DOE SYNCHROTRON: BETWEEN ACADEMIA AND INDUSTRY

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Sept 23, 2016
UIUC
UNPACKING THIS:

I’m a beamline scientist at the Advanced Photon Source at Argonne National Lab

OUTLINE

- My background
- National Lab Primer: How the Advanced Photon Source fits into Argonne
- Beamline Scientist at Advanced Photon Source
- Advice I should have taken
BACKGROUND

- BA in physics from University of Chicago 1999
- PhD in physics from UIUC in 2005
  - Photoemission with T.C. Chiang at Synchrotron Radiation Center in Stoughton, WI
- Postdoc at Brookhaven National Laboratory with John Hill 2005-2008
  - Resonant Inelastic X-ray Scattering
  - Visited Advanced Photon Source for experiments
- Beamline scientist at Advanced Photon Source at Argonne since 2008
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ARGONNE STATS

3,200+ EMPLOYEES IN 2015

1,250+ SCIENTISTS AND ENGINEERS

750+ POSTDOCS AND STUDENTS
###ARGONNE STRUCTURE###

####RESEARCH PROGRAMS####
- Lots of scientists performing closely related research
- Range between the very practically focused (Power Grid Modelling Group) to more basic research (Materials Science Division)
- Subjects driven by Dept of Energy – Energy storage and battery group

####USER FACILITIES####
- Provide visiting scientists with tools/techniques. Include – Advanced Photon Source – Leadership Computing Facility
- Visiting and local scientists work together to produce results
- Range between basic research and proprietary (industrial) research
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U.S. DEPARTMENT OF ENERGY OFFICE OF SCIENCE X-RAY LIGHT SOURCES

- Advanced Light Source at Lawrence Berkeley National Laboratory
- Linac Coherent Light Source and Stanford Synchrotron Radiation Light Source at SLAC National Accelerator Laboratory
- Advanced Photon Source at Argonne National Laboratory
- National Synchrotron Light Source II at Brookhaven National Laboratory

- Sources of scientific discovery and technological innovation
- A critical component of maintaining U.S. leadership in the physical sciences
HOW THE APS WORKS – THE EXPERIMENT HALL

APS is a bright source of monochromatic x-rays

- X-rays interact with electrons and are used for a lot of experimental techniques
- Electrons orbit the ‘ring’ (actually a polygon)
- When electrons turn a corner they emit photons (bremsstrahlung radiation)
- After each corner there is a research station that contains the instrumentation for an x-ray technique (diffraction, XAS, RIXS)
HOW THE APS WORKS – THE EXPERIMENT HALL

APS is a bright source of monochromatic x-rays

Actually a polygon, not a ring

Ring circumference ~1km so we use giant tricycles to get around
RADIATION ENCLOSURE FOR EXPERIMENT

- Sector 27 experimental equipment in radiation enclosure
- Sector 27 staff
WHERE YOU DURING AN EXPERIMENT

- Control station on the floor
- Users doing an experiment
FOUR MONTH SYNCHROTRON LIFECYCLE

Three times per year

- Proposals for experiments submitted
  - Rated by independent committee (not beamline staff)
  - Feasibility comments from beamline staff

- Eleven weeks of beamtime
  - ~9 external experiments
  - ~2 weeks of internal beamtime for commissioning/ internal experiments
  - 6 days of beamtime followed by one day of maintenance
  - Each (RIXS) experiment is granted 6 days of beamtime

- Six weeks of maintenance time
  - More extensive maintenance done – such as installing new optics, etc.
BEAMLINE SCIENTIST RESPONSIBILITIES

Help users perform experiments

- First day of experiment
  - Align beamline
  - Help users align sample
  - Teach users how to take measurements (software, displex, etc)

- Keep the beamline up and running
  - Take calls through evenings and weekends if needed
  - Help with measurements

- Work with users before they show up
  - Discuss what is possible with them (“No, we can’t reach 0.1K”)
  - Make sure needed equipment is there and ready (displex, sample holders)

- Talk to them after the experiment
  - Most typically how technical factors affected data
BEAMLINE SCIENTIST RESPONSIBILITIES

Maintain and improve beamline during maintenance periods
- Monochromator motor slipping – investigate and fix
- Install new optics, etc.
- Preparing for safety, funding, etc. review (DOE has lots of rules)

Do research and publish
- How important is this? It depends who you ask and when you ask them
DAY TO DAY

- Very autonomous
  - Good because we’re all adults and can get things done
  - Bad because communication can suffer

- Some things I did last (shutdown) week
  - Made drawings for machine shop for new piece of instrument. Discussed with lab tech who will make them.
  - Worked on DOE beamline review document
  - Thought about proposal to do Cobaltate research at different beamline
### BETWEEN ACADEMIA AND INDUSTRY

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<thead>
<tr>
<th>EXTREME ACADEMIC</th>
<th>INDUSTRIAL EXTREME</th>
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<tr>
<td>▪ Product is publications where you are the last author – they ensure more grant money/ tenure</td>
<td>▪ Product is developing processes/products desired by company</td>
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<td>▪ Direct research from a high altitude</td>
<td>▪ Closer to the bench</td>
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<td>– Much time spend writing grants/ teaching classes</td>
<td>– You’ll hold a wrench and work directly with lab techs</td>
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<td>– Promoting your results by giving talks, etc.</td>
<td>– Time also spend explaining results to rest of company</td>
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<tr>
<td>▪ Lots of research freedom</td>
<td>▪ Very directed work</td>
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BETWEEN ACADEMIA AND INDUSTRY

BEAMLINES SCIENTIST

- Product is beamline publications.
- Close to the bench
  - You’ll hold a wrench
  - With support staff (machine shop, lab techs, engineering group)
- Research often dictated by available tools
DOWNSIDES

- Can be tough to change jobs – we’re very specialized
- Schedule can be inflexible
  - Every now and then I’ll have a user that needs a lot of handholding nights/weekends
  - Worst beamtime ever: food poisoning during experiment
  - Caveat: most interesting jobs aren’t 9-5
- Politics can be nuts
- Government funding less secure than it once seemed
WHY BEAMLINE SCIENTIST

- The right amount of hands-on work
- Interesting days
  - Very smart, motivated colleagues
  - Always a lot going on
- Geographic area a good fit for me
  - I no longer was willing to live anywhere
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ADVICE I WISH I’D TAKEN

Soft skills are important

- Talk to more people. Maintain connections better.
  - A 30 minute chat with a collaborator often pushes projects forward more than 8 hours staring at data on computer screen
  - Like most enterprises, the relationships you have matter and should be looked after

- Prioritized better
  - Said ‘no’ to more requests
  - Ask for what you want