Charge to NSRC sub-committee

- What has been the impact of the NSRCs?
- How are the collective NSRCs synergistic?
- NSRC synergies with the other user facilities at the laboratory?
- Best practices and opportunities for diversifying the user community?
- How should the NSRCs evolve to better serve the nation and user research?

NSRC Committee Members

- Harry Atwater, Caltech
- Donna Chen, U. South Carolina
- Yi Cui, SLAC
- Abhaya Datye, U. New Mexico
- Helmut Dosch, DESY
- Yan Gao, GE (ret.)
- Murray Gibson, FAMU-FSU *
- Clare Grey, U. Cambridge
- Sossina Haile, Northwestern
- Boris Kozinsky, Harvard
- Karl Mueller, PNNL*
- Abbas Ourmazd, U. Wisc. Milwaukee
- Joan Redwing, Penn State
- Frances Ross, MIT
- Eric Stach, U Penn
- Cathy Tway, Johnson Matthey

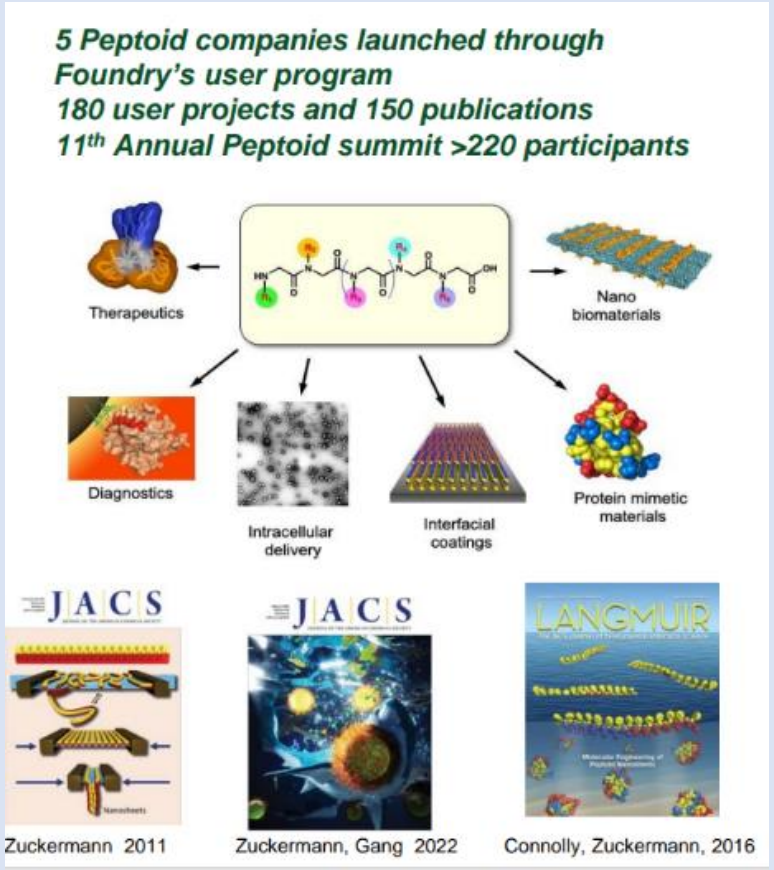
* co-chairs

Collecting input

- Much data provided by the centers and the BES office
- Very productive 2-day meeting with committee, center directors and representatives held on August 21-22 in Gaithersburg, MD
- Three additional zoom meetings of the committee

- Preliminary recommendations from the subcommittee follow
  - These are preliminary - we expect to complete our report by Spring 2024

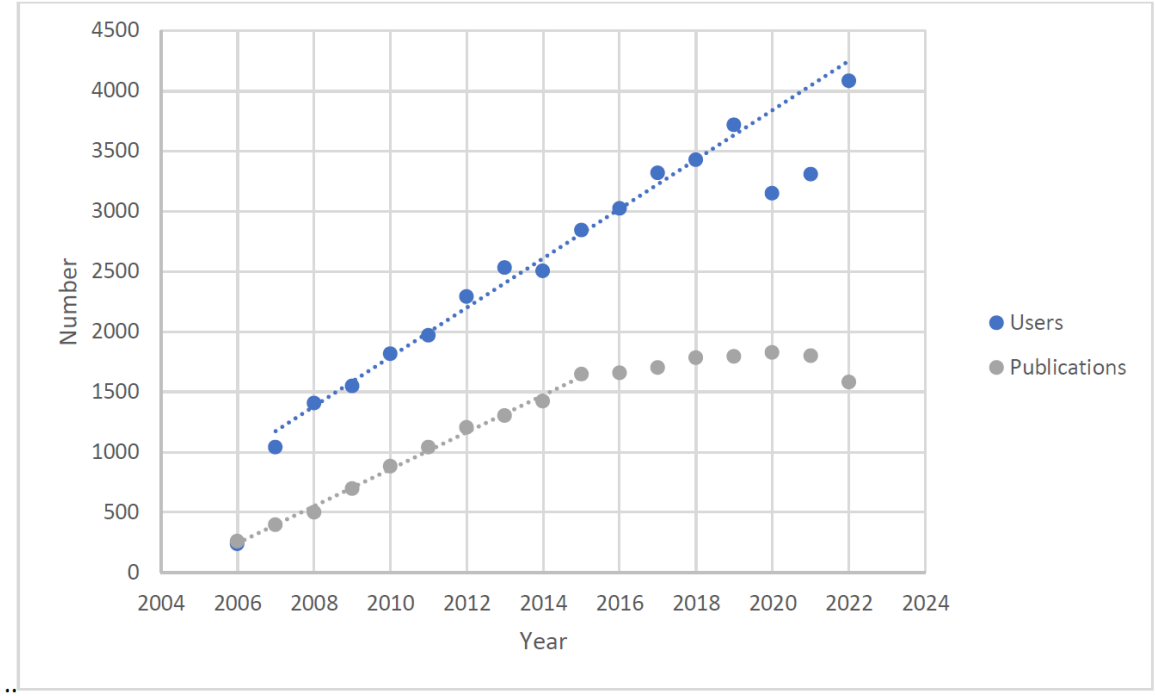
Many scientific highlights to choose from…

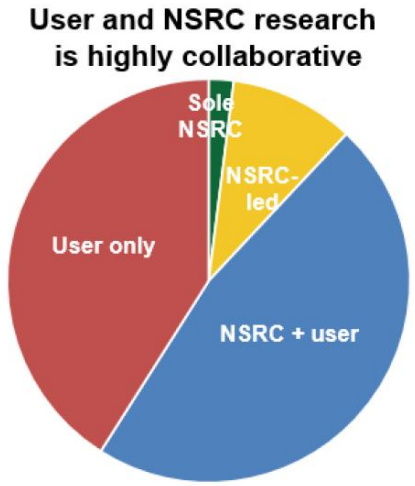


Sequence-defined hierarchical peptoids from the Molecular Foundry

Unique Quantum Materials Press facility at the Center for Functional Nanomaterials

Recommendation: Sustain and strengthen the NSRC ecosystem that has become a key element of US competitiveness in instrumentation development and application to high priority scientific problems.





Healthy growth in users and publications metrics, with evidence for a slight slow-down in productivity growth coincides with funding and staffing limitations in recent years (compounded with COVID-19).

Other metrics, such as citations, IP and spin-offs are impressive.

"Instrumental science is the noblest and, above all others, the most useful."

– Leonardo da Vinci

Instrumentation development is successful when it meets scientific needs. NSRC's, where expertise meets the user science community, are an ideal crucible.

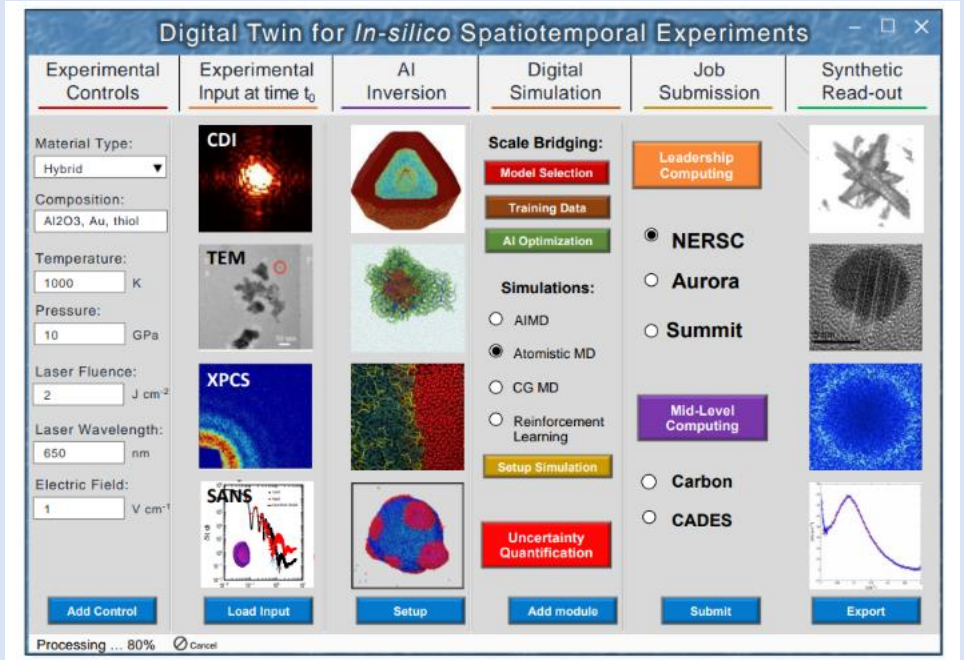
Recommendation: Develop a singular strategic plan involving all five centers, focusing on national science priorities and grand challenge areas.

- **This is *the* game-changing recommendation for the future which has emerged from the review.**

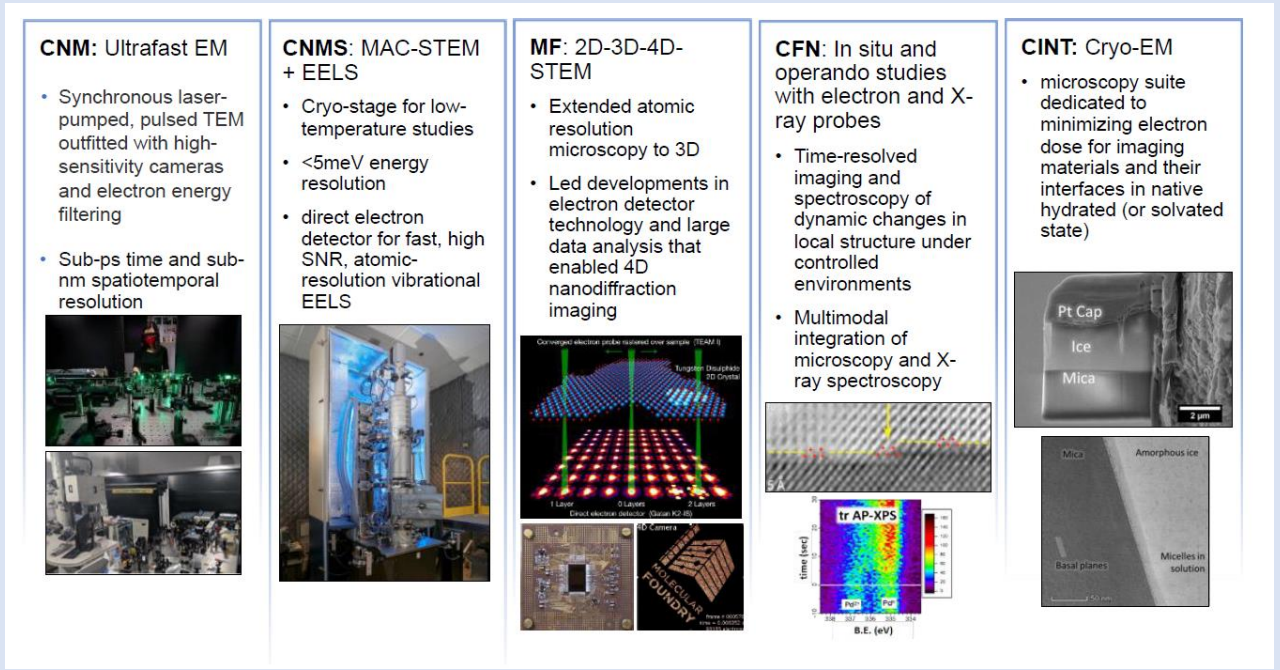
Greatly increase efforts to have the centers play a collective role and take leadership nationally and beyond in selected scientific priority areas. In doing so, ensure adequate engagement with the broader community of scientists. Efforts, especially collaborative efforts among NSRCs, in the co-development of science-driven novel instrumentation and data management/analysis/infrastructure should be prioritized.

*The centers have achieved remarkable success since their inception, and their development required a center-focused effort to build the user community, hire and develop staff, and acquire and develop instruments. But it is clear today that their impact could be greatly boosted by **adding** a new level of co-operation and planning. Together the NSRC ecosystem represents a power-house that can help the US regain international leadership in instrumentation-enabled science.*

Current collective work of the centers…



Collaboration Across Scientific User Facilities:
CNM, CNMS, MF, CFN, CINT, APS, ALS, SLAC



Complementary TEM developments

In this area centers are distinctive and complementary

Exciting future ideas in Instrument Automation, AI/ML and Data…

Instruments + **People** => Science impact

Rama Vasuvan staff member at CMS, is a leader in autonomous synthesis

Fernando Rua from University of Puerto Rico received a Gordon and Betty Moore Foundation grant to support CINT user research

Jana Zaumseil CNM postdoc now leading Heidelberg's Center for Nanophotonics

Katherine Jungjohann CFN postdoc, staff member at CINT, now group leader at NREL for Advanced Materials Characterization

Jeff Neaton began as a Materials Theory postdoc at MF, now Associate Lab Director at LBNL

Recommendation: Strengthen postdoc programs at the centers

Synergy with large facilities is very strong

Article

Characterization of just one atom using synchrotron X-rays

https://doi.org/10.1038/s41586-023-06011-w
Received: 23 December 2020
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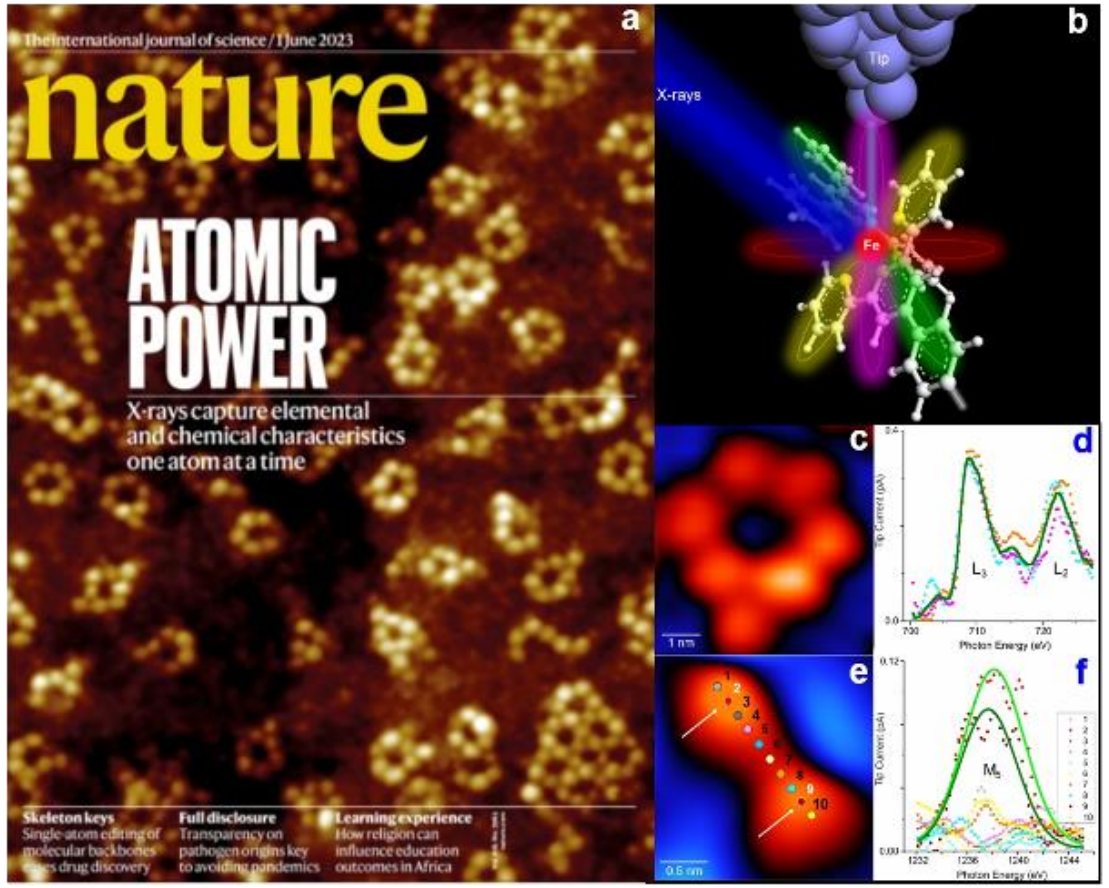

Scanning tunneling microscopy with synchrotron excitation enables the fingerprinting of a single atom, the L2,3 and M4,5 absorption edge signals for iron and terbium, respectively, being clearly observed in the X-ray absorption spectra.

This multimodal system, developed at CNM, utilized an STM to resonantly extract x-ray generated electrons from single atoms in close proximity (<0.5nm) to the STM tip.

Ajayi et al, Nature, 618, 69-73 (2023)

Recommendation: Take advantage of large facility upgrades with new beamlines and capabilities

Other recommendations

- Develop a single proposal portal for all NSRCs and challenge the user community to generate proposals that take advantage of multiple facilities.
- The Centers must considerably expand their proactive efforts to increase the diversity of their user community and their staff. Training (e.g. summer schools, workshops, short courses) is viewed as a key element, as is remote access.
- The centers have great impact with small companies, but very little interaction with large industry. Lower barriers to industry participation and identify tangible incentives for NSRC staff.

Questions or Comments?