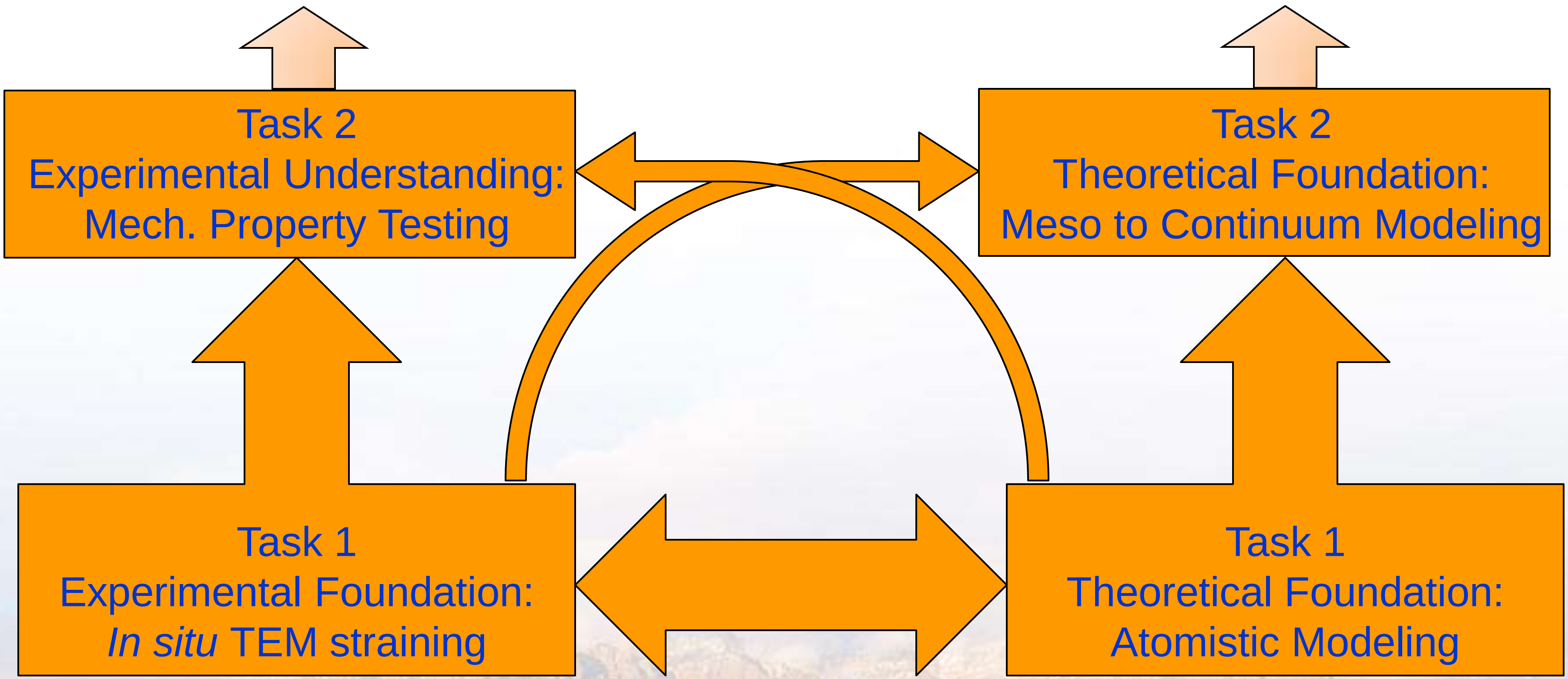
PPM Task 1 Direction

SAND2012-9673C

K. Hattar, J. Zimmerman, L. Hale, P. Kotula, and C. Weinberger - SNL

C.B. Carter - UConn

October 30, 2012



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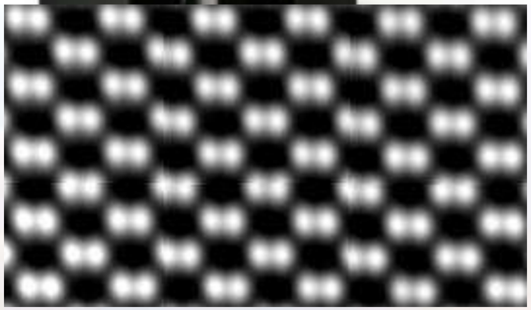
Developing a Strong Experimental Base

- **Aim: Fundamental understanding not currently achievable**
  - Development of the necessary skills and tools
  - Large portion of it is exploratory research
- **Effects 10+ years out**



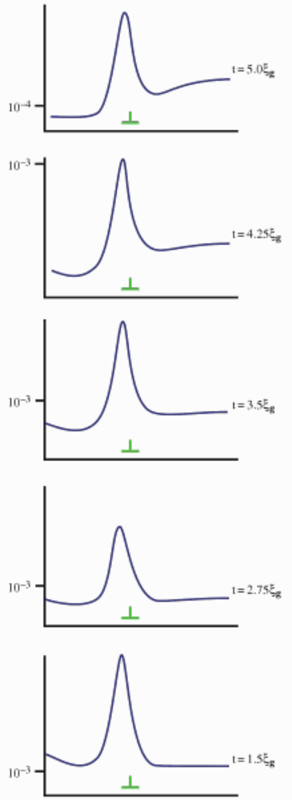


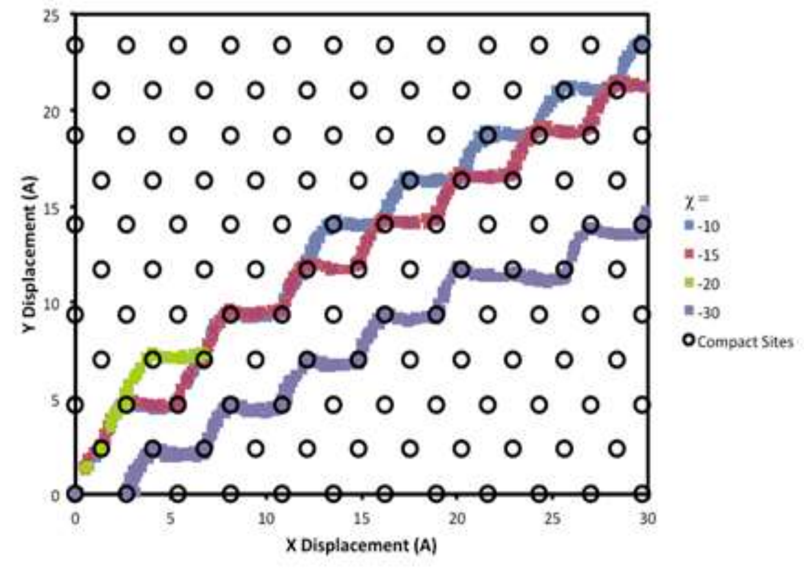
FIGURE 27.10. Examples of computer-calculated intensity peaks in WB images of an edge dislocation in Cu for different values of t. The intensity is relative to the unit incident-beam intensity. Note that the dislocation position and the peak intensity never coincide.

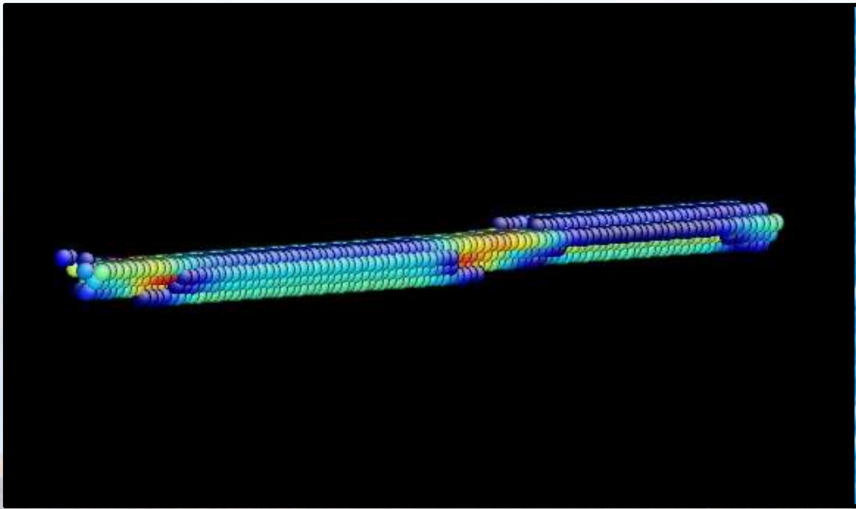
Task 1
Experimental Foundation:
In situ TEM straining

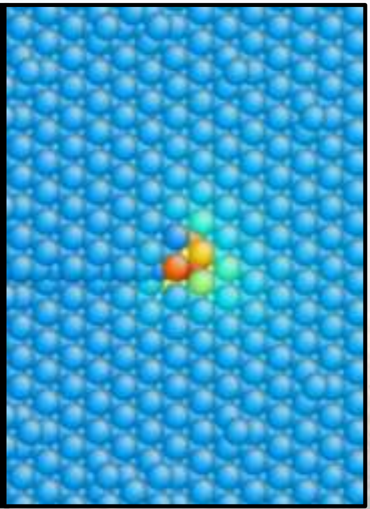
Transmission Electron Microscopy: A Textbook for Materials Science
By David B. Williams, C. Barry Carter

Develop a Strong Theoretical Base

- **Aim: Theorize the active mechanisms at the atomistic scale**
  - Ask the proper questions
  - Develop models to provide length and time scale understanding not possible elsewhere
  - Investigate hypothetical scenarios
- **Effects 10+ years out**







Task 1
Theoretical Foundation:
Atomistic Modeling

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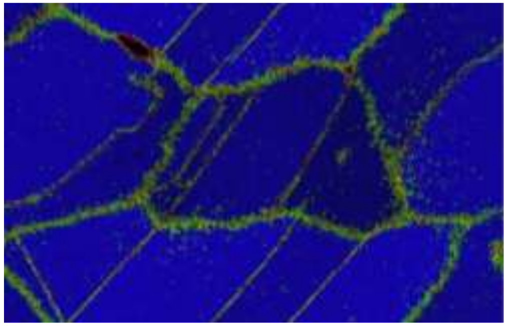
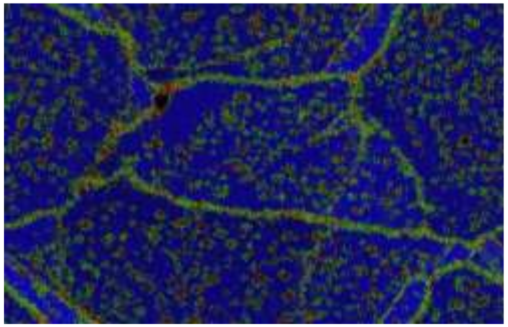
Base Experimental and Theoretical Connection

- **Experimental insight feed into models**
  - Search for atomistic motion of a dislocation
- **Modeling insight directs experiments**
  - Introduction of various size voids in pre-strained samples

30% strain



System consists of 3 grains of 15nm diameter, film thickness of 7nm.



5% porosity via vacancies

Task 1
Experimental Foundation:
In situ TEM straining

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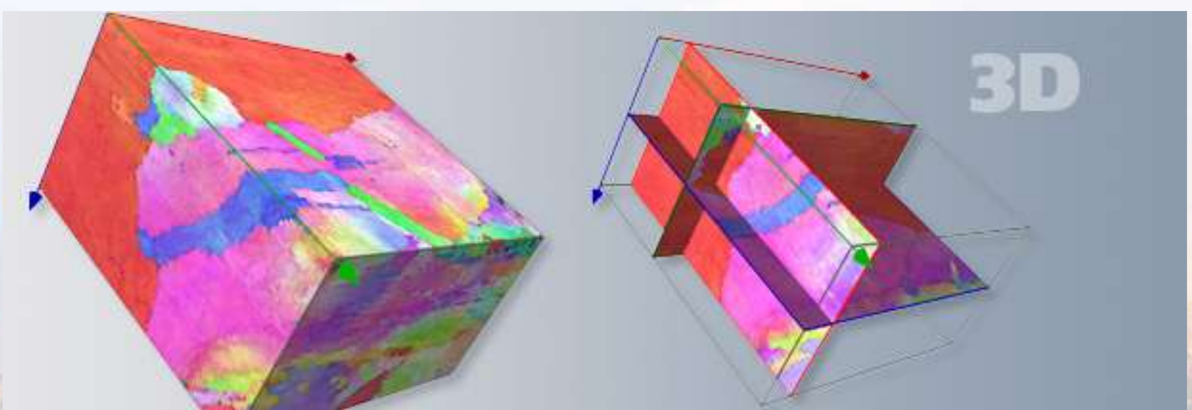
Task 1
Theoretical Foundation:
Atomistic Modeling

Experimental Input to Task 2

Task 2
Experimental Understanding:
Mech. Property Testing

Task 1
Experimental Foundation:
In situ TEM straining

- **Connecting the length scales**
- **Multi-length scale analysis of shared samples**
- **Intermediate level characterization**
  - 3D understanding of deformed samples
    - 3D EBSD of voids (J. Michael)
    - 3D Optical Microscopy of strained samples (J. Madison)
- **Constant consideration of various experimental conditions**

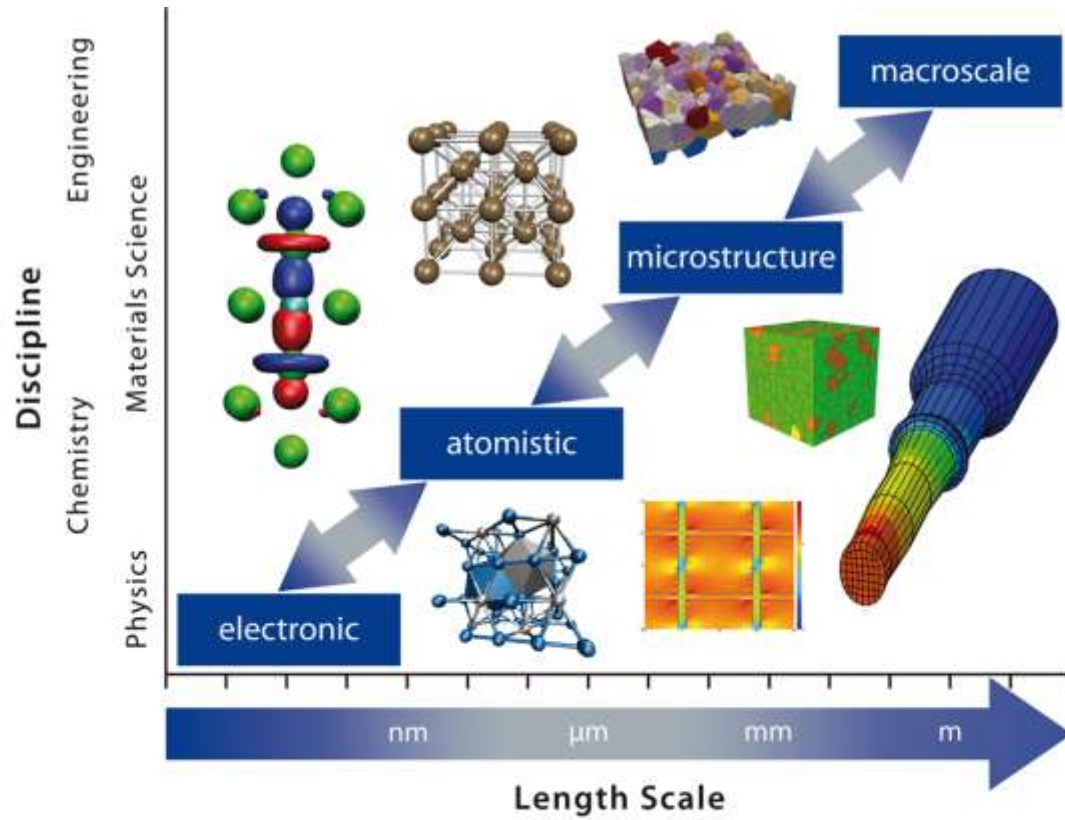


http://www.oxford-instruments.com/products/microanalysis/ebsd/3d-ebsd

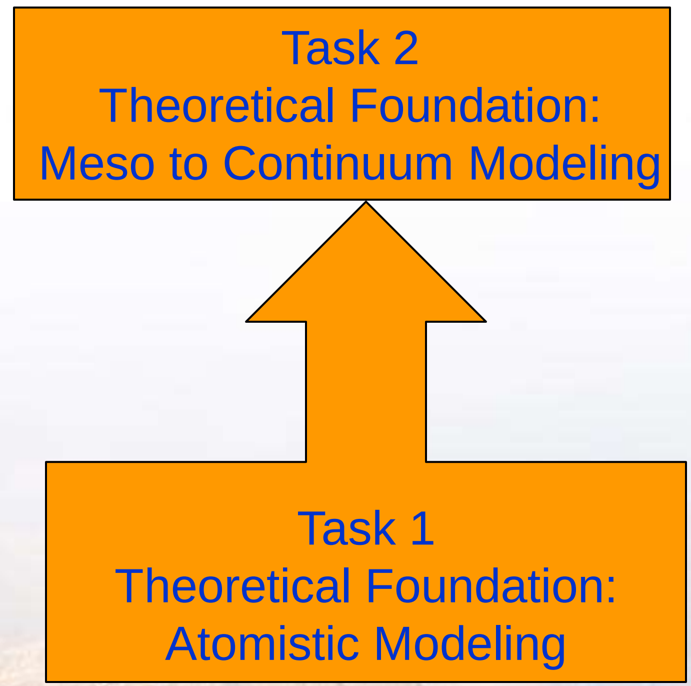
http://www.ues.com/content/robomet3d

Theoretical Input to Task 2

- **Identifying key variables that can be passed to task 2**
- **Performing some models based on structures important to task 2**
  - Modeling dislocation interactions with:
    - Voids
    - Various grain boundaries



http://www.icams.de/content/research-at-icams/research-index.html



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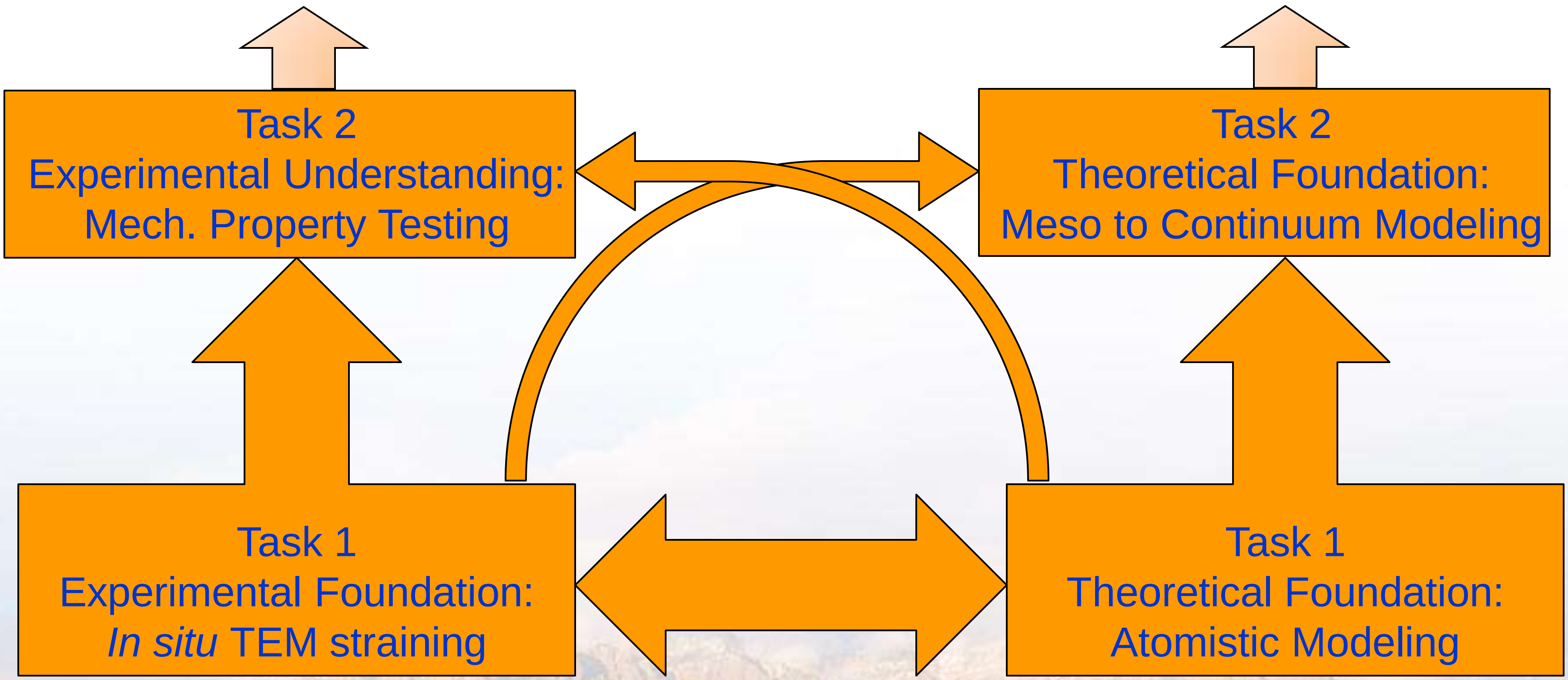

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