

# Joint University-Fermilab Doctoral Program in Accelerator Physics

- Established in 1985
- Program works in a joint agreement with universities.
  - ❑ Fermilab provides the research facilities and mentors
  - ❑ Students maintain relationships with their home institution's advisers

## The Process :

- Student completes all of the university course requirements and prelim. exams
- A professor at the university acts as advisor
- Fermilab staff member acts as mentor
- PhD awarded by the university

☐ Fermilab PhD Committee approves application, and thesis topic.

☐ The Committee periodically reviews progress, approves continuation of the student in the program.

☐ Fermilab reimburses the university for the student's salary, and also provides an additional housing allowance.

# Fermilab Accelerator PhD program

## Graduates:

Vadim Kashikhin	(SRIEA, Russia) 2002	sc magnets
Vincent Wu	(Cincinnati) 2001	rf cavities/muCool
Jean-Paul Carneiro	(U. of Paris) 2000	photoinjector
O. Krivosheev	(TPU, Russia) 1998	energy deposition
K. Langen	(Wisconsin) 1997	
E. Colby	(UCLA) 1997	
L. Spentzouris	(Northwestern) 1996	
D. Olivieri	(Massachusetts) 1996	
P. Chou	(Northwestern) 1995	
D. Siergiej	(New Mexico) 1995	
X. Lu	(Colorado) 1994	
W. Graves	(Wisconsin) 1994	
K. Harkay	(Purdue) 1993	
P. Zhou	(Northwestern) 1993	
T. Satogata	(Northwestern) 1993	
J. Palkovic	(Wisconsin) 1991	
X. Wang	(IIT) 1991	
P. Zhang	(Houston) 1991	
S. Stahl	(Northwestern) 1991	
L. Sagalofsky	(Illinois) 1989	
L. Meringa	(Michigan) 1989	
M. Syphers	(Illinois - Chicago) 1987	

# Fermilab Accelerator PhD program

## Present Students:

### Kip Bishofberger

(Vladimir Shiltsev) (UCLA, J. Rosenzweig) Tevatron tune-shift compensation.

### Sergei Seletskiy

(Segei Nagaitsev) (Rochester, Adrian Melissinos). Recycler electron cooling.

### Linda Imbasciati

(Pierre Bauer) (TU-Vienna, H. Kirchmayr). Quench process in VLHC magnets.

### Ludovic Nicolas

(Nikolai Mokhov) (Glasgow, P. Bussey) Small angle effects in the Tevatron.

### Mohammad Alsharoa

(Al Moretti) (IIT, M. Gosz) High gradient rf cavities for muon collider and neutrino factory

### Phil Yoon

(Tanaji Sen/Mike Syphers) (Rochester, Arie Bodek) Beam stability studies in the Tevatron

### Xiaobiao Huang

(Eric Prebys) (Indiana, SY Lee) Booster studies for higher intensity

### Pavel Snopok

(David Neuffer/Carol Johnstone) (Michigan State, Martin Berz) Capture of a large phase space beam

### Alexey Poklonsky

(Carol Johnstone/Valeri Lebedev) (Michigan State, Martin Berz) Optimization and control of Tevatron parameters

### Bernardo Bordini

(Emanuela Barzi) (Pisa) Nb3Sn cable. NOT YET STARTED

## Other (non-program) Graduate Students...

### **Present Students with research at Photoinjector:**

Yin-e Sun, Chicago, flat beam  
Shauheng Wang, Indiana, flat beam  
Rodion Tikhoplav, Rochester, laser acceleration  
Matt Thompson, UCLA, plasma electron trapping  
Dan Bollinger, NIU, plasma acceleration

### **Relatively recent (since 1997) dissertations from Photoinjector:**

Eric Colby (UCLA)\*  
Alan Fry (Rochester)  
Michael Fitch (Rochester)  
Sven Fritzler (Darmstadt)  
Jean-Paul Carneiro (Paris)\*  
Nick Barov (UCLA)

*\*participants in FNAL PhD Program*

### **Present Student with research in Cryogenics:**

Christine Darve (Northwestern)

## The Russian Connection...

Early summer 2001, Victor Yarba proposed seeking Russian graduate students to participate in FNAL PhD program.

By August 2001, Witherell agreed to donate funds for 5 more positions, with ICAR playing a leading role in the search. Efforts coordinated by Linda Spentzouris.

Universities participating:

Chicago, IIT, NIU, Northwestern,  
Illinois, MSU, UCLA, Cornell

Spring 2002, team assembled and sent to Russia --

Kwang-Je Kim  
Jaime Rosensweig  
Hasan Padamsee  
Victor Yarba

February 2003:

Pavel Snopok and Alexey Poklonsky from St. Petersburg accepted into program, as students from MSU

# Web Page...

## <http://www-ap.fnal.gov/PhDProgram/>



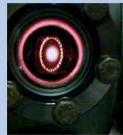
### Joint University-Fermilab Doctoral Program in Accelerator Physics

#### Degree Program Trains Accelerator Physicists at the World's Highest-Energy Particle Accelerator.

The Joint University-Fermilab Ph.D. Program was established in 1985 as a way to create dedicated training for accelerator physicists at the world's highest energy particle accelerator. The Ph.D. Program works in a joint agreement with universities. Fermilab provides the research facilities and mentors to guide students through their research, while the students maintain relationships with their home institution's advisers who oversee the student's progress toward their degree.

The University-Fermilab Ph.D. Program offers unique opportunities for research leading to a Ph.D. degree. Some of the current research areas include:

- Tevatron Luminosity Upgrade
- Stochastic and Electron Beam Cooling
- Beam-Beam and Space Charge compensation
- Accelerator Modeling and Simulation



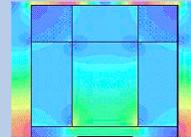
Electron beam for [beam-beam compensation](#) experiment

- Conventional and Superconducting Magnet Technology
- Conventional and Superconducting Radio Frequency Accelerating Structures
- Beam Instrumentation and Diagnostics
- Beam Transport and Magnetic Optics
- Non-linear Beam Dynamics



Pelletron assembly for [Electron Cooling Project](#)

- Linear Electron Colliders
- Very Large Hadron Colliders
- Muon Colliders and Neutrino Sources
- Advanced Accelerator R&D
- Medical Accelerators and Beams



Permanent Magnet field map

A graduate student at a university, interested in pursuing a degree in accelerator physics, who has completed all of the university course requirements, can do his/her research at Fermilab. A professor at the university acts as the university advisor, and the student carries out research at Fermilab with a Fermilab staff member on problems of current importance to the Laboratory's accelerator facilities, leading to a PhD awarded by the university.

The Fermilab Accelerator PhD Committee must approve the application of an interested student, and must also approve the thesis topic. The Committee periodically reviews the progress of the student, and approves continuation of the student in the program.

Fermilab reimburses the university for the student's salary, and also provides an additional housing allowance.

#### Joint University - Fermilab Doctoral Program in Accelerator Physics

- [List of graduates](#)
- [List of current students](#)

#### The Fermilab/NICADD Photoinjector Laboratory

The Fermilab/NICADD Photoinjector Laboratory supports a duplicate of the photoinjector that presently delivers beam to the superconducting linear accelerator at DESY's TESLA Test Facility. It comprises a copper radiofrequency (rf) photocathode gun, a TESLA 9-cell superconducting rf cavity operating at 1.3 GHz, and a beamline that includes a bunch compressor, assorted diagnostics for measuring the transverse and longitudinal phase spaces of the electron beam, and experimental stations. The overall program is dynamic and subject to change in keeping with new ideas for research, with many [possible thesis topics](#) related to the photoinjector and superconducting RF.



Fermilab/NICADD photoinjector

Particle beams are generated at Fermilab for high energy research and for accelerator research and development. The primary [Fermilab Accelerator Complex](#) consists of hydrogen ion sources, a 400 MeV linear accelerator, an 8 GeV proton Booster synchrotron, a 150 GeV Main Injector synchrotron, and the Tevatron synchrotron -- presently the world's highest energy particle accelerator operating at 980 GeV.

From the Main Injector, 120 GeV protons are targeted to produce and capture 8 GeV antiprotons which are stored in the 8 GeV Antiproton Accumulator Ring -- presently the collector of the world's most intense antimatter beams.

Other particle beam research presently being conducted at Fermilab utilizes electron beams for [electron cooling](#), [beam-beam compensation](#), and a linear collider-caliber photo-injector (see [above](#)).



Antiproton beams can be reverse-injected into the Tevatron to produce  $\sim 2$  TeV center-of-mass collisions of protons and antiprotons at points within the Tevatron accelerator. These collisions are observed with the [CDF](#) and [D0](#) detectors, which use this operational mode to discover, for example, the [Top Quark](#).

New experiments, using beams transferred from the Booster synchrotron and from the Main Injector, are also being constructed to perform searches for neutrino oscillations. (See, for example, the [HooNE](#) and [MINOS](#) experiments.)

Interested students and faculty can find information concerning accelerator and accelerator technology at Fermilab through the web sites of the Fermilab [Beams Division](#) and [Technical Division](#). Both divisions of the Laboratory participate in the PhD in Accelerator Physics program.

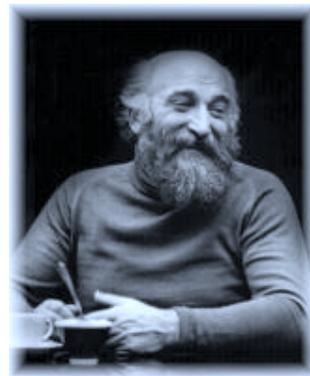
Graduate Students are invited to apply to this program by contacting [Roy Rubinstein](#), Fermi National Accelerator Laboratory, MS 105, P.O. BOX 500, Batavia, IL 60510 or the current chairman of the Accelerator PhD Committee, [Mike Syphers](#).

Last updated May 14, 2001. MJS

# Budker Seminar Series in Accelerator Physics

*Initiated in 1990's, later "named" by V. Shiltsev; since, coordinated by S. Nagaitsev, now P. Bauer.*

Student "pizza and beer" seminars for monitoring progress, posing questions, and practicing presentations...



**G. I. Budker 1918-1977**

Day: Last Tuesday of the month (typically, but not always!)

Time: 6:00 p.m.

Place: Music Room, Fermilab Users Center, Fermilab Village

Coordinator: Pierre Bauer, x5409, [pbauer@fnal.gov](mailto:pbauer@fnal.gov)

# United States Particle Accelerator School

## Fermilab Instructors Summer 1988 - Summer 2003

(ug) -- denotes *undergraduate* credit course; otherwise, all courses for graduate credit.

<u>Instructor</u>	<u>Total Credit Hours</u>	<u>Course Titles</u>
Carey, David	3	Introduction to Accelerator Optics (ug)
Cossairt, J. Donald	9	Topics in Radiation Damage Radiation Physics at Accelerators Radiation Physics, Regulation, and Management
Edwards, Donald	12	Introduction to Accelerator Physics
Glass, Henry	1.5	Magnetic Measurements
Holmes, Stephen	12	Experimental Methods in Accelerator Physics An Introduction to Particle Accelerators
Jackson, Gerald	13.5	Experimental Methods in Accelerator Physics Accelerator Instr. & Beam Measurement Lab Accelerator Vacuum Laboratory
Carol Johnstone	3	Accelerator Fundamentals (ug)
McGinnis, David	6	Introduction to RF Systems Microwave Measurement and Beam Physics Lab
Michelotti, Leo	6	Introduction to Modern Dynamics
Ng, K. Y.	6	Physics of Collective beam Instabilities
Ostiguy, Francois	9	Computer Lab for Accel Phys and Tech courses
Pasquinelli, Ralph	4.5	Microwave Measurement and Beam Physics Lab
Read, A. Lincoln	1.5	Topics in Radiation Damage
Spentzouris, Linda	9	Accelerator Fundamentals (ug) Plasma Physics in Beams
Syphers, Michael	25.5	Introduction to Accelerator Physics Design of High Energy Accelerators Accelerator Fundamentals (ug)
Webber, Robert	1.5	Introduction to RF Systems

**16 instructors,**

**123 credit hours,**

**~16 topics**

*List does not include semester courses taught at non-USPAS universities.*

M. Syphers /  
FNAL Accelerator PhD program