USPAS from a student’s perspective: learning about accelerator physics.

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Outline


- From the start: applying to USPAS and choosing a class.

- Curriculum: My two USPAS experiences.

- Extra curriculum.

- Conclusion: thank you, USPAS!
Motivation: US education in accelerators and microwaves.
European vs. US education

Europe

Basic University Education
Bachelor’s and Master’s
*Mostly classwork*

Graduate Education
PhD
*Mostly thesis*

USA

Basic University Education
Bachelor’s
*Mostly classwork*

Graduate Education
Master’s and PhD
*Classwork and thesis*

Classwork is an essential part of the US graduate education.
My MIT education

I came to MIT to learn about the accelerator physics.

MIT’s program in accelerators and microwaves: 8 students enrolled currently, 1-3 students graduate yearly.

MIT’s curriculum does not have classes in accelerator physics or microwaves.

My Russian education

I started my MIT PhD research relying on my Russian background in microwaves.

My education from Russia included training in:
- Vacuum electronics (undergraduate);
- Quasioptical systems;
- Physics of electron beams;
- Waves in media;
- Propagation and diffraction of waves;
- Laboratory in high power electronics.
Education in other US universities

<table>
<thead>
<tr>
<th>University</th>
<th># of classes in accelerators</th>
</tr>
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<tbody>
<tr>
<td>Stanford University</td>
<td>2</td>
</tr>
<tr>
<td>UCLA</td>
<td>2 (4 more in microwaves)</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>1 (in microwaves)</td>
</tr>
<tr>
<td>Indiana University</td>
<td>1</td>
</tr>
<tr>
<td>University of Wisconsin – Madison</td>
<td>4</td>
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Two-week courses: June 16-27, 2008
(each of the following full courses earns 3 credits from the University of Maryland)

- **Fundamentals of Accelerator Physics and Technology with Simulations and Measurements Lab (undergraduate level)**
  Vica Wu and Steven Mitboum, Duke

- **Beam Dynamics Experiments on the University of Maryland Electron Ring**
  Rami Kishek, Santiago Bernal, Ralph Fiorito, Patrick O'Shea, and the UMER Staff

Applying to USPAS and choosing a class

- **RF Superconductivity: Physics, Technology and Applications**
  Jean Delayen, Jefferson Lab

- **Beam Physics with Intense Space Charge**
  John Barnard and Steven Lund, Lawrence Livermore National Lab
Talking to my supervisor

- My supervisor was very supportive of my first attempt to go to USPAS.
- Second time he was very surprised “Why do you need to go for the second time, you have already been to USPAS last year?”
- He never had time to give me suggestions on the classes to take.
Choosing a class

In my first visit I took “Linear accelerators” class, because I needed background to progress in my thesis work.

In my second visit I took “Accelerator physics” class to learn about the accelerator physics in general.

I wish USPAS had an academic advisor to help students choose the right class for them.
Linear Accelerators class

The class on Linear Accelerators helped me design the traveling-wave $2\pi/3$ PBG accelerator structure.
Linear Accelerators class: cont.

I learned about structure’s shunt impedance, quality factor, coupling, and measuring the field’s profile with bead-pull. I applied this knowledge to my research right away.
Accelerator Physics class

Introduced in 1997 and has been presented at every school starting in 1998.

One of the two most popular classes at USPAS (Accelerator Fundamentals is the other most popular class).

Must teach about history and various types of accelerators, beams and rf, and applications of accelerators.
Accelerator Physics class: cont.

In my class I learned about:

- FODO lattice, FODO lattice once again, FODO lattice for the third time...

- Well, beam dynamics is important. But should not the Accelerator Physics class have a rigid curriculum year to year?
Extra curriculum
Extracurricular program: communication

USPAS should foster the sense of community among young accelerator physicists. Daily homework, breakfasts and dinners together serve the purpose!
What I did on the weekends 😊

On the weekends I went skiing…

Should I have been learning about the accelerator physics instead?
Extracurricular program: tour

A visit to a major accelerator laboratory would be of great interest to most students.

According to Prof. Wiedemann such a tour would be hard to organize due to the big size of the school.

Size of each USPAS is about 150 students. PAC tours involve more than 400 people. Tours should be possible for USPAS students.
Learning about today’s state-of-the-art

Many students would love to hear an easy introductory talk about new big accelerator projects, such as SNS, RHIC, LHC, and the current status of ILC.
Suggestions

- Educate University professors about the importance of the School.
- Develop core curriculum (Accelerator Physics class).
- Introduce tours of the US accelerator facilities and talks about the state-of-the-art.
Conclusion

- We are unlucky not to have an adequate accelerator physics curriculum in our Universities.

- The USPAS plays an essential role substituting for regular University classes in Accelerator physics for the US students.

- USPAS will succeed even more if we work with our accelerator community promoting the school.