




WELCOME TO THE ADVANCED PHOTON SOURCE

JOHN MACLEAN
Associate Division Director
APS Engineering Support Division



ON DECEMBER 2, 1942
MAN ACHIEVED HERE
THE FIRST SELF-SUSTAINING CHAIN REACTION
AND THEREBY INITIATED THE
CONTROLLED RELEASE OF NUCLEAR ENERGY



STORY OF CHICAGO PILE-1 TOLD VIA LEGO ANIMATION

<https://youtu.be/mTPiTJ2bKS0> or search for “chicago pile lego”



The Advanced Photon Source at Argonne supports the mission of the U.S. Department of Energy Office of Science by operating a technologically sophisticated, outstanding synchrotron radiation research facility that provides researchers in nearly every scientific discipline with high-brightness, high-energy, highly penetrating x-ray beams for studying the structure, chemistry, and behavior of the materials, both physical and biological, that comprise our world.



EPICS AND APS HISTORIES INTERTWINE

- EPICS collaboration born when Marty Kraimer visited Los Alamos for 6 months in October 1989 to work on GTACS
- 2nd ever EPICS collaboration meeting held at APS in 1994
- First ever meeting held in A5000 (executive meeting room)
- EPICS collaboration is older than this building

QUICK FACTS ABOUT THE ADVANCED PHOTON SOURCE

- 66 Independent experiment stations – most running EPICS
- More than 2,000 conventional electromagnets & 16 pulsed electromagnets
- More than 700 electron beam-position monitors, 600 magnets, & 80 computer systems to monitor & correct beam orbit and steer x-ray beams onto experiment samples to micron-size tolerances
- X-ray beam-position monitors to provide beam stability that is equivalent to firing a stream of bullets through the bull's-eye of a target from several miles away
- More than 120 computers, monitoring more than 25,000 signals, for personnel protection systems
- APS beam diagnostics that control 66 x-ray beams simultaneously
- A control system of more than 450 IOCs + 155 soft IOCs, more than 10,000 replaceable hardware components, & over 100,000 I/O points monitoring or controlling more than 500,000 process variables

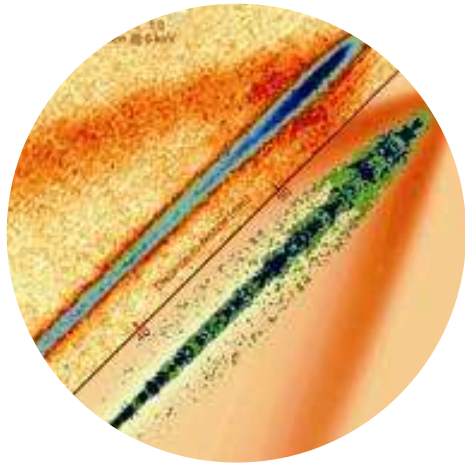


5300
researchers
each year

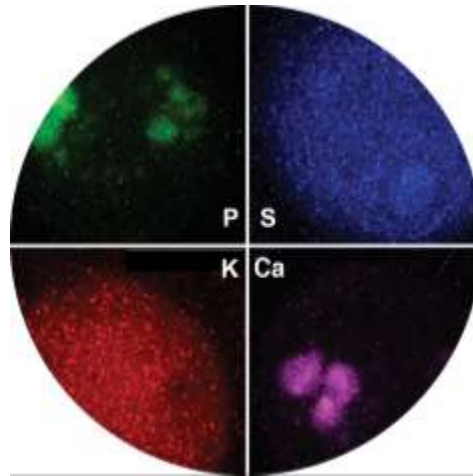
ADVANCED PHOTON SOURCE

- Researchers come to the APS from:
- 50 states plus Puerto Rico and the District of Columbia
- 33 countries
- 150 companies
- 250 universities

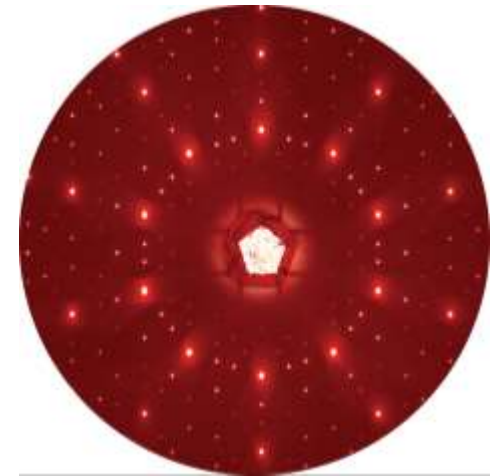
ADVANCED PHOTON SOURCE RESEARCH – THREE EXPERIMENT TYPES



IMAGING



SPECTROSCOPY



SCATTERING

- A number of techniques can be combined to gain the deepest understanding of a material or a physical or biological system.
- Results are increasingly multimodal and track changes as a sample evolves in time.

ADVANCED PHOTON SOURCE – SEEKS ANSWERS TO BIG QUESTIONS

What drives a material's electrical and mechanical properties?

How are new physics revealing secrets of superconductors?

What are the keys to new pharmaceuticals?

How do we gain a complete understanding of plutonium?

What is the Earth's core made of?

Why do battery electrodes degrade over time?

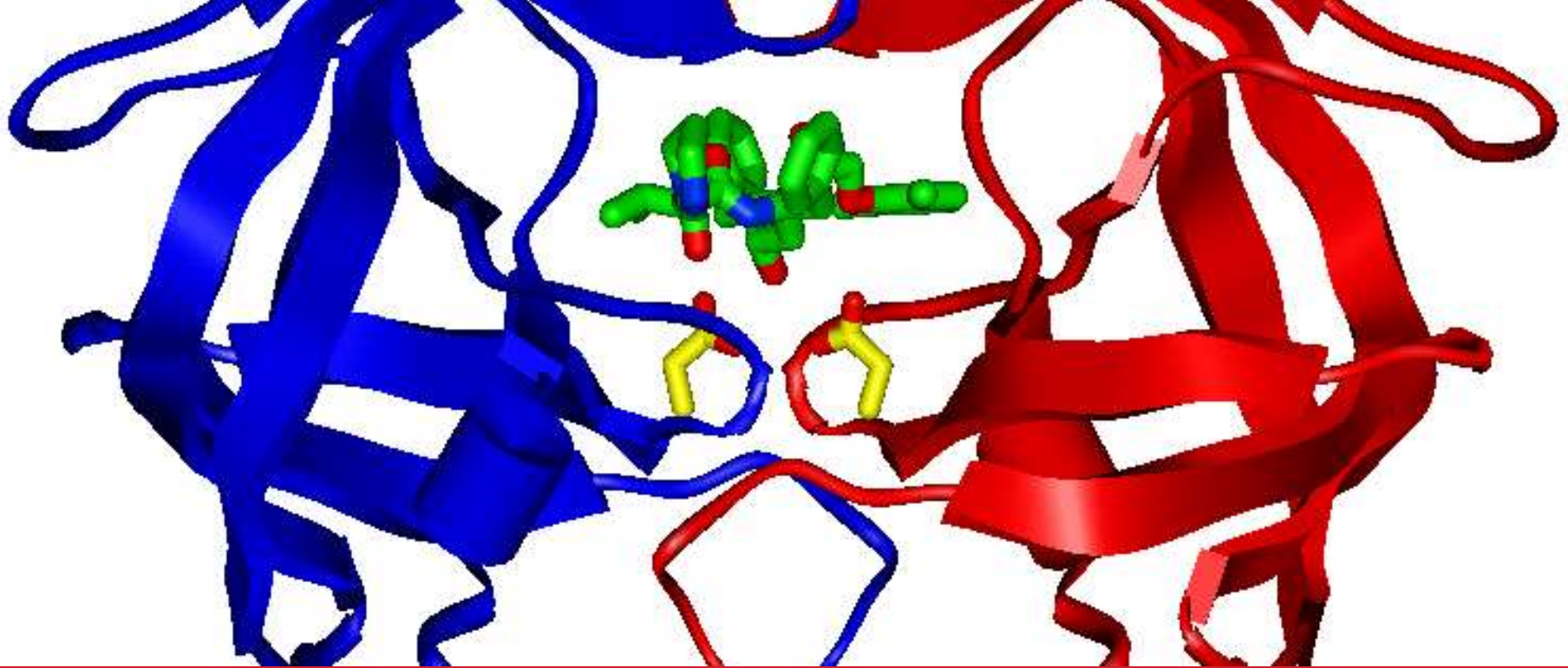
How do stresses and impurities alter a material's durability?



ARGONNE'S CATHODE TECHNOLOGY IN THE CHEVY VOLT BATTERY

- APS research gave critical information on cathodes, chemistry in Li-ion batteries
- Led to safer, longer-lasting, less expensive batteries

**50-100%
increase in
capacity**
over conventional
cathode material



ABBOTT LABS' KALETRA

- World-leading drug to fight AIDS
- Atomic-resolution structural research of HIV-drug interactions at APS

MICRO TOMOGRAPHY



Courtesy of Carmen Soriano Hoyuelos

NOBEL-PRIZE WINNING RESEARCH AT THE APS

Important discoveries about human physiology and clues to new pharmaceuticals to combat disease



Ada Yonath
Weizmann Institute
of Science, Israel



Thomas Steitz
Yale University, U.S.



**Venkatraman
Ramakrishnan**
MRC Laboratory of
Molecular Biology, U.K.

**2009 Nobel
Prize in
Chemistry**
Structure and
function of
the ribosome

**2012 Nobel
Prize in
Chemistry**
Studies of
G-protein-coupled
receptors (GPCRs)



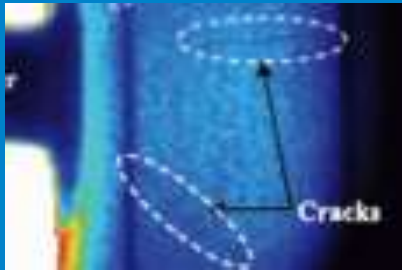
Brian K. Kobilka
Stanford University, U.S.



Robert J. Lefkowitz
Duke University, U.S.

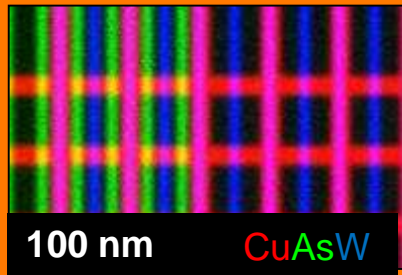
APS UPGRADE: THE ULTIMATE 3D MICROSCOPE

A next-generation synchrotron light source for science and industry



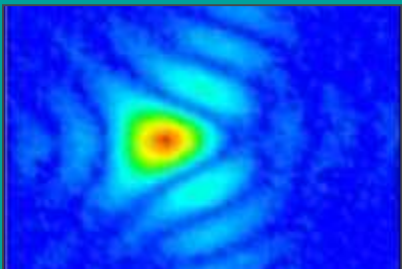
HIGH ENERGY

Penetrating bulk materials
and operating systems



BRIGHTNESS

Providing time-resolved, macroscopic
fields of view with nm-scale resolution



COHERENCE

Enabling highest spatial resolution
even in non-periodic materials

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THANK YOU.

