Opportunities for Cosmic Ray Measurements at Spelman College

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A Choice to Change the World

Outline

- What is Spelman College? [The Institution]
- What work can be done? [The Work]
- How does this translate to you? [The Connection]

The Institution:



The United States #1 HBCU

- Spelman College is one of approximately 100 Historically Black Colleges & Universities.
- These institutions were established by the Higher Education Act of 1965
- Spelman has been the #1 HBCU for 6 continuous years!
- Highest number of Gates Millennium/Fulbright Scholars

SPELMAN COLLEGE WOMEN WHO SERVE

Spelman College was founded in 1881. The National Alumnae Association of Spelman College (NAASC) was organized by Clara Howard in May 1892. Miss Howard, a member of the first graduating class (1887), served as association president.

Spelman alumnae have served humanity in home and foreign missions, education, government, the arts, law, the sciences and religion, with a major emphasis on community service. Spelman alumnae are the living college.

Spelman College - By The Numbers

3 80	1209	25
	SAT	
GPA	(M&V)	ACT

2,100 students with a Student to Faculty ratio of 11:1

Spelman Physics Department

- The department established in 1991 by Dr. Derrick Hylton.
- We are composed of 5 full-time faculty members.
- There are between 16-20 Physics majors.
- There are 75 engineering programs participants.
- We graduate 4-6 undergraduate students per year.
- 32 students over a 6-year period makes Spelman Physics one of the top 3 producers of Black women with physics degrees.
- We are part of a Liberal Arts College - efforts are made to highlight interdisciplinarity.



The Work:



The Plan

- Access to Title III funding (to improve courses) has allowed our department to purchase the necessary materials to build hodoscopes and cosmic ray muon telescopes (approximately 6).
- Students will be involved in all aspects of the project:
 - Create GEANT simulations to optimize the geometry of detectors
 - Build the detectors
 - Manage the collection and storage of detector data/shower data
- This system of detectors will be kept on campus during the normal academic year.
- Detector systems will travel with students in the Study Abroad Program or going "home" for the summer/winter.

Current Work (Baby Steps...)

- Students are designing small scale projects.
 - Reflectivity
 - FPGA design
 - ADC electronics
 - Data Storage/Analysis
- The purpose is education/experience for using products already designed



Feasibility

- Pros:
 - Spelman has a robust Study Abroad Program (78% of students participate)
 - Great publicity & community outreach

• Cons:

- Good Undergrad. Research takes time
- Student's limited experience
- Interest in cosmic ray detectors
- Facilities for testing and construction



The Connection:



My "Identity"...

As a trained physicist:

- I mentor students in:
 - Experimental design
 - Data analysis
 - Data management
 - Simulation design
- I study cosmic ray effects on simple biological systems.

As an education researcher:

- I plan to investigate the ways research projects foster scientific identity.
- I study expert/novice reading strategies for physics journal articles. (with help from Cognitive Psychologists)

What do undergraduates gain?

Easily Measured

- Skills (hard & soft): data analysis, communication, physical creation
- Links: conceptual/theoretical knowledge to real world applications
- Responsibility: interdependence of the research group

Best Measured by Self-Report

- Clarity: Is this the right career/educational choice?
- Scientific Identity: Do I see myself as a scientist/physicist?

Communities of Practice

- Remember your Ph.D. defense?
- CoP's are individuals linked by common or "shared" experiences.
- These experiences are critical for students in the development of their identity as a scientist/physicist

PHYSICAL REVIEW SPECIAL TOPICS - PHYSICS EDUCATION RESEARCH 10, 010109 (2014)

Conditions for building a community of practice in an advanced physics laboratory

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We use the theory of communities of practice and the concept of accountable disciplinary knowledge to describe how a learning community develops in the context of an upper-division physics laboratory course. The change in accountable disciplinary knowledge motivates students' enculturation into a community of practice. The enculturation process is facilitated by four specific structural features of the course and supported by a primary instructional choice. The four structural features are "paucity of instructor time," "all in a room together," "long and difficult experiments," and "same experiments at different times." The instructional choice is the encouragement of the sharing and development of knowledge and understanding by the instructor. The combination of the instructional choice and structural features promotes the development of the learning community in which students engage in authentic practices of a physicist. This results in a classroom community that can provide students with the opportunity to have an accelerated trajectory towards being a more central participant of the community of a practice of physicists. We support our claims with video-based observations of laboratory classroom interactions and individual, semistructured interviews with students about their laboratory experiences and physics identity.

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PACS numbers: 01.40.G-, 01.55.+b



Stereotype Threat

- Social Psych. Suggests that students don't even need to believe a stereotype, just be aware of it.
- Are they suppressing an unconscious thought?
- Documented reduction in selfefficacy (AKA perseverance)
- This can undermine the drive to pursue scientific endeavors.



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Imposter Syndrome

- Imposter Syndrome is a pattern of (unfounded) negative emotions/thoughts a person has when dismissing their own achievements.
- Deal with it by:
 - Finding a good mentor
 - Expect initial failure
 - Be enthusiastic to learn



Assessing Utility

- We know the benefits of undergraduate research (Anecdotally).
- Do the students know it?
- UC Boulder developed URSSA to collect data on how student identify as a scientist.
- 350 interviews & 150 Surveys to assess validity
- This was a 4-year process at 4 liberal arts colleges



With the last few minutes...Discuss...

I spent too long bragging about my institution.

- Is there something your institution is known for?
- Tell me about your undergrad/grad population...
- Do you worry about the identity/skill set of your students?

Thanks for your Attention/Participation!

Practice

mastery of accountable disciplinary knowledge

"what we do"

Participation

participation in overlapping communities of physicists

"where we belong"

Personal

slowly-changing manifold individual traits & abilities "who we are"

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