

High Pressure -- A New Dimension at APS

Guoyin Shen

HPCAT

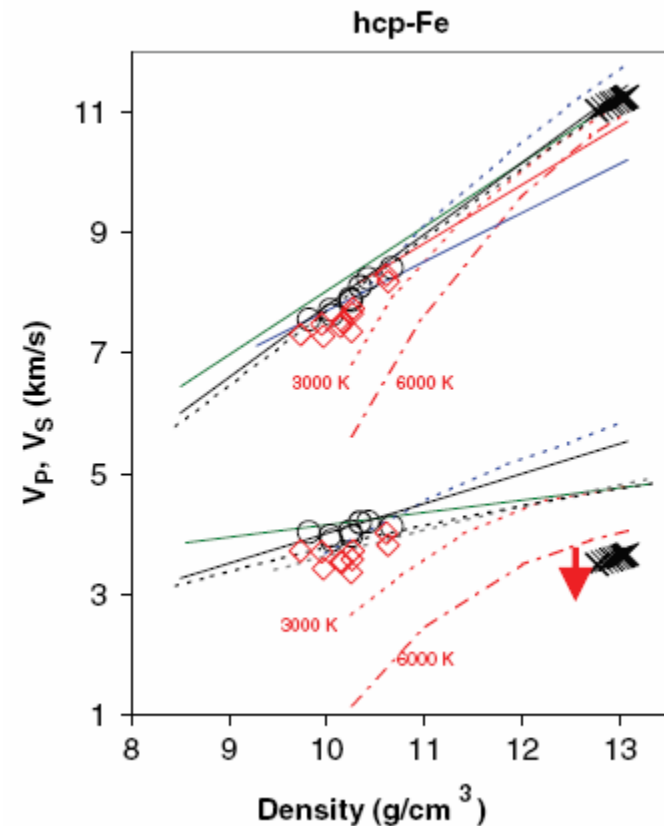
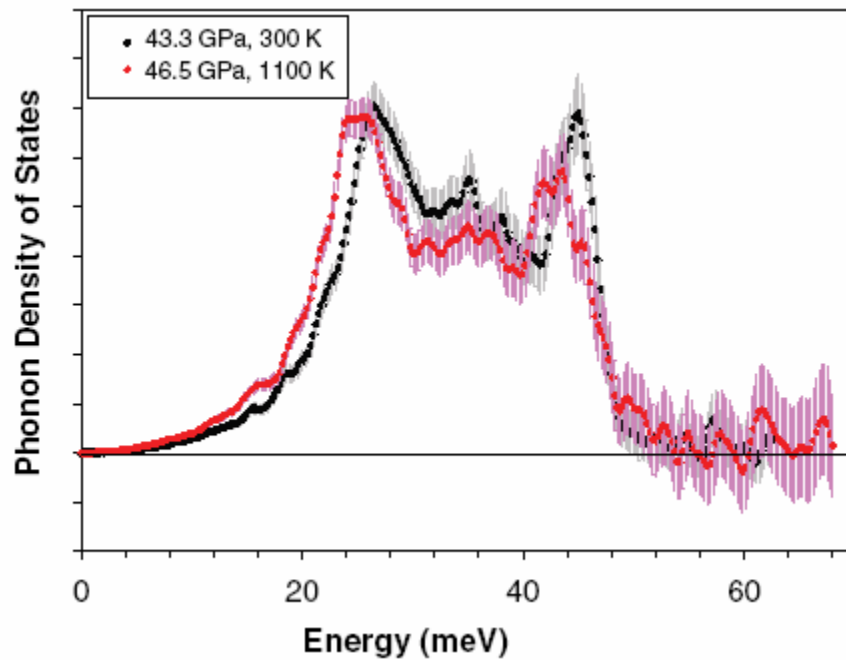
High-pressure and synchrotron

- Sample size and synchrotron beam
- Surrounding (window) materials and x-ray energies
- Novel science and synchrotron *in situ* probes

Pressure as a dimension

- **Fundamental Physics**
Novel Phenomena and States of Matter
- **Fundamental Chemistry**
New Periodic Table and Bonding
- **Geophysics & Geochemistry**
Root of Plate Tectonics and Core Formation
- **Planetology & Astrophysics**
Extrasolar Planets and Warm Dense Matter
- **Materials Science**
New Classes of Materials (10X)
- **Biology and Biochemistry**
Origin and Evolution of Life

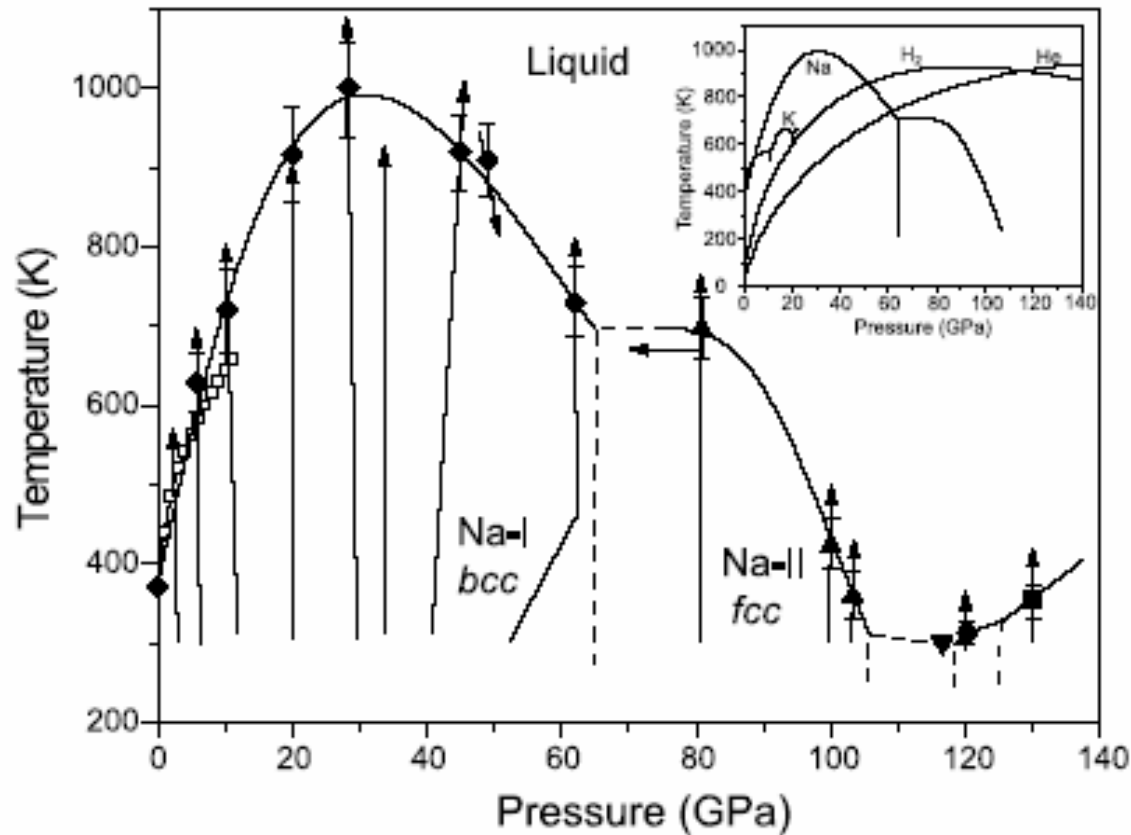
Lin et al, Science (2005) Hot iron at high pressures



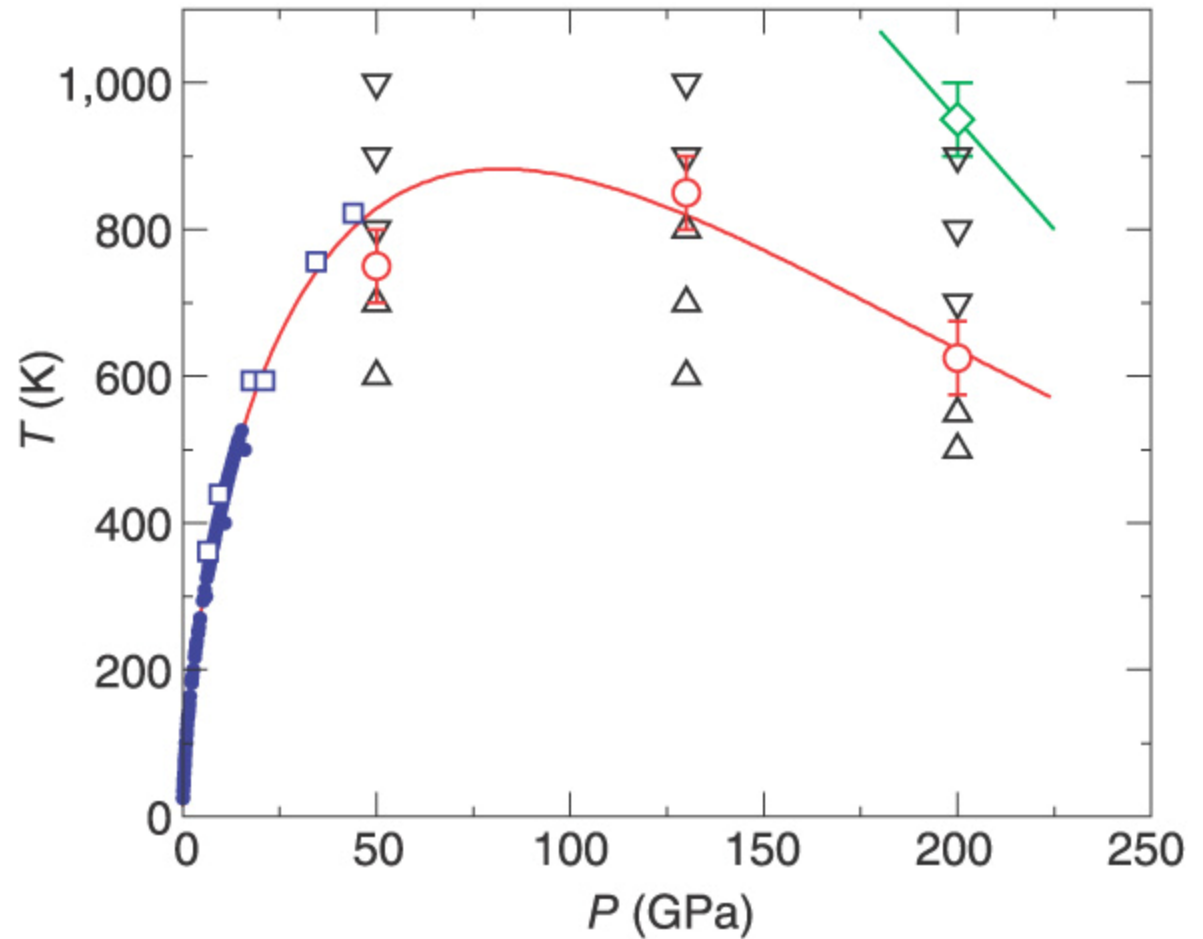
Sectors 3, 13, 16

Gregoryanz et al, PRL (2005)

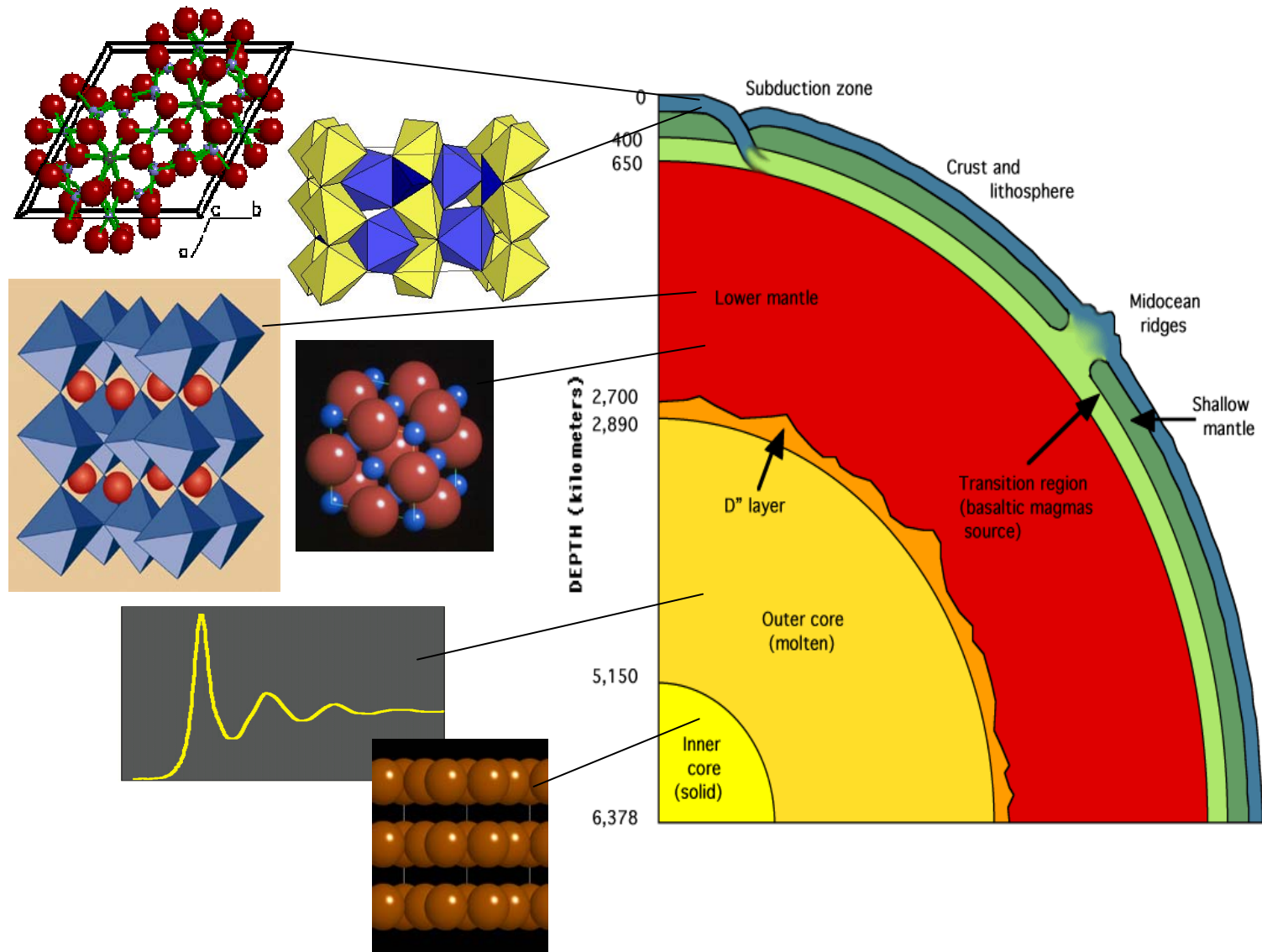
Dense sodium at high pressure



Bonev et al, Nature (2004) – first principles



GSECARS: Understanding micro-to-macro relations



High-pressure researches at APS

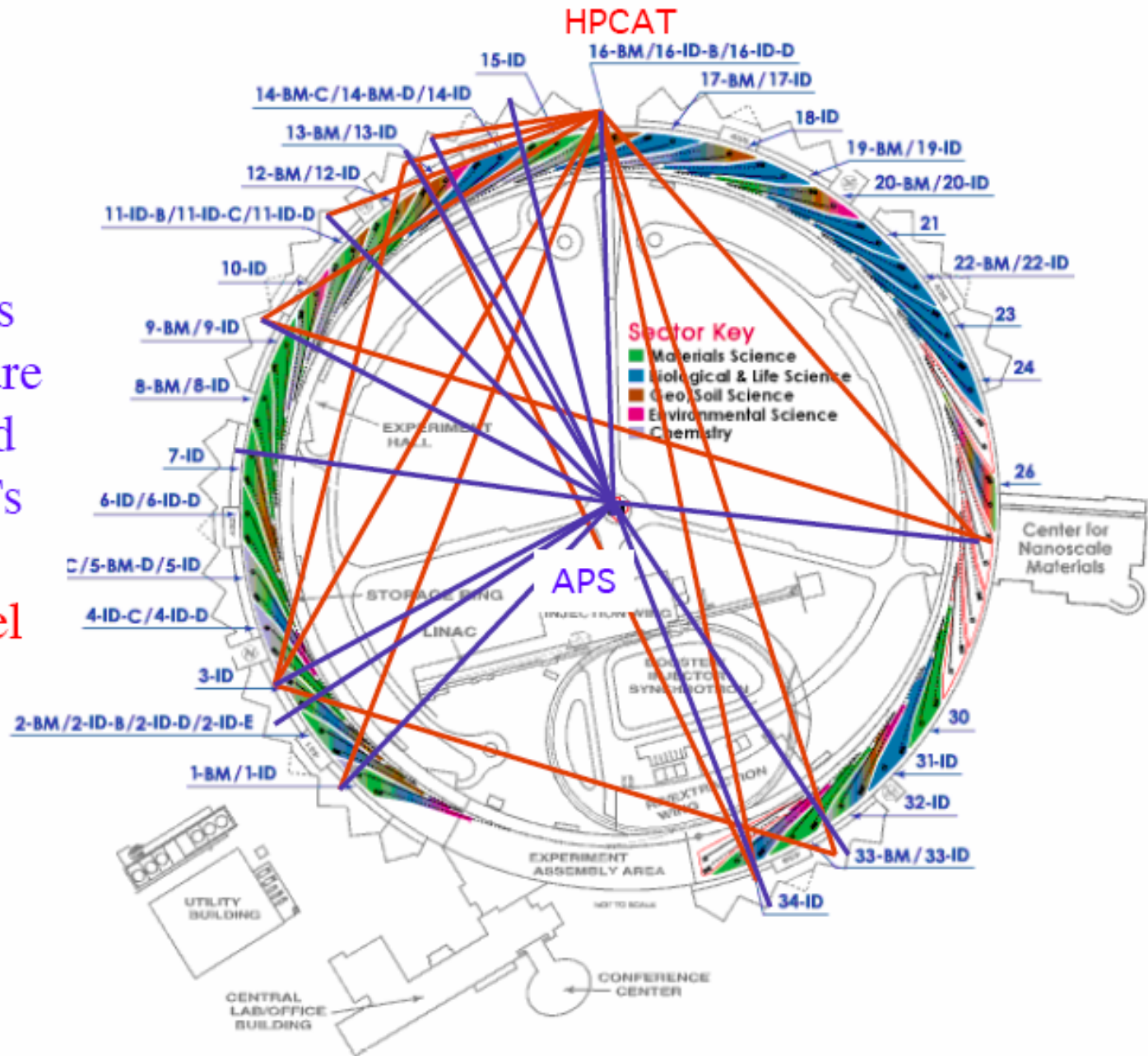
- Sector 1: PDF, high energy
- Sector 3: Phonon DOS, NFS, NEXS
- Sector 4: Magnetic, XMCD
- Sector 11: Amorphous, high energy
- Sector 13: DAC, LVP, diffraction, imaging, Geoscience
- Sector 16: Diffraction, spectroscopy (NRIXS, XES, Raman)
- Sector 20: EXAFS
- Sector 34: micro-diffraction, single crystal

The ideal approach

APS promotes the high-pressure dimension and connects CATs

HPCAT

advances novel development



Town meeting on Nov 2, 2005 at APS

8:30 a.m.	Welcome	Murray Gibson/Dennis Mills Gabrielle Long
8:45 a.m.	A proposal for a High-Pressure Center at the Advanced Photon Source - HPCAPS	Dave Mao
9:15 a.m.	GSECARS needs and COMPRES Facilities Committee Views of HP-CAPS	Mark Rivers
9:30 a.m.	HPCAT facilities for high pressure research	Guoyin Shen
9:45 a.m.	High pressure research with nuclear resonant scattering	Wolfgang Sturhahn
10:00 a.m.	Research opportunities at the large-volume high pressure facilities at GSECARS	Yanbin Wang
10:45 a.m.	Prospects for Polychromatic Nanoprobe Beams for HP	Gene Ice
11:00 a.m.	Capabilities for high-energy scattering at Sector 1 and how they might benefit HPCAPS	Dean Haeffner
11:15 a.m.	High Pressure Biological Macromolecules	Keith Brister

Town meeting on Nov 2, 2005 at APS

11:30 a.m.	EXAFS at high pressure	Matt Newville
11:45 a.m.	High pressure studies from glasses and amorphous materials	Chris Benmore
1:30 p.m.	High pressure XMCD studies of 3d metals	Jonathan Lang
1:45 p.m.	High pressure induced quantum phase transition in strongly correlated condensed matter systems	Yejun Feng
2:00 p.m.	Novel approaches to microdiffraction and their applications in high-pressure research	Przemek Dera
2:15 p.m.	Prospects for high pressure research at the new IXS beamline	E. Ercan Alp
2:30 p.m.	Sector 2 microprobes' capabilities	Barry Lai
2:45 p.m.	Round table discussion: Mission of the HPCAPS	

HPC at APS - missions

- Advance novel HP-SR science & technology
- Establish a state-of-the-art HP center lab
- Support/coordinate HP instrumentation and program development at APS sectors
- Support/coordinate APS HP users
- Community outreach and technology transfer

HPC at APS - organization

- An APS Consortium
- A executive committee (APS, CAT members, users)
- At the beginning, the CIW-HPCAT group will take the initiative to organize the user community, raise funding from non-conflicting sources, provide high-pressure expertise.

We would like to have your input.

- Your vision of HP science at your sector.
- What do you want the HPCAPS to do for you, your users, and your science?
- Anything you would like to contribute to the HPCAPS? Science? Equipment? Beam time? Coordination?