Teaching Inquiry in Nigeria & Canada

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University of British Columbia
Carl Wieman Science Education Initiative

Scientific Thinking

Scientific Thinking

- Asking questions
- Developing and using models
- Planning and carrying out investigations
- Communicating information

(NRC 2012: from U.S. Next Generation Science Standards)

Inquiry-based Teaching

(adapted from the Institute for Scientist & Engineer Educators, Hunter et al. 2014)

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Learning practices and concepts is intertwined

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Learning practices and concepts is intertwined

Mirrors authentic scientific research

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Inquiry Structure

Engaging the Learner

→ Focused Investigating

→ Making Meaning Together

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2nd West African International Summer School for Young Astronomers

July 13 - 17, 2015

FM20.2.04 (Friday 8:45am)

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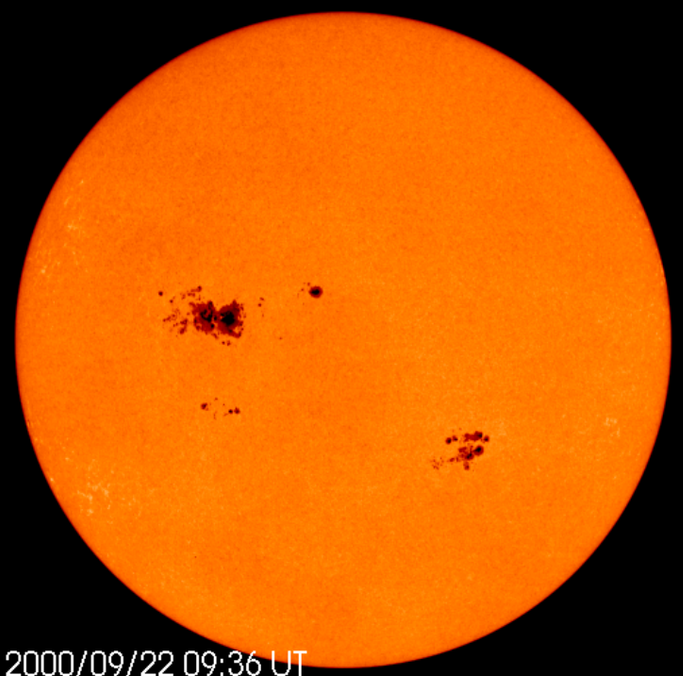
Inquiry Topic: Distances in the Universe

Learning goals:

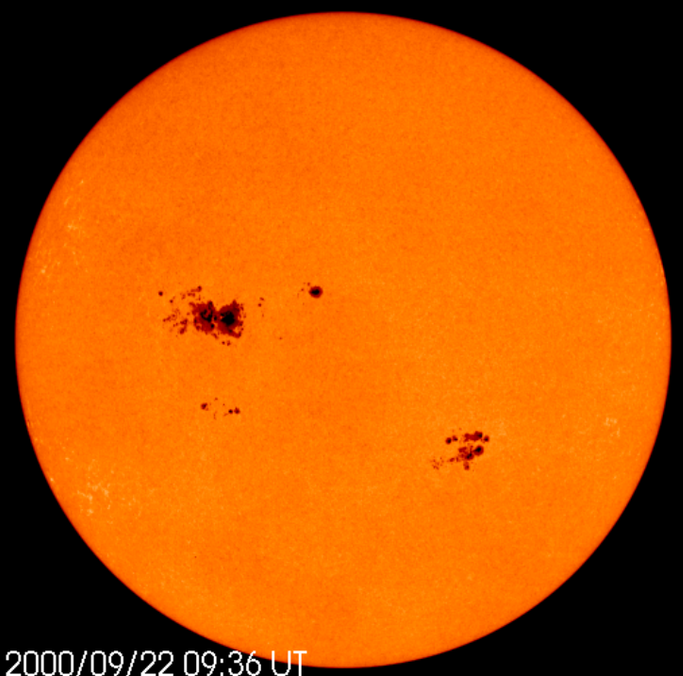
- Concept: parallax
- Practice: solve a problem by breaking into smaller questions to investigate

Activity structure



Activity structure

- Hands-on challenge: measure distance to model planet in a field



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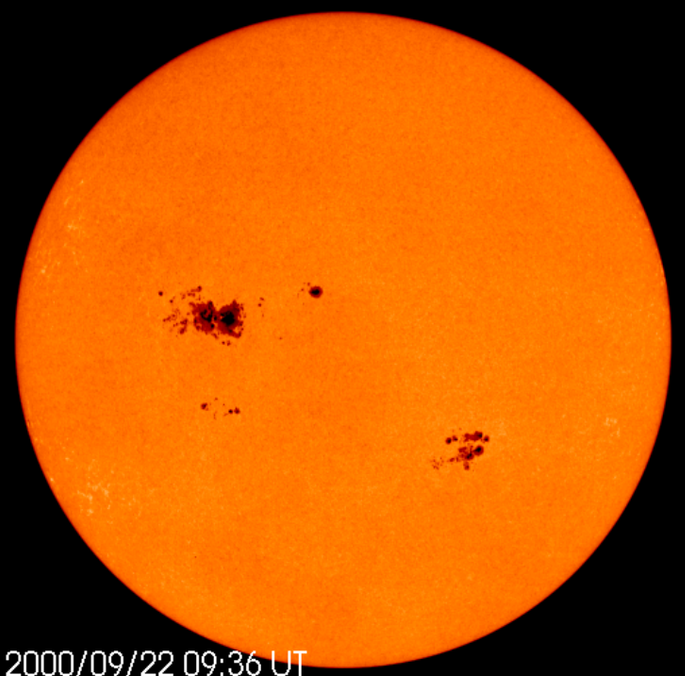

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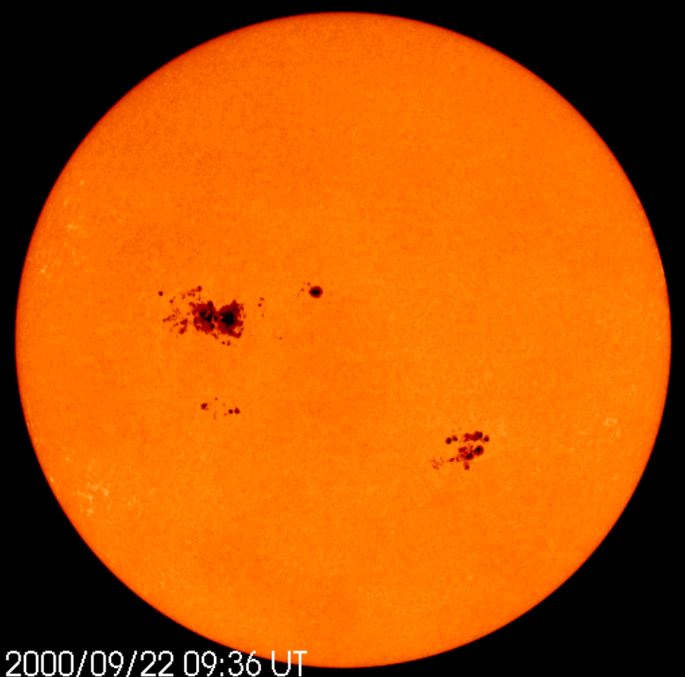

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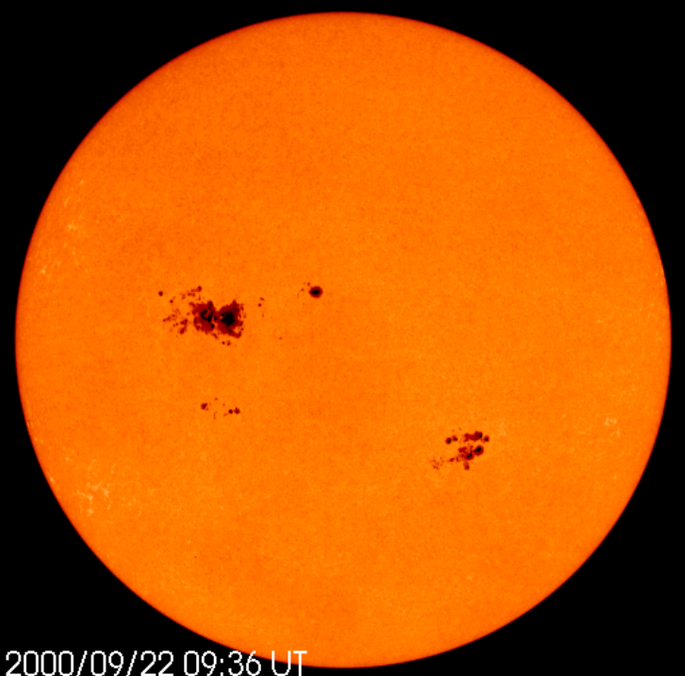
- Choose own question to study, break down to focus on distance
- Work in teams to plan distance measurement



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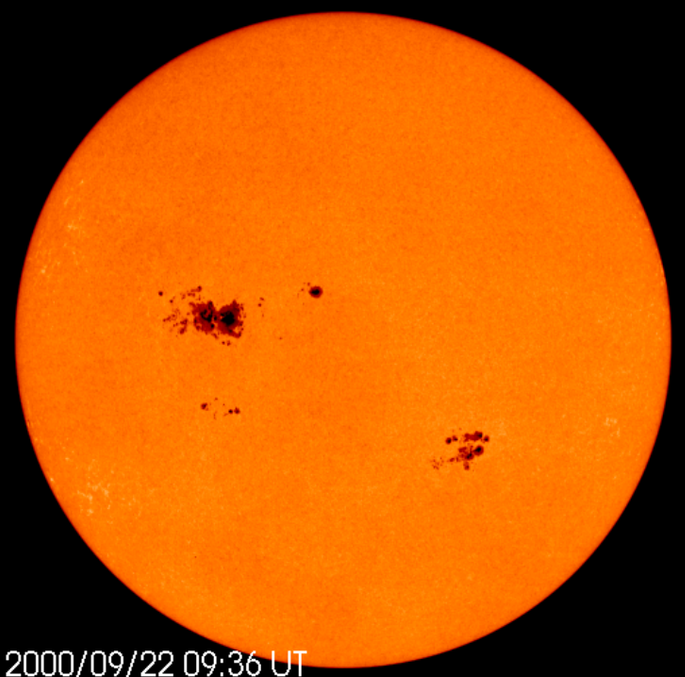
- Discuss results and process in different groups



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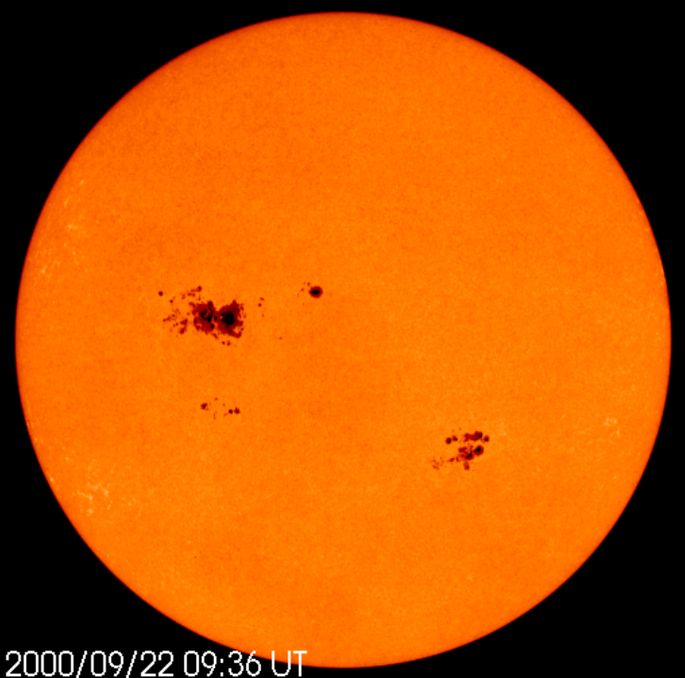
- Choose own question to study, break down to focus on distance
- Work in teams to plan distance measurement
- Discuss results and process in different groups
- Reflect on learning



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-- Sister Matilda Okoyeowell

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I have learned that scientists are very curious...They are not so exceptional, just that they ask lots of questions, and they're really passionate about finding solutions to things. -- Emmanuel Ezenwere

Order-of-Magnitude Problem Solving in Physics & Astronomy

5-week “mini course”
Physics & astronomy Graduate students at
CITA / University of Toronto

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Course learning goal:

- How to estimate solutions to complex problems by breaking into smaller pieces, making approximations and assumptions, using knowledge they already have.

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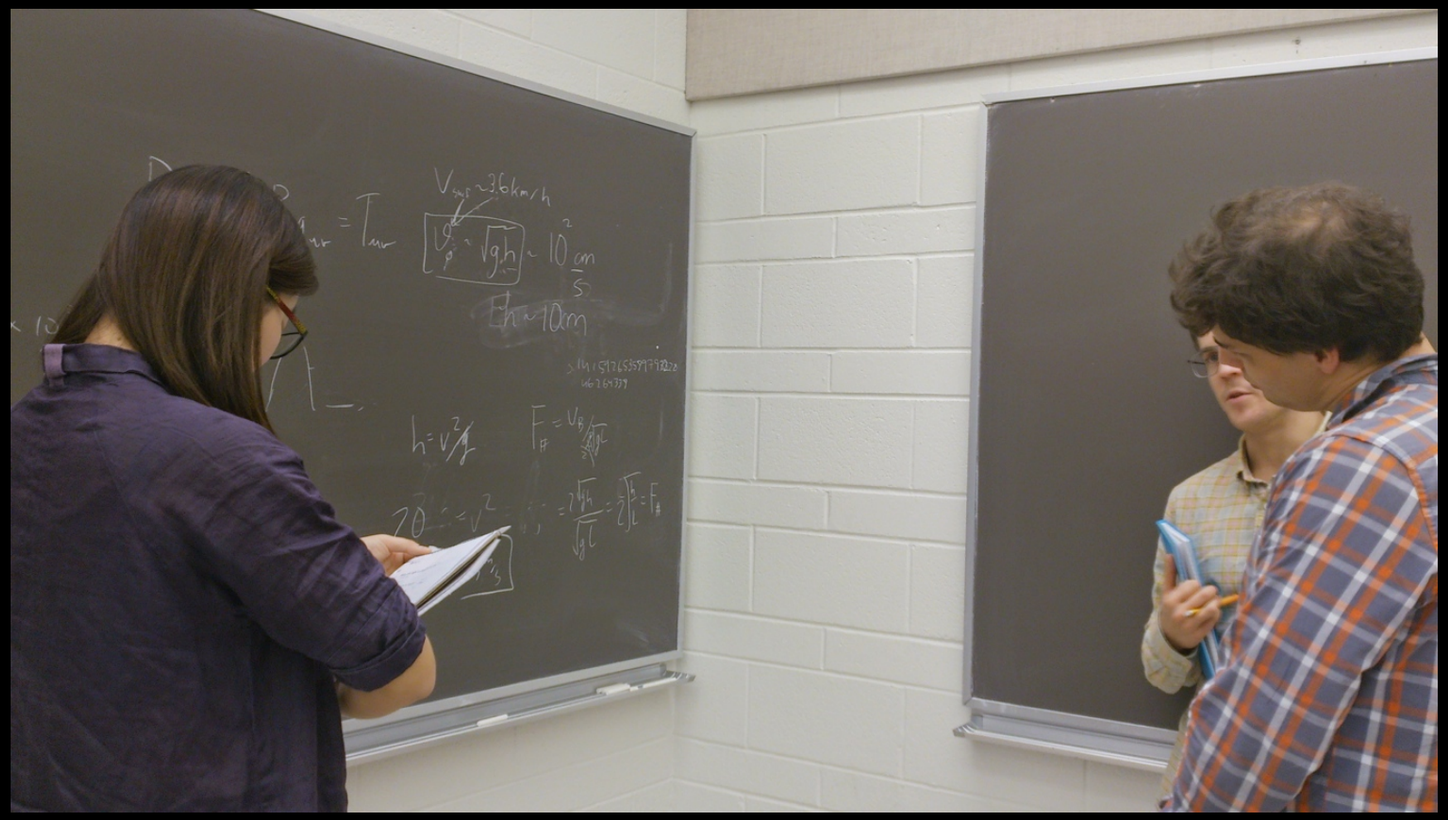
What is the oblateness of the Earth?



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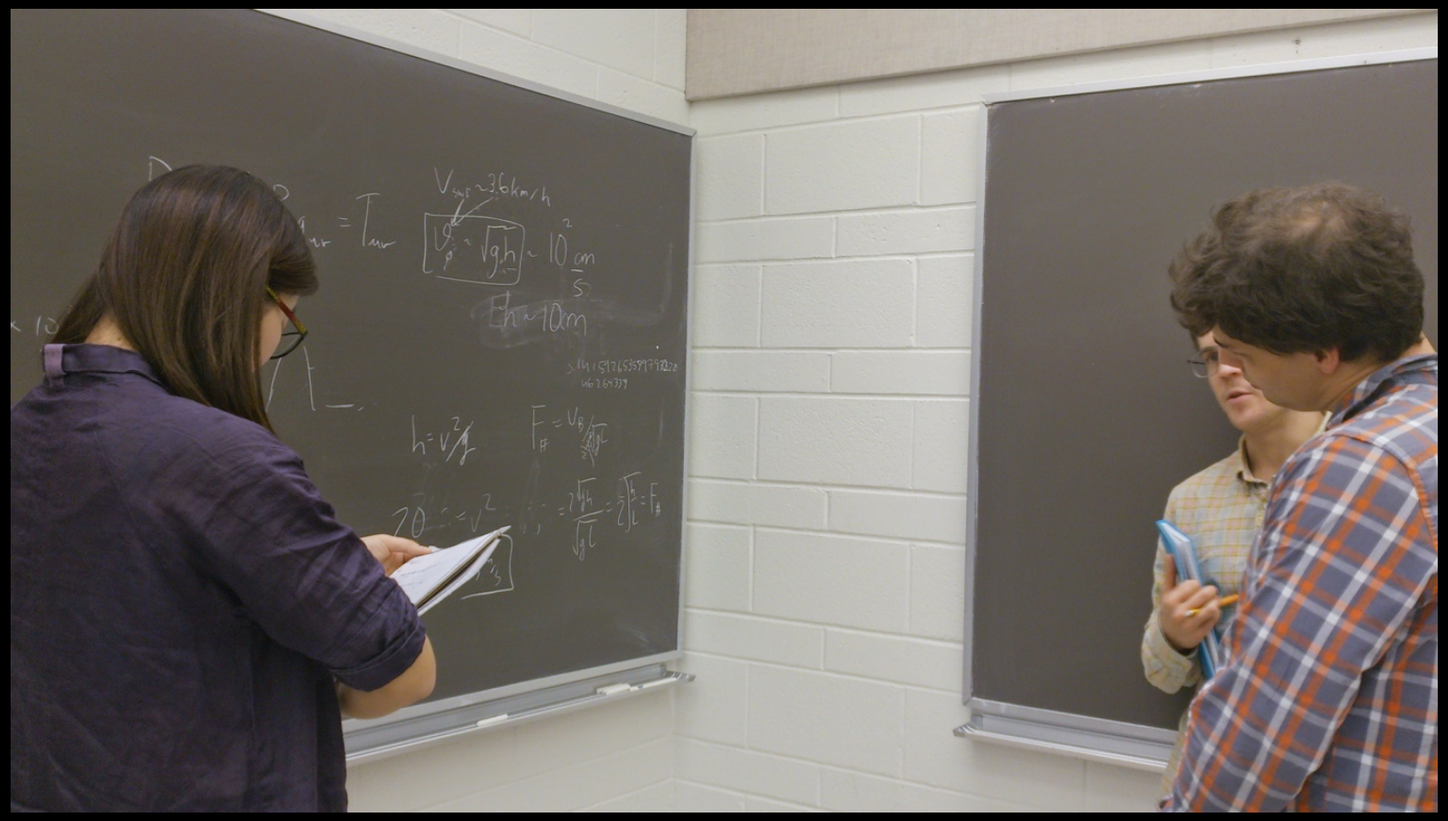

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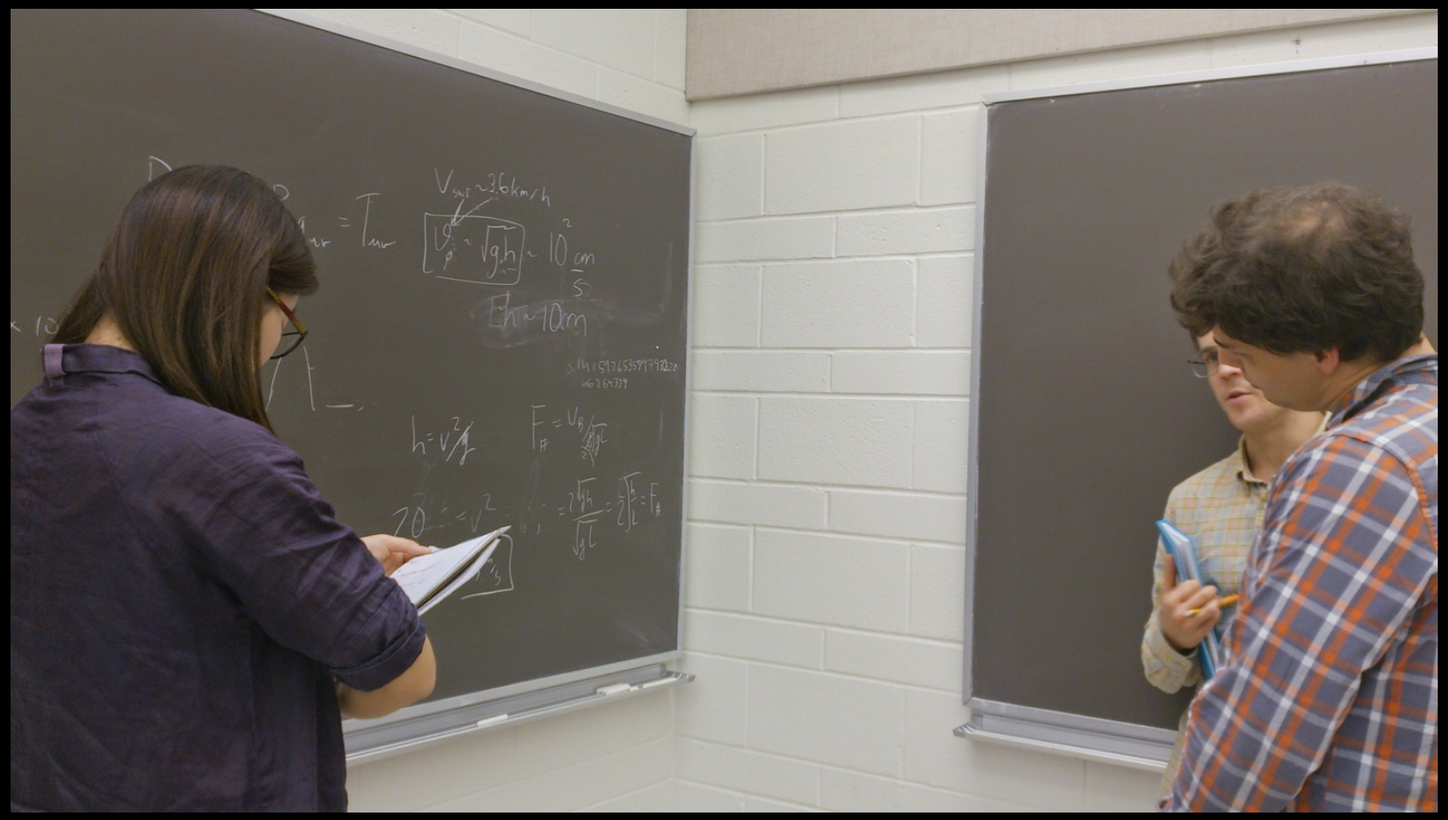

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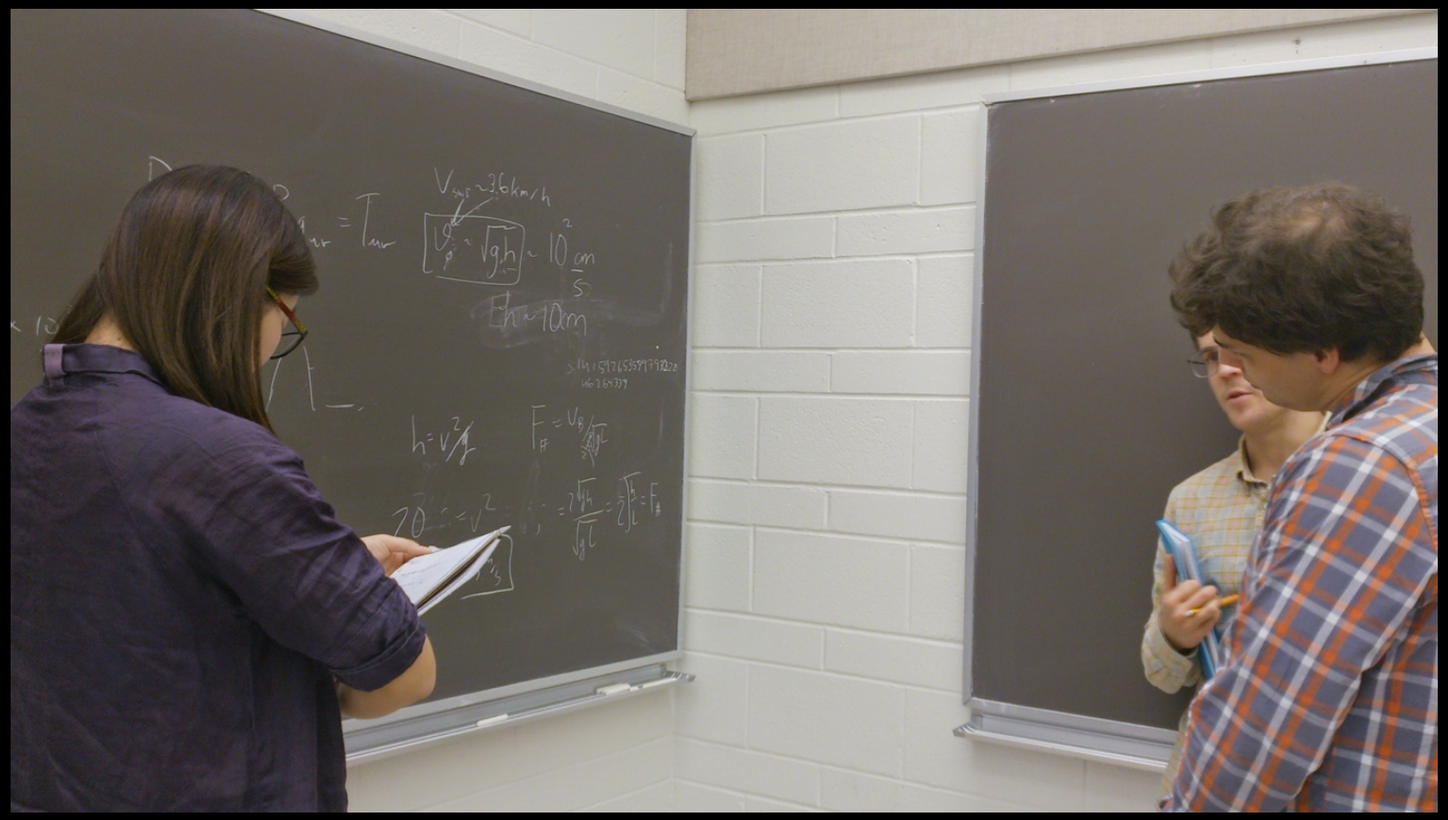

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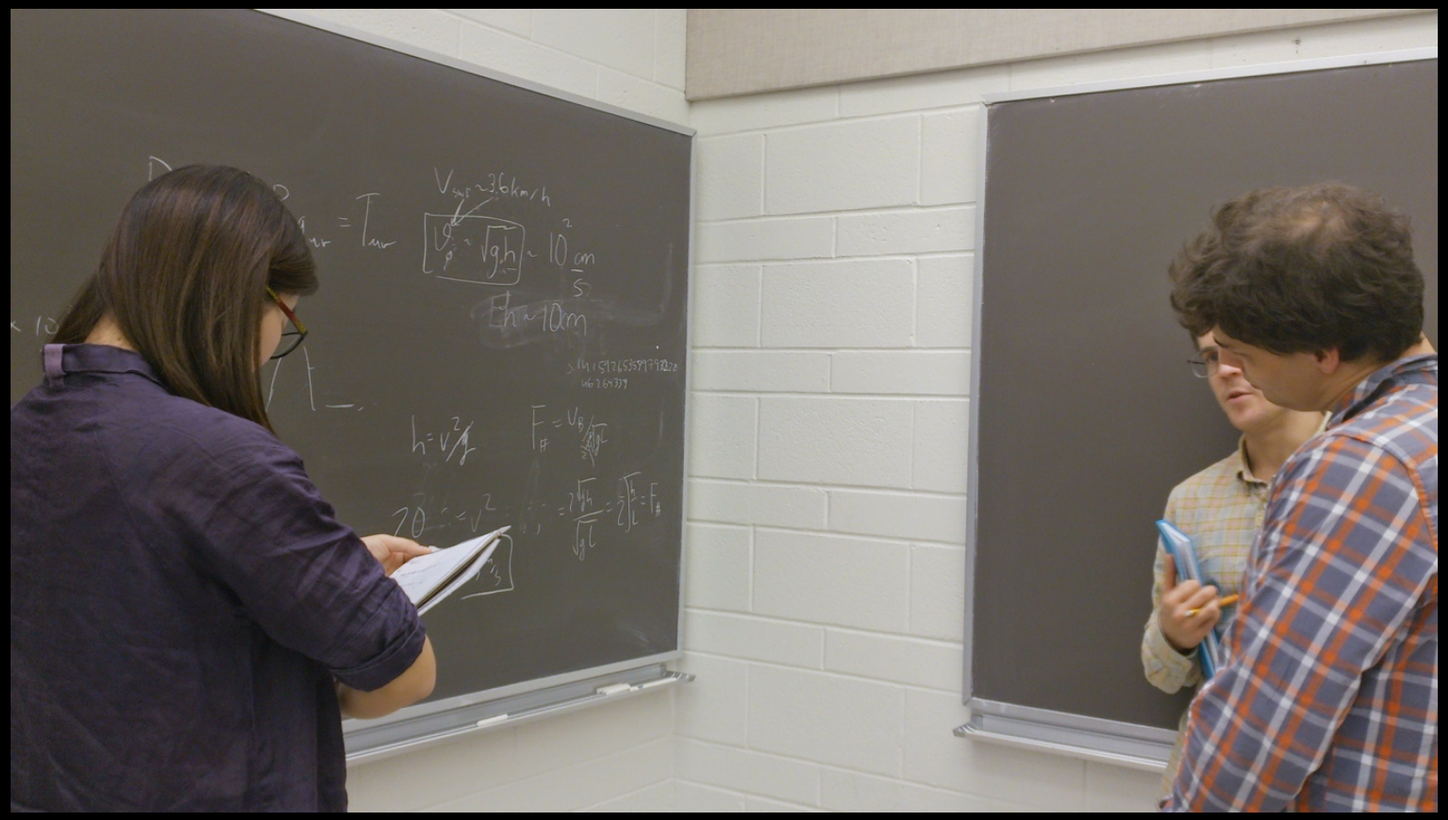

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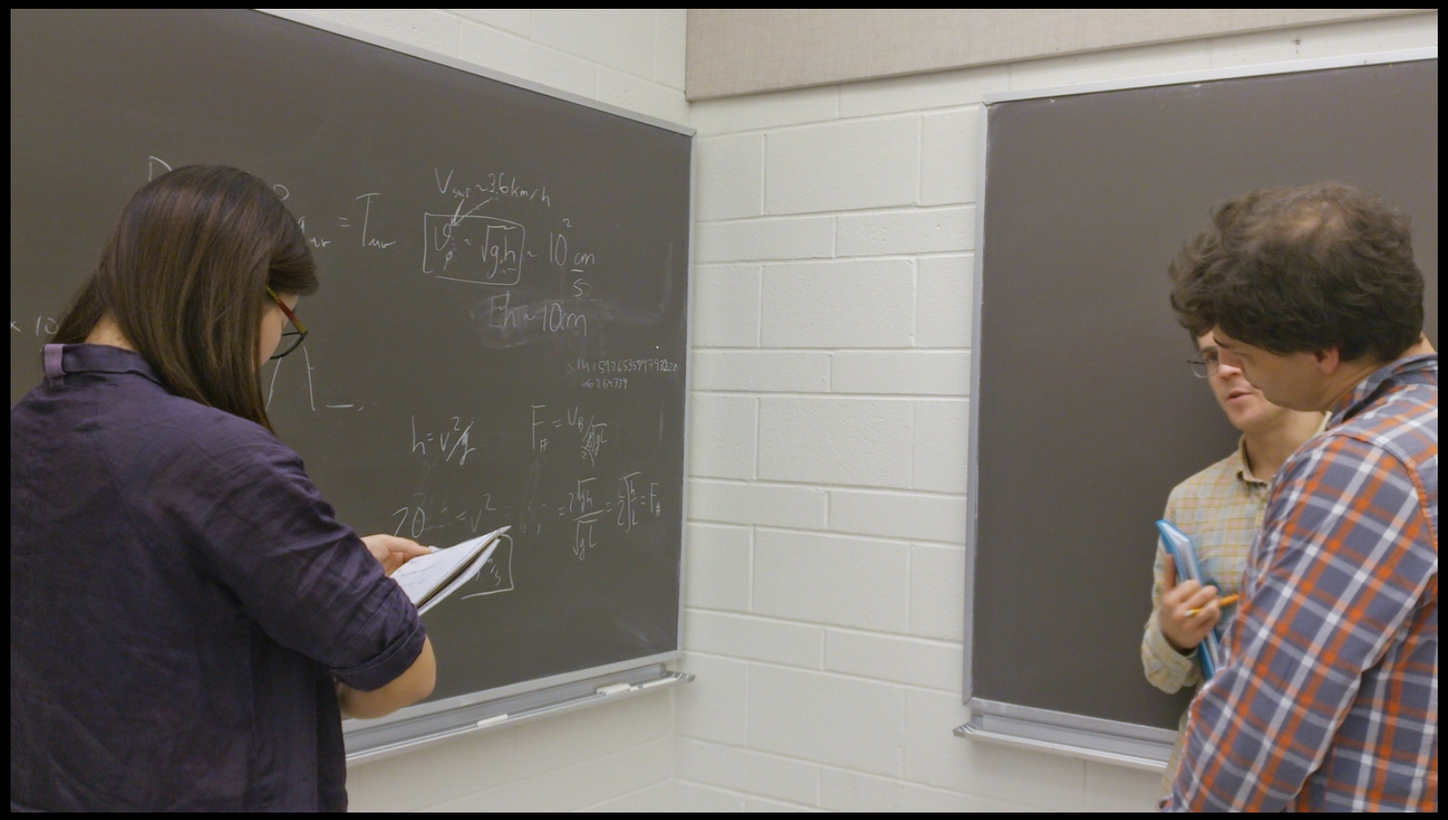

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- Work in teams at blackboard
- Instructors observe and facilitate
- Students share results with class

First-Year Inquiry Physics Labs at UBC

- reflect on quality of experimental results
- make comparisons
- understand measurement uncertainty
- improve measurements and iterate

Natasha Holmes, Doug Bonn, Dhaneesh Kumar, James Day, Carl Wieman

Paired teaching:

Method of professional development for teaching

Stang & Strubbe (2015): http://arxiv.org/abs/1507.05948

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Method of professional development for teaching

- **Expert and novice teach course *together***

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Method of professional development for teaching

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- **Pilot study and funding at UBC**

- **Jared Stang and I are studying what factors lead to effective professional development**

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Institutions:

IAU Office of Astronomy for Development
Canadian Institute for Theoretical Astrophysics
Dunlap Institute for Astronomy & Astrophysics (Canada)
University of Toronto
University of British Columbia
Carl Wieman Science Education Initiative (Canada)
Harris Foundation (Canada)
Institute for Scientist & Engineer Educators (USA)
European Southern Observatory (Germany)
University of Nigeria, Nsukka
Centre for Basic Space Science (Nigeria)
National Space Research & Development Agency (Nigeria)

Thank you!

West Africa Team:
Bonaventure Okere
James Chibueze
Sudum Esa
Romanus Eze
Wolfgang Kerzendorf
Valerie Murray
Thai Duy Cuong Nguyen
Finbar Odo
Chukwujekwu Ofodum
Patrice Okouma
Jielai Zhang

CITA:
Chris Matzner
Norm Murray

UBC:
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