

DOE SYNCHROTRON: BETWEEN ACADEMIA AND INDUSTRY



MARY UPTON

Physicist

Advanced Photon Source

Argonne National Laboratory

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 IS PART OF THE DEPARTMENT OF ENERGY NATIONAL LABORATORY SYSTEM



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

Linac Coherent Light Source
and Stanford Synchrotron
Radiation Light Source at SLAC
National
Accelerator Laboratory



Advanced Light Source
at Lawrence Berkeley
National 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

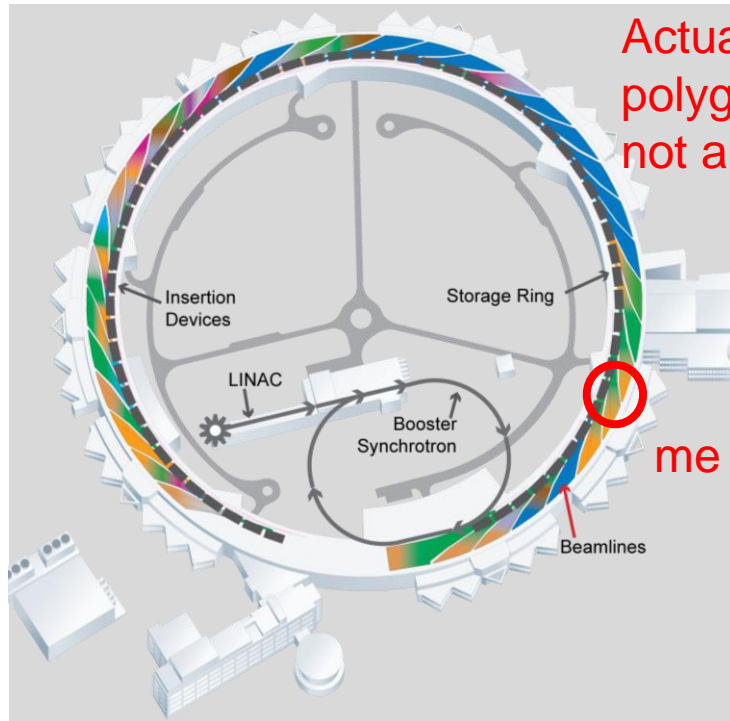
APS is a bright source of monochromatic x-rays



- 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

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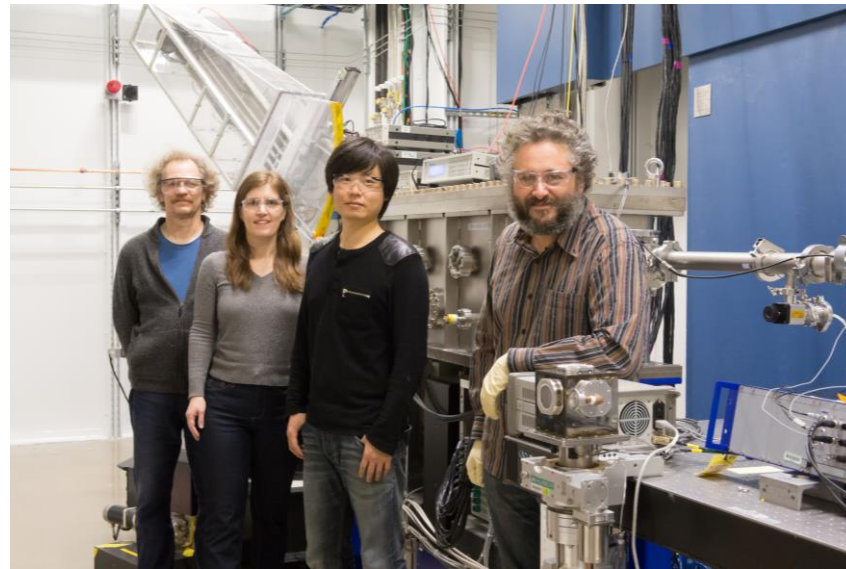
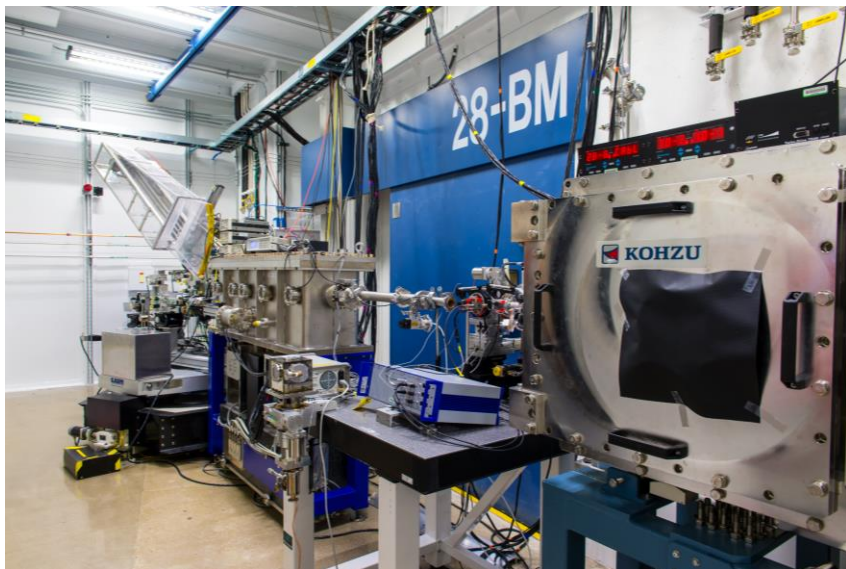
Actually a
polygon,
not a ring

me



Ring circumference ~1km so we
use giant tricycles to get around

RADIATION ENCLOSURE FOR EXPERIMENT



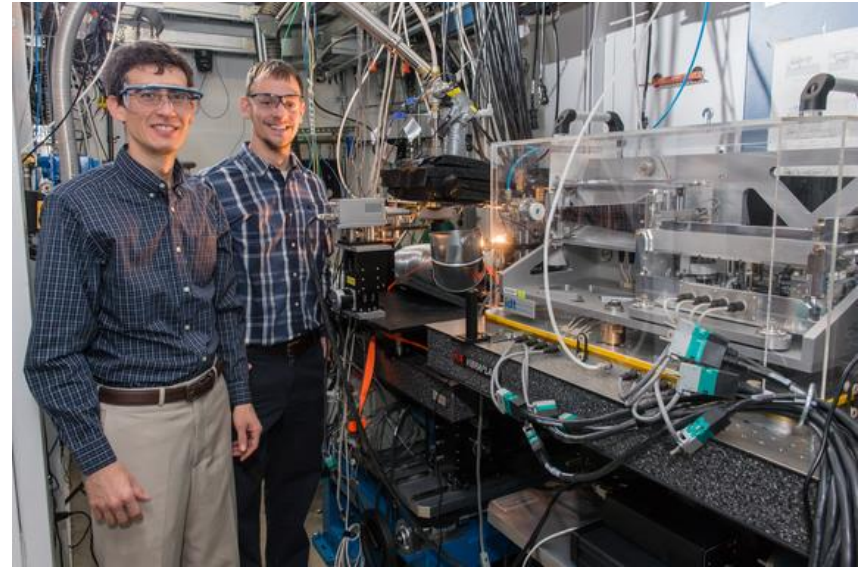
- Sector 27 experimental equipment in radiation enclosure

- 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

EXTREME ACADEMIC

- Product is publications where you are the last author – they ensure more grant money/ tenure
- Direct research from a high altitude
 - Much time spend writing grants/ teaching classes
 - Promoting your results by giving talks, etc.
- Lots of research freedom

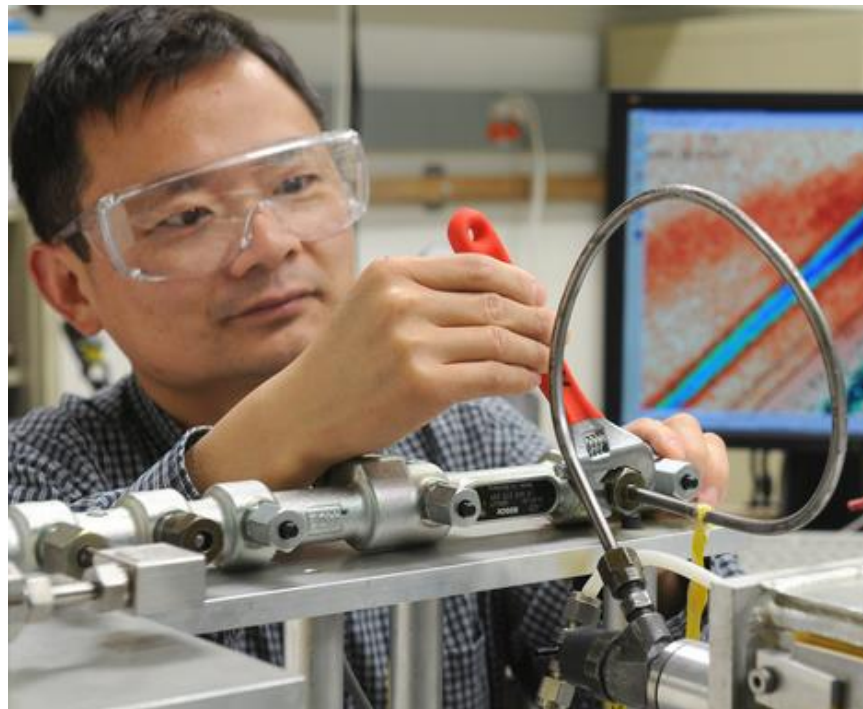
INDUSTRIAL EXTREME

- Product is developing processes/ products desired by company
- Closer to the bench
 - You'll hold a wrench and work directly with lab techs
 - Time also spend explaining results to rest of company
- Very directed work

BETWEEN ACADEMIA AND INDUSTRY

BEAMLINE 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



DOWNSIDERS

- 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





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