

The background of the slide is dark, featuring a bright purple laser beam that creates a starburst effect in the center. A faint blue light streak is visible in the upper left corner.

Faculty-Student Collaborative Research

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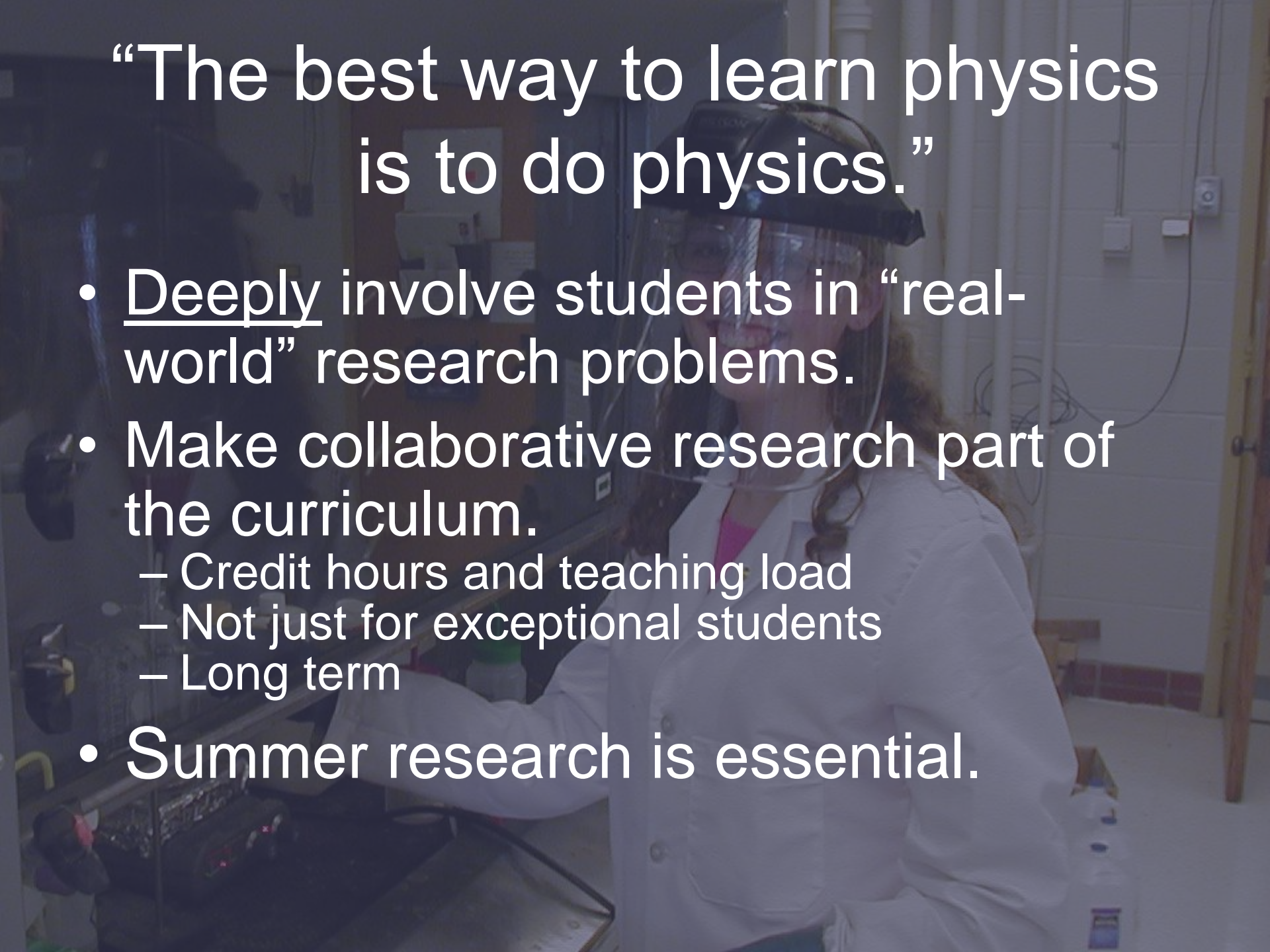
Houghton College Physics

Characteristics

- ✓ Welcoming and friendly
- ✓ Engaging
- ✓ Active


Small Program

- ✓ ~20 majors
- ✓ 3-5 graduates/year
- ✓ 2½ professors

A background image of a female student in a physics laboratory. She is wearing a white lab coat, a black hard hat, and clear safety goggles. She is looking down at a piece of equipment on a lab bench. The lab has white tiled walls, various pipes, and electrical outlets. There are some bottles and equipment on the bench in the foreground.

“The best way to learn physics
is to do physics.”

- Deeply involve students in “real-world” research problems.
- Make collaborative research part of the curriculum.
 - Credit hours and teaching load
 - Not just for exceptional students
 - Long term
- Summer research is essential.



How does this impact students?

- Its fun!
- Increased motivation to learn.
- Application of skills in new contexts.
- Integration of Concepts.
- Enhanced Self-confidence.
- Practical Experience.

How does this impact faculty?

- Its fun!
- Enhances faculty scholarship.
- Encourages internal/external collaborations.

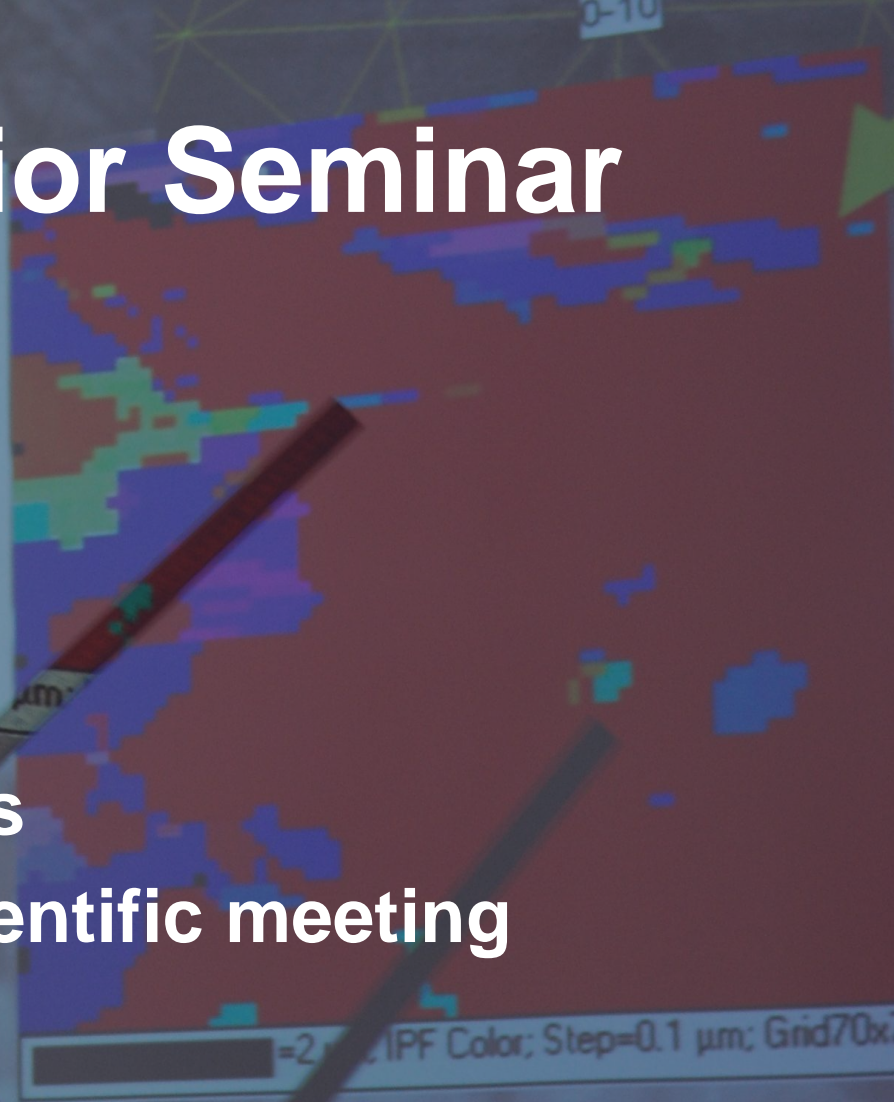
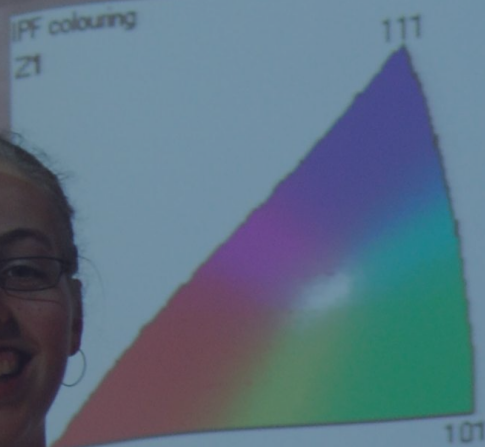
PHYS 471,2 Physics Project Lab

Participation with a faculty member in a collaborative research project. May be repeated for credit.

- Beginning of junior year (or earlier)
- Advisors select projects
- Student load: 1 credit hour/semester (4-6 total)
- Teaching load: 1.5 units (same as $\frac{1}{2}$ course)
- Typically 3-6 students per advisor

PHYS 482 Senior Seminar

- Undergraduate thesis
- Presentation at a scientific meeting
- Student load: 1 credit hour
- Teaching load: 1.5 units ($\frac{1}{2}$ of a course)



PHYS 393 Summer Collaborative Research in Physics

Collaboration with a faculty member on a current research problem. Students work individually or in small teams reviewing literature, designing and building apparatus, collecting and analyzing data, and describing their work in written form. This course usually involves travel to other laboratories, such as Los Alamos National Laboratory or Cornell University.

- Student load: 1-4 credit hours
- Student stipend
- Faculty stipend
- 6-10 weeks

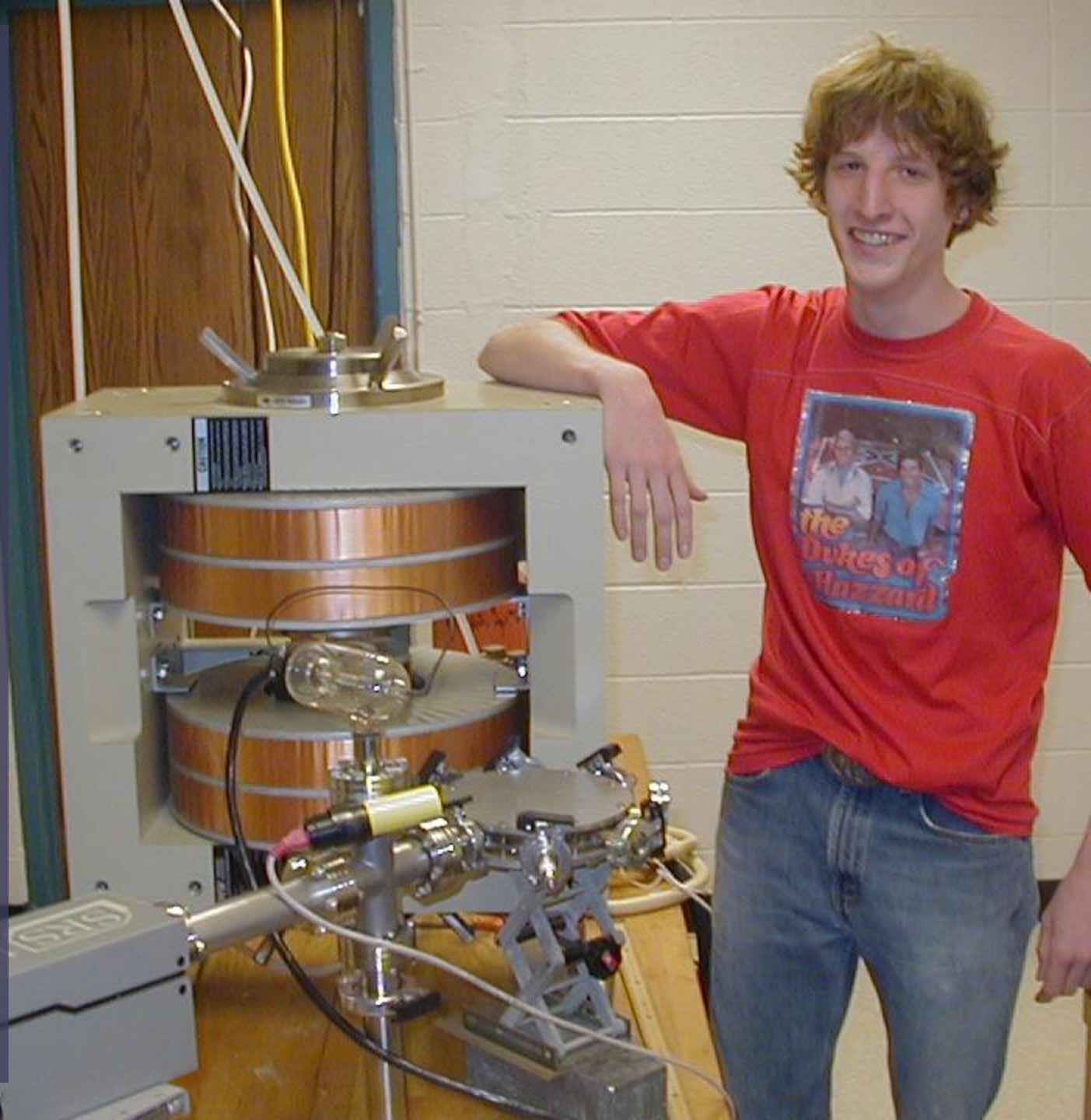
Houghton College Cyclotron

Barry T. King, "A Preliminary design for a small permanent magnet cyclotron", 2003.

Sharon C. Tuminaro, "The Design of a Small Cyclotron," 2003.

Mickael J. Cressman, "The Design and Construction of a Small Cyclotron," 2006.

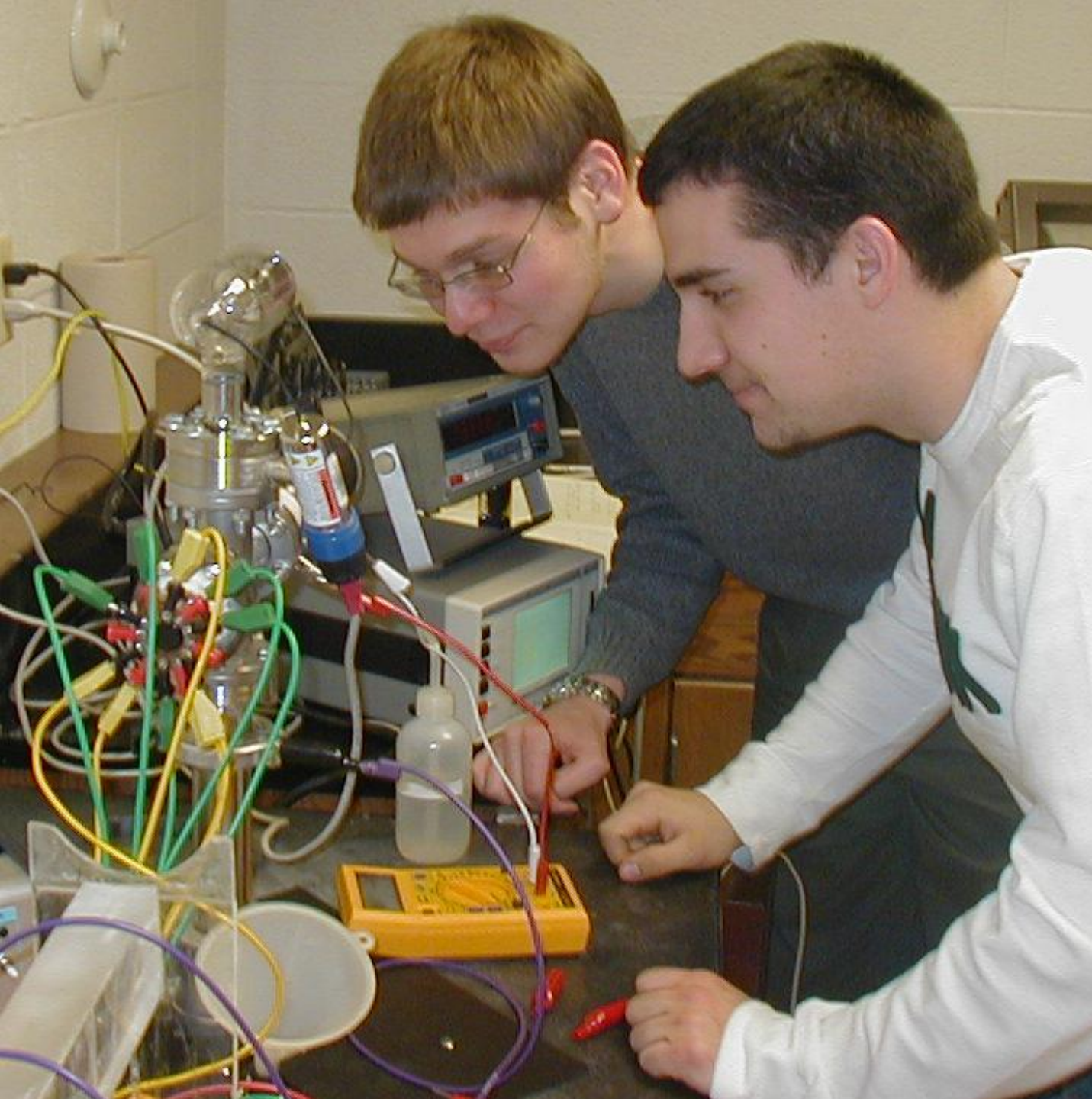
Andrew J. Loucks, "Initial Results from the Houghton College Cyclotron," 2007.



Atomic Force Microscope

Bethany Little (2009)





Electrostatic Accelerator

Brian A. Winey, "A Low-Cost Van de Graaff Accelerator", 2002.

Peter T. Brady, "The Construction of a 200 keV Electrostatic Accelerator," 2004.

Joshua Troyer, "Considerations in the Design of Electrostatic Accelerator Columns," 2007.

Alexander Lipnicki, "A Remotely-Controlled Electron Gun for a 200 keV Electrostatic Accelerator." 2007.



Orthopositronium

Blake K. Winter, ["The Decay Rate of Orthopositronium,"](#) 2005.



CT Scanner

Kaitlin Smith (2010)

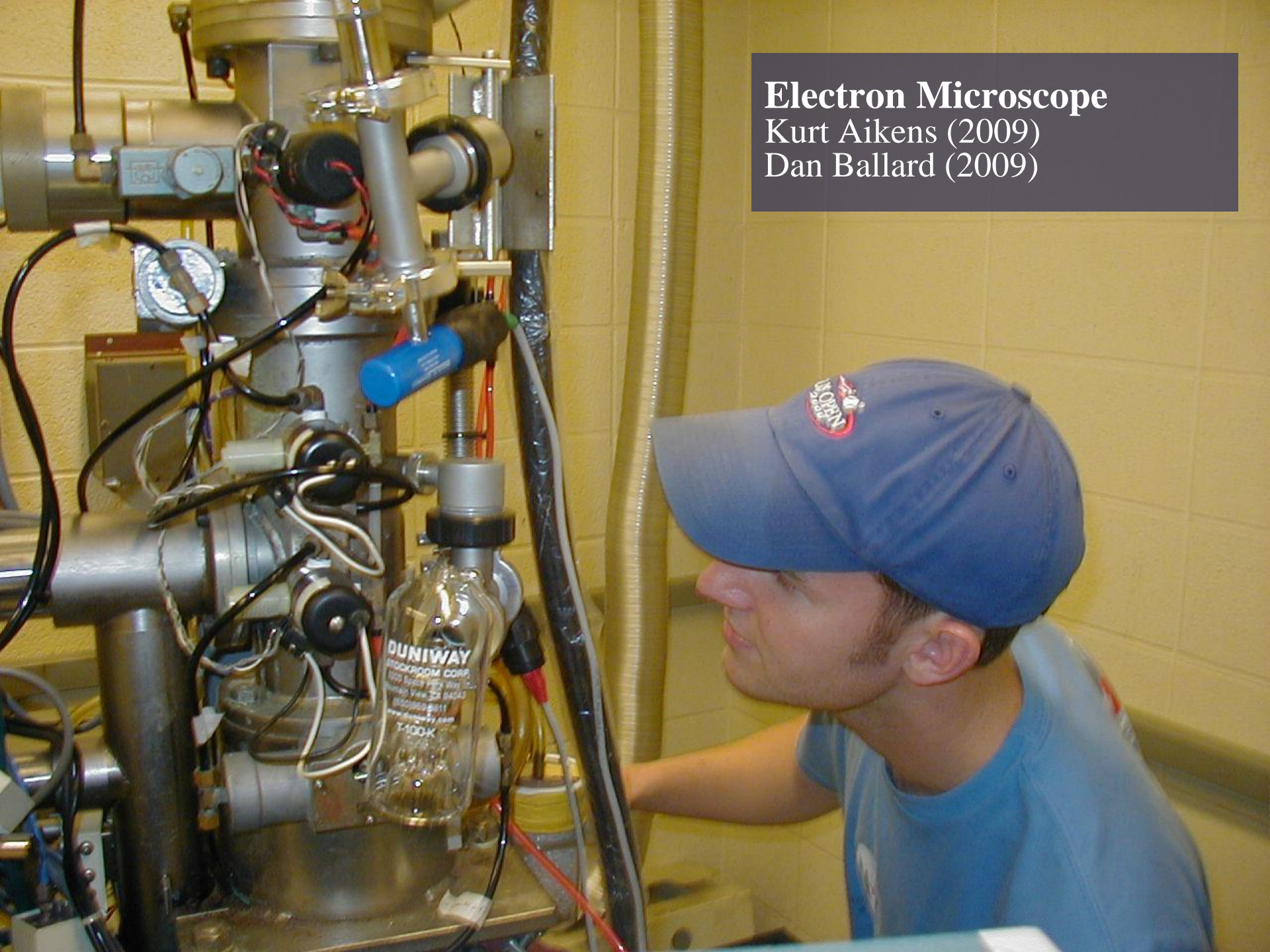
Rebekah Y. Clifford,
"A Tabletop
Transmission
Computed
Tomography
Scanner", 2003.

Nicholas L.
Kingsley, "A Novel
1st Generation
Computed
Tomography
Scanner," 2004.

Electron Microscope

Kurt Aikens (2009)

Dan Ballard (2009)



Proper Motion of Asteroids

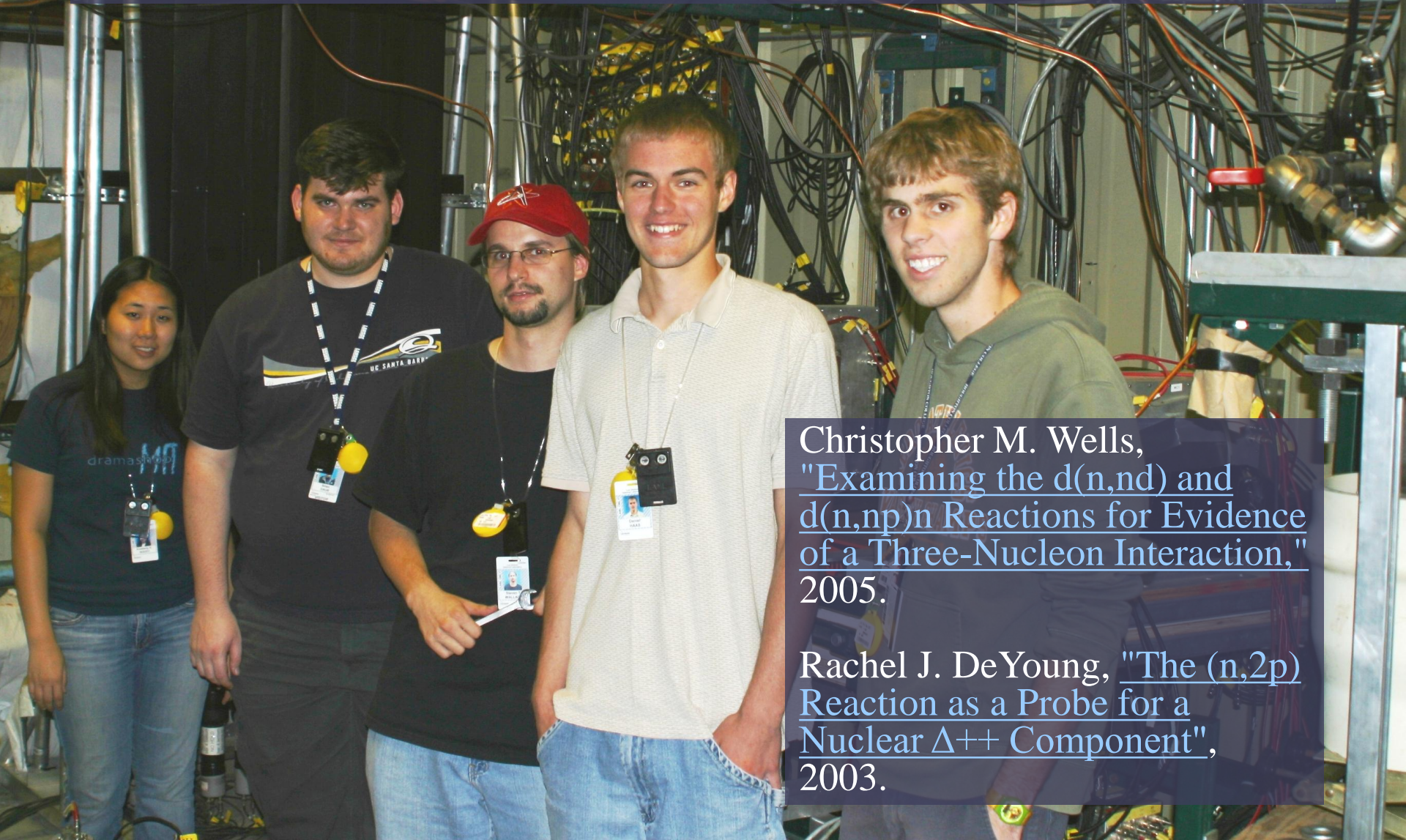
Kirby Runyon (2008)



Cornell Center for Material Research



Los Alamos Neutron Science Center



Christopher M. Wells,
"Examining the $d(n,nd)$ and $d(n,np)n$ Reactions for Evidence of a Three-Nucleon Interaction,"
2005.

Rachel J. DeYoung, "The $(n,2p)$ Reaction as a Probe for a Nuclear Δ^{++} Component",
2003.