybe picnic or hike casually.