APS Upgrade Update

George Srajer and Dean Haeffner

APS Stakeholders Meeting

9 September 2013

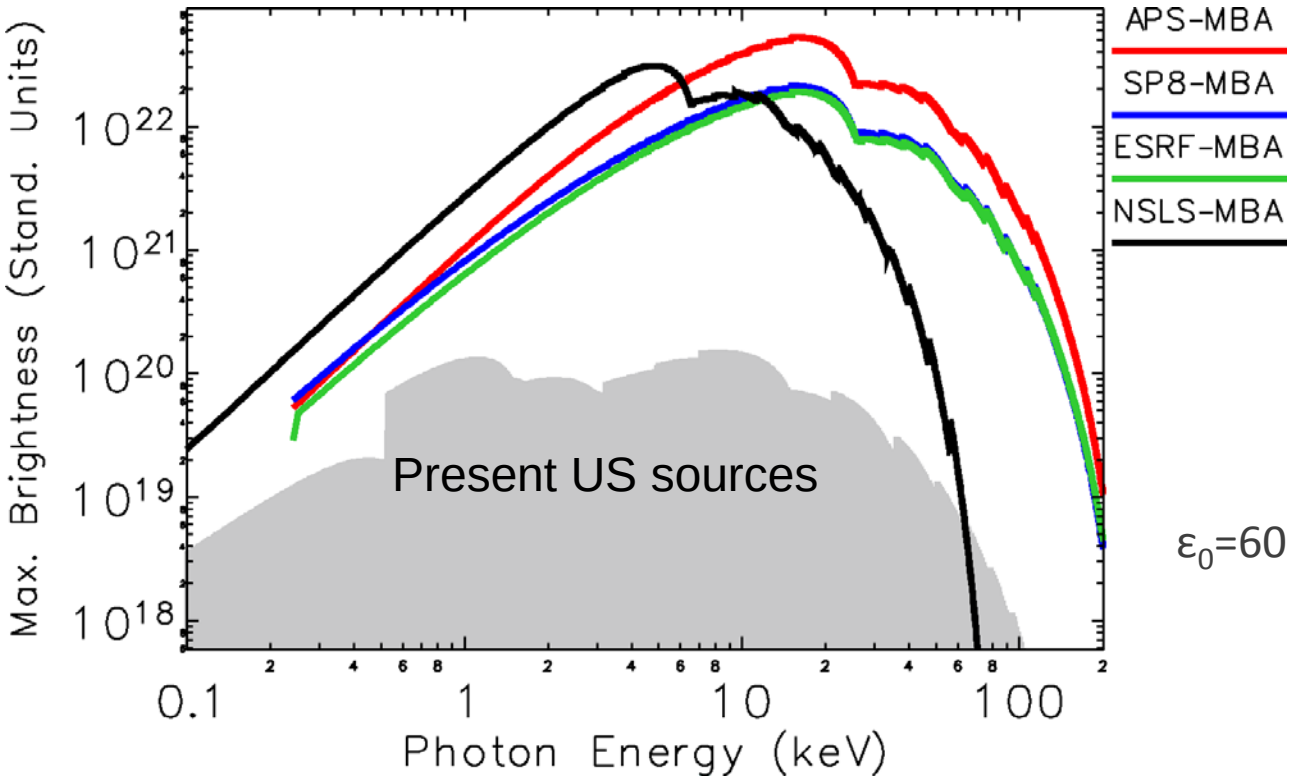
Planning at APS

Recommendation of BESAC Future Light Sources Review:

"The very large, diverse U.S. user population presently utilizing U.S. storage rings represents a major national resource for science and technology. It is essential that the facilities this science community relies on remain internationally competitive in the face of the innovative developments of storage rings in other countries. Such developments include diffraction-limited storage rings with beamlines, optics, and detectors compatible with the 10^2-10^3 increase in brightness afforded by upgraded storage rings."

APS is working with DOE to evaluate the incorporation of MBA technology into the ongoing APS Upgrade project

Opportunity for APS: World-Leading Brightness



ε_0=60 pm-rad

MBA lattice offers major improvements in brightness, coherent flux needed for nanoprobes, coherent imaging and dynamics

Community Engagement Plan

- August:

  - Initial evaluation of impact on the Upgrade and draft White Paper on incorporating MBA lattice into APS Upgrade http://www.aps.anl.gov/Upgrade/Documents

- September:

  - Engage user community, APS staff and other Labs in evaluating opportunities and organizing October workshop

- October 21-22:

  - Workshop to optimize incorporation of MBA into APS-U, including science opportunities for all communities

- November 6-7:

  - APS Scientific Advisory Committee review of Workshop report

Workshop on Science Opportunities with MBA Lattice

Monday, October 21

9:00-11:30 Plenary Session

MBA sources overview: scientific opportunities and global perspective

Source properties of a potential MBA lattice at the APS

Optics, detector, and instrumentation developments for high brightness x-ray sources

1:00-5:00 Breakout Sessions

Scanning Probe Imaging

Coherent Diffraction and Phase Contrast Imaging, XPCS

Timing and Dynamics

Interface and Single Crystal Diffraction

Structural and High Energy Scattering, SAXS

Spectroscopy and Inelastic Scattering

Macromolecular Crystallography

Tuesday, October 22

9:00-11:00 Breakout Discussion and Report Preparation

11:00-12:00 Workshop Reports and Plenary Discussion

1:30-4:30 Workshop Reports and Plenary Discussion continued

Organizing Committee

- *Dean Haeffner (chair)*
- *George Srajer*
- *Jonathan Lang*
- *Dennis Mills*
- *Mark Beno*
- *Connie Vanni*
- *Diane Wilkinson*
- *Denis Keane*

Workshop on Science Opportunities with MBA Lattice

Breakout Session	Internal Lead	External Lead*
Scanning Probe Imaging	Stefan Vogt	Tonio Buonassisi
Coherent Diffraction & Phase Contrast Imaging, XPCS	Jin Wang	Oleg Shpyrko
Timing/Dynamics	David Keavney	Paul Evans
Interface and Single Crystal Diffraction	Jon Tischler	Paul Fuoss
Powder/PDF/SAXS/HighE/nanoDiff/ HP	Ian Illavsky	Lyle Levine
Spectroscopy & Inelastic Scattering	Steve Heald	Clem Burns
Macromolecular Crystallography	Robert Fischetti	George Phillips

* Invited. Not all confirmed yet.

Proposed Topic Area Teams

Scanning Probe Imaging	**Stefan Vogt**	**Tonio Buonassisi**
	Wenjun Liu	Steve Sutton
	Jörg Maser	Conal Murray
	Martin Holt	Gayle Woloschak
	Barry Lai	
Coherent Diffraction & Phase Contrast Imaging, XPCS	**Jin Wang**	**Oleg Shpyrko**
	David Vine	Ian Robinson
	Alec Sandy	Stephan Hruszkewycz
	Ian McNulty	Paul Neeley
	Ross Harder	Wenge Yang
	Francesco De Carlo	Larry Lurio
	Kamel Fezzaa	
Timing/Dynamics	**David Keavney**	**Paul Evans**
	Eric Dufresne	David Ries
	Tim Graber	Lin Chen
	Ercan Alp	Herman Durr
	Steve Southworth	Bill Bailey

Proposed Topic Area Teams

Interface and Single Crystal Diffraction	**Jon Tischler**	**Paul Fuoss**
	Christian Schleputz	J. Kent Blasie
	Zahir Islam	Paul Fenter
	Hawoong Hong	Jim Viccaro
	John Freeland	Fred Walker
		Tai Chang
		Roberto Felici
Powder/PDF/SAXS/HighE/nanoDiff/HP	**Jan Illavsky**	**Lyle Levine**
	Karena Chapman	Angus Wilkinson
	Randy Winans	Jon Budai
	Matt Suchomel	Mark Rivers
	Jon Almer	Gouyin Shen
		Bob Suter

Proposed Topic Area Teams

Spectroscopy & Inelastic Scattering	**Steve Heald**	Clem Burns
	Daniel Haskel	Peter Abbamonte
	Thomas Gog	Dario Arena
	John Freeland	Gerald Seidler
	Tom Toellner	Simon Bare
		John Hill
		Paul Chow
Macromolecular Crystallography	**Robert Fischetti**	George Phillips
	Keith Brister	Sean McSweeney
	Keith Moffat	Vadim Cherezov
	Steve Ealich	Janet Smith
	Andrzej Joachimiak	

Goals for the Workshop

- *Inform the APS community* concerning the properties of an MBA low-emittance lattice being considered in the APS Upgrade.
- *Gather input on the new science opportunities* offered by such a source.
- Address how our current suite of beamlines map onto these envisioned science opportunities, and *what new capabilities are needed.*
- *Explore the technical advances in optics, detectors, and undulators* that are required to realize these science opportunities.
- *Identify areas that require R&D efforts* to achieve the ultimate performance from an MBA x-ray source.

Input from the user community and APS staff essential

Pre Workshop Activities

- *Form subject teams to support leads with outreach, report writing, workshop activities*
  - *Local people invited*
  - *Outside user invitations out this week*
- *Local preliminary meeting with each of the seven areas*
  - *Start on Thursday (timing), others by end of next week*
  - *Orientation by Dean Haeffner, accelerator aspects by accelerator representative*
  - *Participants will be given homework assignments on the effects of MBA upgrade on their program*
  - *Goal is to have every interested person at the APS at one of these meetings*
- *Local follow up meeting*
  - *Approximately two weeks before the workshop*
  - *Follow up to questions*
  - *Initial attempt to put together draft report for the workshop*

Work in Progress

- *Invitations out to preliminary meetings starting today*
- *Webpage should be up today*
- *Registration page open by end of the week*
- *Template for workshop report should be finished today and will be distributed to leads*

Summary

- Recent report by the BESAC recommended evaluating "multi-bend achromat" (MBA) technology that provides 100x brightness improvements
  - High coherent flux, high intensity focusable to smallest (e.g. nanometer) spots
  - Maintains advantages of rings: high flux (~10^{14}-10^{15} photons/sec), stability and capacity
  - Essential to remain world-leading
- We will work with DOE Office of Science and the scientific community to study incorporating an MBA lattice into the APS Upgrade project
- Workshop on Science Opportunities is scheduled for October 21-22
- Workshop report will be reviewed by SAC and subsequently incorporated in a proposal to the Office of Science
- Incorporation of the MBA lattice in the APS Upgrade offers transformational scientific opportunities