

# Proposal for the workshop on challenges in the study of materials at extreme conditions using DAC at NSLS-II

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## Motivation:

NSLS-II began operations in October 2014, and is currently rapidly ramping up its science and user programs and continuing the development of new beamlines and associated scientific capabilities. It is designed to deliver world-leading intensity and brightness, producing x-rays more than 10,000 times brighter than the original NSLS. The exceptional beam brightness enables the study of material properties and functions with unprecedented spatial and energy resolution and with the ultra-high sensitivity required to probe materials at extreme conditions. Diamond anvil cells (DACs) with laser heating capability supply extreme environments to study physics, chemistry, mechanical and transport properties of materials, especially at the conditions relevant to the Earth and other planets' interiors. The COMPRES DAC program at the original NSLS had been a workhorse for synchrotron-based experimental high-pressure research in the COMPRES community, and was the most productive COMPRES facility based on the data in the COMPRES 2017-2022 renewal proposal to NSF (see table below).

Table 1. COMPRES Facilities Publication Statistics (2012-2016)

	2012	2013	2014	2015	2016*	Total
12.2.2 DAC ALS	32	31	22	20	11	116
U2A IR DAC NSLS	16	12	20	11	10	69
X17B2 Multi-anvil NSLS	12	13	14	5	6	50
X17C/B3 DAC NSLS	34	34	51	27	20	166
Sector 3 IXS DAC + Mössbauer APS	10	3	13	9	6	41
Gas Loading APS	17	23	24	40	24	128
ASU Multi-anvil	3	9	9	7	3	31
PX <sup>2</sup> APS	N/A	N/A	N/A	N/A	3	3
6BM-B Multi-anvil APS	N/A	N/A	N/A	N/A	0	0
E01D other	4	4	0	0	0	8
Central Office	2	8	0	0	0	10
Total	130	137	153	119	83	622

Peer-reviewed publications and theses.

\* Through July 2016

Although COMPRES has decided to terminate the DAC program at NSLS and not to continue the program at NSLS-II, the emerging x-ray techniques, heavily oversubscribed high pressure

beamlines at the Advanced Photon Source (APS) and the increasing growth in the demand of high-pressure in-situ x-ray studies using DACs in the COMPRES community (e.g. quite a few recently hired faculty members in Earth science departments at various universities (*e.g.*, Rebecca Fischer at Harvard University, June Wicks at Johns Hopkins University, Heather Watson at Union College, Susannah Dorfman at Michigan State University, Jin Zhang at University of New Mexico and Mainak Mookherjee at Florida State University) are appealing for a community-based discussion regarding ideas about how to take the advantages of NSLS-II for Materials Properties Research in Earth Science. This workshop aims to offer a platform for such discussions.

### **Scope of the workshop:**

- \*Review and highlight features of existing beamlines and planned future beamlines at NSLS-II.
- \*Review the demands for a DAC facility from the COMPRES community.
- \*Discuss the possible proposal to COMPRES for establishing a DAC facility at NSLS-II and its management structure.
- \*Solicit ideas for fundraising to maximize resources to support the operation of the DAC facility at NSLS-II.

### **Date of the workshop:**

Saturday, October 14, 2017

### **Workshop site:**

Long Island, NY

### **Agenda of workshop:**

#### **Schedule:**

9:00 opening

9:10-9:35, 9:35-10:00, 10:00-10:25 (3 talks, 25min each)

10:25-10:40 (break)

10:40-11:05, 11:05-11:30, 11:30-11:55 (3 talks, 25 min each)

11:55-13:30 lunch

13:30-13:55, 13:55-14:20, 14:20-14:45 (3 talks, 25min each)

14:45-15:00 (break)

15:00-15:25, 15:25-15:50, 15:50-16:15 (3 talks, 25min each)

16:15-17:00 Discussion on proposal key elements: unique techniques at NSLS-II to apply to DAC, COMPRES user group for NSLS-II DAC.

17:00 Adjourn

Invited speakers (\*) and invited attendees (more are acceptable):

Total 40 people expected

- \*Dave Mao
- \*Qun Shen (NSLS-II)
- \*Ian Robinson (X-Ray Scattering Group leader, BNL)
- \*Eric Dooryhee (lead scientist of XPD, NSLS-II)
- \*Zhong, Zhong (lead scientist of HEXXS, NSLS-II)
- \*John Parise (Stony Brook)
- \*Mark Rivers (APS)
- \*Wenge Yang
- \*Tom Duffy
- \*Yingwei Fei
- \*Kanani Lee
- \*Jung-fu Lin
- \*John Parise
- \*Steven Jacobsen
- \*Jin Zhang
- \*Sean Shieh

Jiuhua Chen (Florida International)  
Rebecca Fischer (Harvard U)  
Mainak Mookherjee (Florida State)  
Peter Heaney (Penn State)  
Elizabeth Cottrell (Smithsonian Institution)  
June Wicks (Johns Hopkins)  
Susannah (Suki) Dorfman (Michigan State University)  
Jie (Jackie) Li  
Wendy Panero  
Heather Watson (Union College)  
Jay Bass  
Mike Walters  
Alexander Goncharov  
Nancy Ross  
John Tse  
Abby Kavner  
Carl Agee  
Donald Weidner  
Lars Ehm  
Zhiqiang Chen (former X17C beamline scientist)  
Xinguo Hong (former X17C beamline scientist)

Zhenxian Liu (NSLS-II IR project)

Cai, Yong (lead scientist of IXS, NSLS-II)

Chu, Yong (lead scientist of HXN, NSLS-II)

Fluerasu, Andrei (lead scientist of IXS, NSLS-II)

John Hill (Director of NSLS-II)

Zschack, Paul (deputy director of NSLS-II)

Pindak, Ronald (supervisor of condense matter division of NSLS-II)

Irving Herman (Columbia University)

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**Budget:**

Support for 30 invited nonlocal participants listed above including speakers: \$27,150

Airline ticket allowance: \$500/participant

Hotel room for two nights at \$130/night: \$260/participant

Meals and coffee breaks (two breakfasts at \$15; one lunch at \$25; two dinners at \$35; two coffee breaks at \$10): \$145/participant

Support for 10 local participants list above including speakers: \$950

Meals and coffee breaks (one breakfast at \$15; one lunch at \$25; one dinner at \$35; two coffee breaks at \$10): \$95/participant

Support for workshop materials printing: \$400

Total support requested: \$28,500.