

Welcome; Structure of the School; X-ray and Lab Safety

Andrew Howard
Illinois Institute of Technology
ACA Summer School
9 July 2007

What you're going to hear here

- I cheated when I said this was just going to be an X-ray safety lecture!
- Welcome to the School
- What we're planning to do
- How you should think about the school
- X-ray and lab safety issues

Welcome!

- Welcome to IIT and to the fifth annual IIT- and Chicagoland-based Crystallography School
- We'll be working in two places over the next two weeks: IIT and APS
- Many people to thank:

Acknowledgements: Financial Contributions

- American Crystallographic Association
- Advanced Photon Source,
Argonne National Laboratory
- X-ray equipment vendors
- Pharmaceutical companies

In-kind contributions: Contributions of Time

- Illinois Institute of Technology (Howard, Segre)
- CSRRI (Kancauski)
- Rigaku / MSC (several people)!
- SER-CAT (Sharon Granger)

In-kind Contributions: Materials and Resources

- Hampton Research
- Emerald
- Beamlines: BioCARS, SBC, SER, NE, LS,
some others to be determined

What we're going to do here

- Lectures: many but short!
Be prepared to study outside sessions!
- Laboratory exercises:
X-rays here at IIT still under development
- Beamline efforts:
mostly so you can get experience;
but if you brought samples, we'll run 'em!

What we're going to try to do

- Expose you to the fundamental physics of crystallography
- Describe its applications to macromolecules
- Give you wet-lab experience
- Let you work on real X-ray equipment
- Let you work at real beamlines

Attitudes

- We want you to work hard , but we'll work our way gradually into it
 - Enjoy Chicagoland while you're here!
- “Life is like a sewer. What you get out of it depends on what you put into it.” -- Tom Lehrer

Use your laptops if you have them!

- We've set up permission to enable you to use our wireless systems
- You can use a lot of the software directly from your laptops
- *And* you can log in remotely to the Dead Nobels cluster in LS112

Tell me if you want to use the Keating Athletic Facility

- They're happy to give us temporary passes
- We just need to give them a list
- So tell me at the break!

X-ray Safety

- Starting point:
X-rays are dangerous.
They can hurt you.
- Next point:
X-rays aren't very dangerous.
You have to try pretty hard to get hurt

Some numbers

- Fatal doses of radiation ~ 10 Gy
- Typical accidental exposure to direct beam:
 $10 \text{ sec} * 0.8 * 10^8 \text{ Xph/sec} * 10^4 \text{ eV/Xph} * 1.6 * 10^{-19} \text{ J/eV} \sim 10^{-6} \text{ J}$
- If exposure is to 1 g tissue, that's 10^{-3} Gy

How to minimize exposure to ALARA levels

- Properly designed equipment
- Shielding
- Interlocks
- Housekeeping
- Signage
- Communication

These are 6-20 KeV X-rays. How is that special?

- X-rays are ionizing radiation!
- X-rays are low-LET radiation
- X-rays leave energy behind over a wide range.
- Less energetic than medical X-rays
 - Higher absorption by tissue
 - Less energy available per photon!

What other hazards are there?

- Electrical
- Falls, trip hazards
- Chemical toxicants
- Heavy atom reagents
 - Many are toxic
 - A few are radioactive, but not very . . .
- Cryogenics