

## Princeton Center for Theoretical Science

The Princeton Center for Theoretical Science is dedicated to exploring the frontiers of theory in the natural sciences. Its purpose is to promote interaction among theorists and seed new directions in research, especially in areas cutting across traditional disciplinary boundaries.

The Center is home to a corps of Center Postdoctoral Fellows, chosen from nominations made by senior theoretical scientists around the world. A group of senior Faculty Fellows, chosen from science and engineering departments across the campus, are responsible for guiding the Center. Center activities include focused topical programs chosen from proposals by Princeton faculty across the natural sciences. The Center is located on the fourth floor of Jadwin Hall, in the heart of the campus "science neighborhood". The Center hopes to become the focus for innovation and cross-fertilization in theoretical natural science at Princeton.

### Faculty Fellows:

Paul Steinhardt, Director  
Igor Klebanov, Associate Director  
Ravindra Bhatt  
William Bialek  
Curtis Callan  
Roberto Car  
David Spergel  
Salvatore Torquato

### Center Postdoctoral Fellows:

Dmitry Abanin 2008-2011  
Benjamin Basso 2009-2012  
Adam Brown 2009-2012  
Bryan Clark 2009-2012  
Thomas Klose 2007-2010  
Jean-Luc Lehners 2007-2010  
M. Lisa Manning 2008-2011  
Matthew Reece 2008-2011  
Branson Stephens 2007-2010  
Aleksandra Walczak 2007-2010

### Center Associate Postdoctoral Fellows:

Jeremy England, Lewis-Sigler Institute for Integrative Genomics 2009-2010  
Shravan Hanasoge, Geosciences, 2009-2010

To find out more about Center Postdoctoral Fellowships and Programs see:

<http://pcts.princeton.edu/pcts>



## Computational Relativistic Astrophysics: *Frontiers of MHD*

**13-16 January 2010**

**Fourth Floor, Jadwin Hall**

### Organizers:

Adam Burrows  
Frans Pretorius  
Anatoly Spitkovsky  
Branson Stephens  
James Stone

**Co-sponsored by The D. E. Shaw Group**

## Wednesday, 13 January 2010

### “Compact object magnetospheres, force-free MHD”

8:45 am	Welcome Remarks <b>Anatoly Spitkovsky &amp; Paul Steinhardt</b>
*9:00 – 10:00 am	"Evolution of magnetized environments: force-free zoology" <b>Anatoly Spitkovsky, Princeton University</b>
10:00 – 11 am	"Dynamic magnetospheres of neutron stars." <b>Andrei Beloborodov, Columbia University</b>
<b>11 – 11:15 am</b>	<b>Coffee Break</b>
11:15 – 12:15 pm	"Force-free pulsar magnetosphere and electron-positron cascades in the polar cap" <b>Andrey Timokhin, UC Berkeley</b>
<b>12:15 – 1:30 pm</b>	<b>Lunch – On Your Own</b>
1:30 – 2:30 pm	"Pulsar Winds: A Possible Origin of Low Wind Magnetization and High Energy Emission". <b>Jonathan Arons, UC Berkeley</b>
<b>2:30 – 2:45 pm</b>	<b>Coffee Break</b>
*2:45 – 3:45 pm	"Unorthodox approaches to Magnetic fields for compact objects." <b>Luis Lehner, Perimeter Institute</b>
3:45 – 4:35 pm	"MHD Simulations of the Disk-Star Interaction" <b>Marina Romanova, Cornell University</b>
4:35 pm - 5:00 pm	"Accretion to Magnetized Stars: Instabilities and QPOs." <b>Akshay Kulkarni, Harvard University</b>
<b>5:00 - 7:00 pm</b>	<b>Reception at PCTS</b>

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\* *Talks appropriate for General Audiences*

*One hour talks are 40 minutes plus 20 minutes discussion.  
Thirty minute talks are 20 minutes plus 10 minutes discussion.*

## Thursday, 14 January 2010

### “Relativistic MHD, physics of accretion”

*9:00 – 10:00 am	"3D GRMHD Simulations: Stress at the ISCO" <b>John Hawley, University of Virginia</b>
10:00 – 11 am	"Relativistic MHD and relativistic radiative transfer". <b>Charles Gammie, University of Illinois</b>
<b>11 – 11:15 am</b>	<b>Coffee Break</b>
*11:15 – 12:15 pm	"3D General Relativistic Magnetohydrodynamical Simulations of Jet Formation and Propagation" <b>Jonathan McKinney, Stanford University</b>
<b>12:15 – 1:30 pm</b>	<b>Lunch – On Your Own</b>
1:30 – 2:30 pm	"Fields, Disks and Jets: The Role of Magnetic Field Topology in Black Hole Accretion Flows" <b>Kris Beckwith, University of Colorado, Boulder</b>
<b>2:30 – 2:45 pm</b>	<b>Coffee Break</b>
2:45 – 3:45 pm	"What Can We Learn from Simulations of Titled Black Hole Accretion Disks?" <b>Chris Fragile, College of Charleston</b>
<b>3:45 - 4:00 pm</b>	<b>Coffee Break</b>
*4:00 - 5:00 pm	"Connecting Radiation to Accretion Dynamics through Simulations" <b>Julian Krolik, Johns Hopkins University</b>

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## Friday, 15 January 2010

### "Relativistic MHD, Formation & Acceleration of Relativistic Jets"

- 9:00 – 10:00 am "The 3D force-free pulsar magnetosphere"  
**Ioannis Contopoulos, Academy of Athens**
- 10:00 – 11 am "On the fate of relativistic magnetized jets-  
computational and theoretical challenges"  
**Andrea Mignone, Torino University, Italy**
- 11 – 11:15 am Coffee Break**
- 11:15 – 12:15 pm "Simulations of relativistic plasma dynamics and jet  
acceleration in PWNe and GRB progenitors"  
**Luca Del Zanna, University of Florence, Italy.**
- 12:15 – 1:30 pm Lunch – On Your Own**
- 1:30 – 2:30 pm "Magnetic accelerations of relativistic jets. Insights  
from numerical simulations"  
**Serguei Komissarov, Leeds, United Kingdom**
- 2:30 – 2:45 pm Coffee Break**
- 2:45 – 3:45 pm "Relativistic hydro and magnetohydrodynamic models  
for AGN jets propagation and deceleration"  
**Rony Keppens, University Leuven, Belgium**
- 3:45 - 4:00 pm Coffee Break**
- 4:00 – 4:30 pm "Simulations and Analytic Models of Magnetized  
Gamma-Ray Burst Jets: Beyond the Progenitor Star"  
**Alexander Tchekhovskoy, Harvard University**
- 4:30 – 5:00 pm "Gravitational Waves from Magnetized Binary Neutron  
Star Mergers"  
**Bruno Giacomazzo, University of Maryland**
- 5:00 – 5:30 pm "Weibel instability in relativistic beams"  
**Igor Kaganovich, PPPL**

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## Saturday, 16 January 2010

### "Non-ideal MHD, radiation and kinetics"

- \*9:00 – 10:00 am "Effects of Anisotropic Thermal Conduction and  
Anisotropic Viscosity on Dilute Astrophysical  
Plasmas"  
**Eliot Quataert, UC Berkeley**
- 10:00 – 11 am "Going beyond the ideal approximations: resistive  
MHD and anisotropic ohm's law"  
**Carlos Palenzuela, CITA**
- 11 – 11:15 am Coffee Break**
- \*11:15 – 12:15 pm "Magnetic Reconnection in Extreme Astrophysical  
Environments"  
**Dmitri Uzdensky, University of Colorado,  
Boulder**
- 12:15 – 1:30 pm Lunch Served at the PCTS**
- 1:30 – 2:30 pm "PIC and MHD Simulations of Magnetic Field  
Amplification"  
**Weiqun Zhang, New York University**
- 2:30 – 2:45 pm Coffee Break**
- 2:45 – 3:15 pm "Charged Particle Acceleration in RMHD"  
**Jonathan Zrake, New York University**
- 3:15 – 3:45 pm "Godunov Methods for Radiation Hydrodynamics"  
**Michael Sekora, Princeton University**
- 3:45 - 4:00 pm Coffee and informal discussion**

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