



# Building STEM Majors: We C.A.R.E. – An emphasis on the “R” for 1<sup>st</sup> & 2<sup>nd</sup> year Majors

Presented at the

31<sup>st</sup> Annual Math Conference  
of

Perimeter College at Georgia State University  
Clarkston, GA

Willie S. Rockward, Ph.D.

Chair & Associate Professor, Department of Physics & Dual Degree Engineering Program

Founding Director, Materials and Optics Research & Engineering (M.O.R.E.) Laboratory

National President, Sigma Pi Sigma Physics Honor Society

President-Elect, National Society of Black Physicists

February 16, 2018



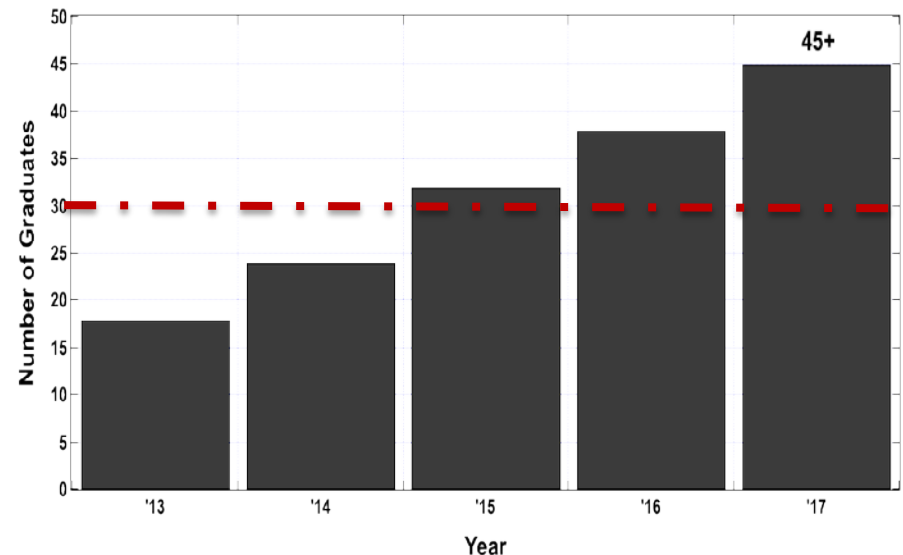
# Overview of Physics & DDEP at Morehouse

## • Division of Math & Sciences

- Strong programs in Biology, Chemistry, Math, & Physics
- **Physics Dept. is the Nation's #1 producer of under-represented minorities with B.S. degrees**
- Boast the Nation's **most productive Dual Degree Engineering Program**
  - **Top 5 (of 14): UMich, GT, Auburn, NCA&T, and RPI**
- Physics Dept. & DDEP
  - 10 Fac. / 1 Adj. Fac. / 2 Staff
  - Majors: 276 = Physics-87 & DDEP-189
  - **2012-17 Grad. Avg.: ~18**
  - **Graduating class 2018: 22 (unofficial)**
- Faculty load distribution
  - Faculty: T-60 / S-30 / R-10
  - **Physics: T-60 / S-30 / R-20**

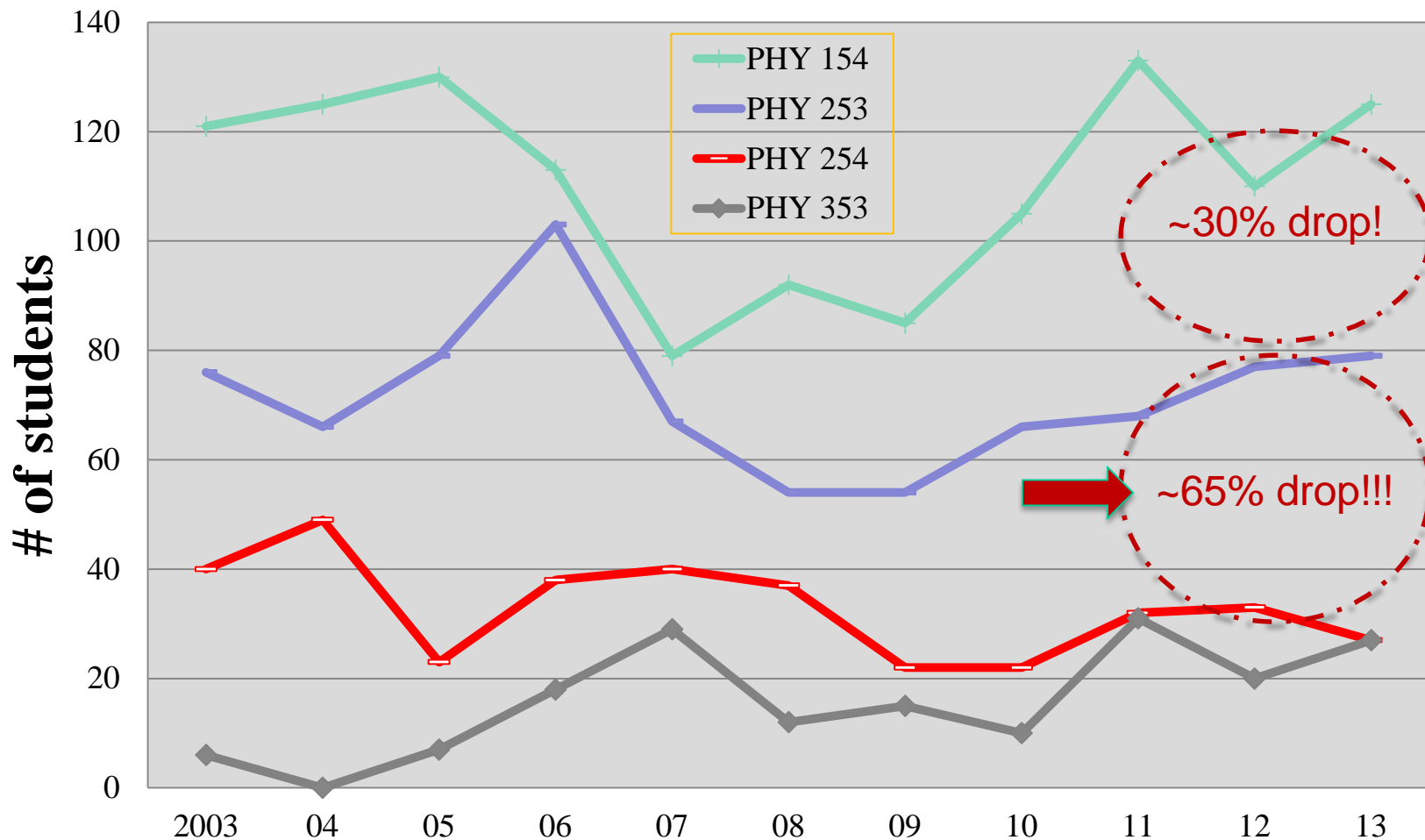
## • Vision **3X** for Physics & DDEP

Over the **next 5-10 years**, the goal of the Department of Physics & Dual Degree Engineering Program at Morehouse College is to **TRIPLE** its number of Physics graduates from **15 to 45**.





## Physics Enrollment Trend (10 yrs)





# Where are we now?

## Highest Number of Physics Degrees Granted to Underrepresented Minorities (URM)

### URM Undergraduate Physics Degrees: Bachelor's Degree Institutions 2010-2012




Institution	Average Degrees/Year
Morehouse College	12
University of PR Humacao University College	5
Xavier University of Louisiana	4
California State Polytechnic University Pomona	4
United States Naval Academy	4
Benedict College	3
St Mary's University	3
South Carolina State University	3
Jackson State University	3
Tuskegee University	3
California State University-Stanislaus	3



# Where we aim to be?

## Highest Number of Physics Degrees Granted

### Undergraduate Physics Degrees: Bachelor's Degree Institutions 2010-2012



Institution	Average Degrees/Year
United States Naval Academy	30
University of Wisconsin-La Crosse	28
St Olaf College	24
SUNY College at Geneseo	22
Carleton College	22
University of Wisconsin-Eau Claire	21
Illinois State University	20
American University	19
University of Wisconsin-River Falls	19
Bethel University	19
Murray State University	18
Harvey Mudd College	17
James Madison University	17
Whitworth University	17
Reed College	17
Grinnell College	16
Kutztown University of Pennsylvania	16
Oberlin College	16
Rowan College of New Jersey	16
Western Washington University	16
Williams College	16



## Morehouse Physics & DDEP: We C.A.R.E. Approach

- Curriculum

- Fixed & Flexible course availability based on student input
- Refresh physics major to reflect viable & known career paths
- Expand offerings with pathways – Computational, Astronomy, etc.

- Advisement

- Career mentoring (academic, life skills, pipelines, SPS career toolbox, etc.)

- Recruitment / Retention / Research / Rewards

- Pre-collegiate summer programs / Faculty high school visits
- Saturday Academy / Summer Placements / Honors & Awards

- Extras

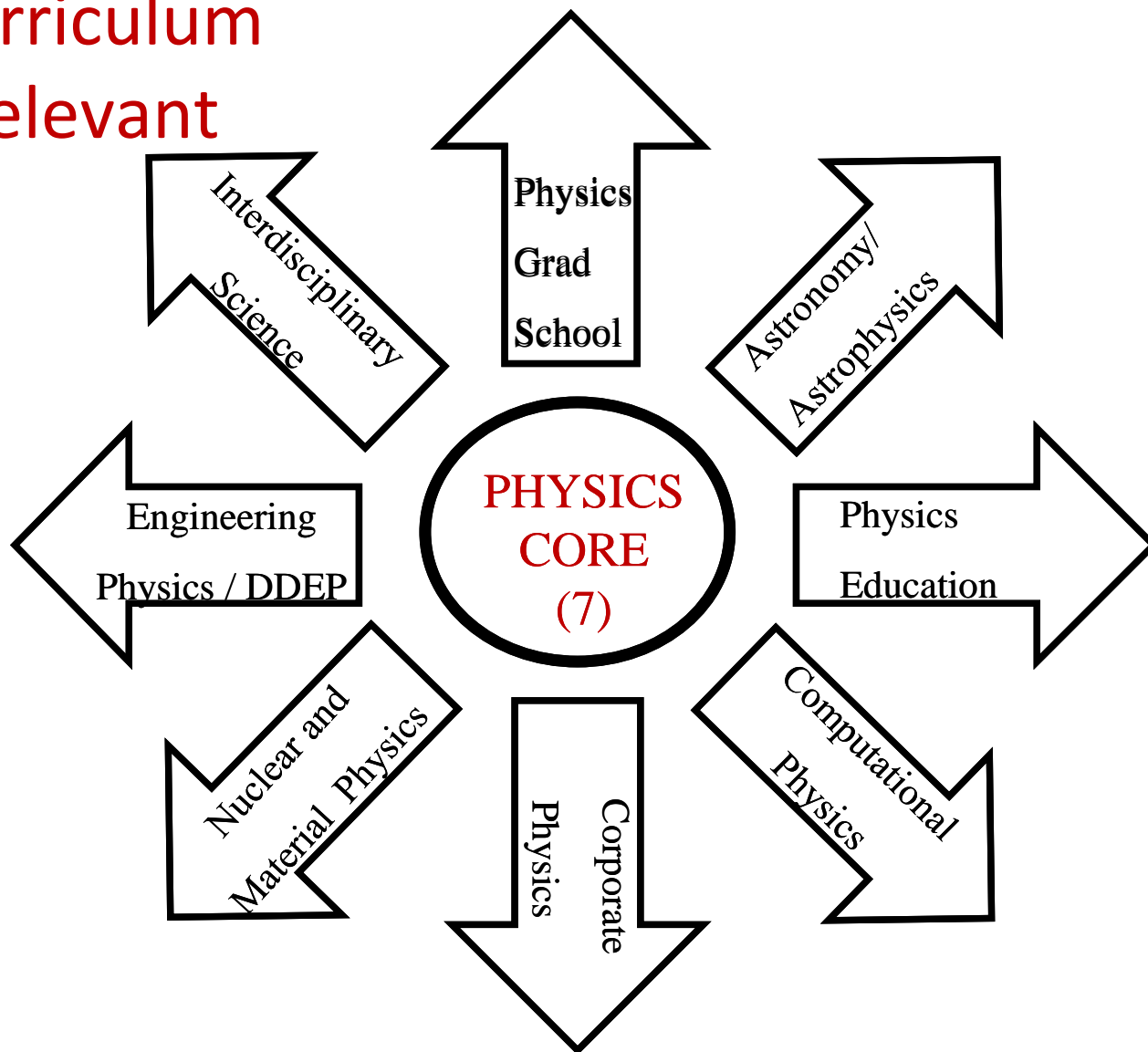
- Graduate School Tours / Special Speakers / DDEP “The Facts” Meetings
- Town Hall meetings by SPS / Scientific leadership & citizenship



## We C.A.R.E.: Curriculum Refreshed & Relevant

### PHYSICS CORE

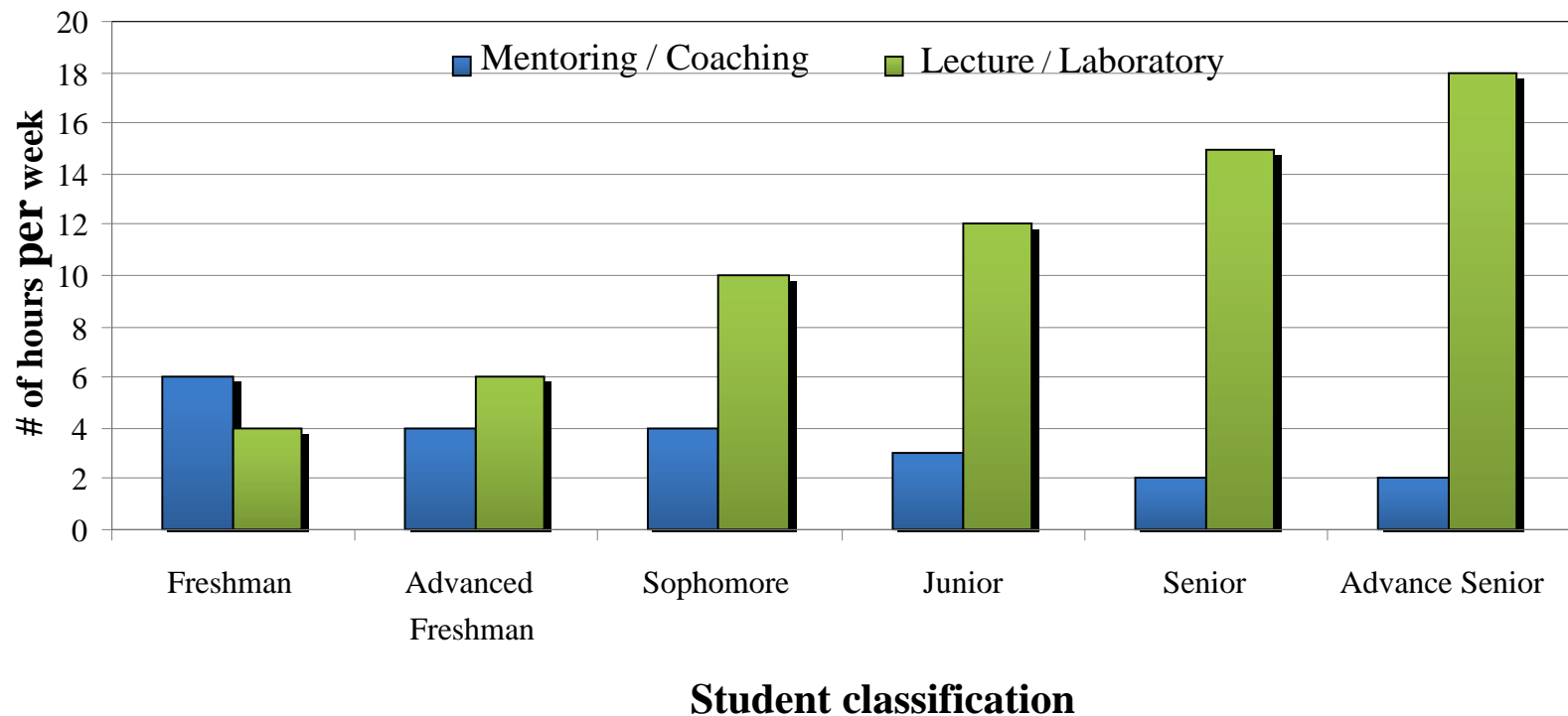
1. Math Physics I
2. Classical Mech.
3. EM Theory
4. Quantum Mech.
5. Thermodynamics
6. Junior Laboratory
7. Senior Seminar  
(Capstone)





## We C.A.R.E.: Advisement/Mentoring with a SMiLE

Methodology & Pedagogy for Undergraduate Research/Teaching Assistants:  
Scholarly Mentoring in Lecture/Laboratory Experiences (SMiLE)

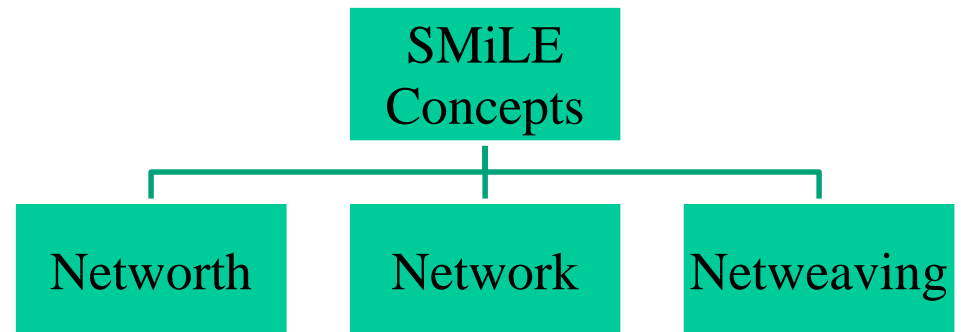






## We C.A.R.E.: Advisement/Mentoring with a SMiLE

- **Networth** = What you know?
  - Knowledge of fundamentals
  - Work ethic
  - Research skills
  - Career aspirations
- **Network** = Who you know?
  - Research experiences
  - Group interactions & dynamics
  - Organization & intrapersonal skills
- **Netweaving** = Who knows you?
  - Conferences & presentations
  - REU mentor, faculty & participants
  - Relational assessment & follow-up





## **We C.A.R.E.: Recruitment/Retention/Rewards**

### **Recruitment with Admissions and Alumni:**

- Become a faculty recruiter for institution
- Be active in Admission-sponsored events (High school visits, Admit Day, Parents Day, etc.)
- Invite alumni for informal career presentations (Homecoming, Founder's Day, etc.)

### **Retention through community and service:**

- Community/family-oriented atmosphere
- “All hands on deck” perspective for faculty, staff and students (**dept. ambassadors**)
- Encourage student outreach activities (free tutoring, K-12 demos, **Physics Day**, etc.)

### **Reward with announcements, scholarships, and annual events:**

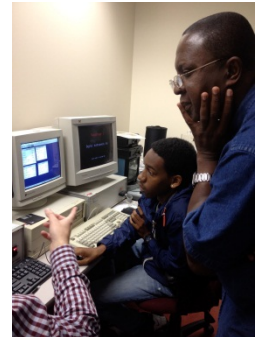
- Faculty kudos and recognition (dept. meetings, Dean/Provost reports, school news)
- Student awards and competitions (1-time and/or annual, sponsored, pizza sessions)
- Department-wide events (catered-lunch, annual induction/graduation ceremony)



## We C.A.R.E.: Research Collaborations

### **Proposed Track in Astronomy/Astrophysics at MC:**

- Courses taken at MC & local ATL institutions to create curriculum for track/concentration in Astronomy/Astrophysics
- Visiting Scientists from major institutions to teach courses at/with Morehouse faculty in related topics



### **Specialized Workshops at MC in relevant topics:**

- Using template of Space Weather Modeling Weekend Workshop (MC with UT-Arlington) create a series of weekend workshops held at MC for students and faculty to attend



### **Increased opportunity for Semester Exchange for MC students and faculty at major institutions:**

- Design MOUs with major institution that allow semester exchange for students and research collaboration with faculty to establish pipeline initiatives



**Space Weather Modeling Weekend at Morehouse College**



## **We C.A.R.E.: Extras**

### **Saturday Academy for Introductory Physics:**

- All-day recitation and problem-solving session with faculty, food, and free jokes (???)
- Considering expansion to select upper-level courses

### **Student-focused organizations and activities:**

- Support existing organizations (SPS, NSBE, etc.)
- Promote annual  $\Sigma\Pi\Sigma$  honors induction (students and faculty)
- Encourage new interest groups (AERO, RoboTigers, etc.)

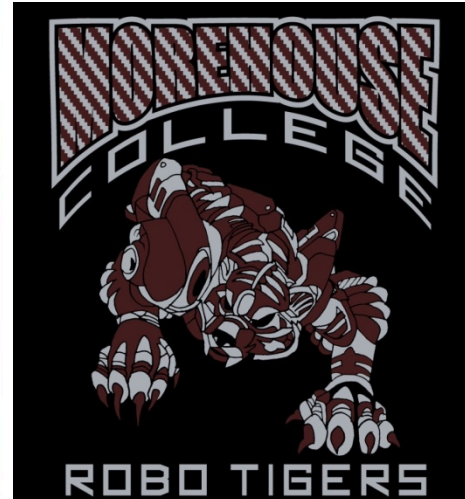
### **Graduate School Tours and Summer REUs:**

- 1- or 2-day visits (usually Fridays) in Spring
- Led by Morehouse SPS &  $\Sigma\Pi\Sigma$  chapters
- Include all STEM majors





# Scientific Citizenship & Leadership Experiences



2014 FIRST LEGO LEAGUE QUALIFIER, BEST ACADEMY, ATLANTA, GA.

**2<sup>ND</sup> PLACE WINNERS**

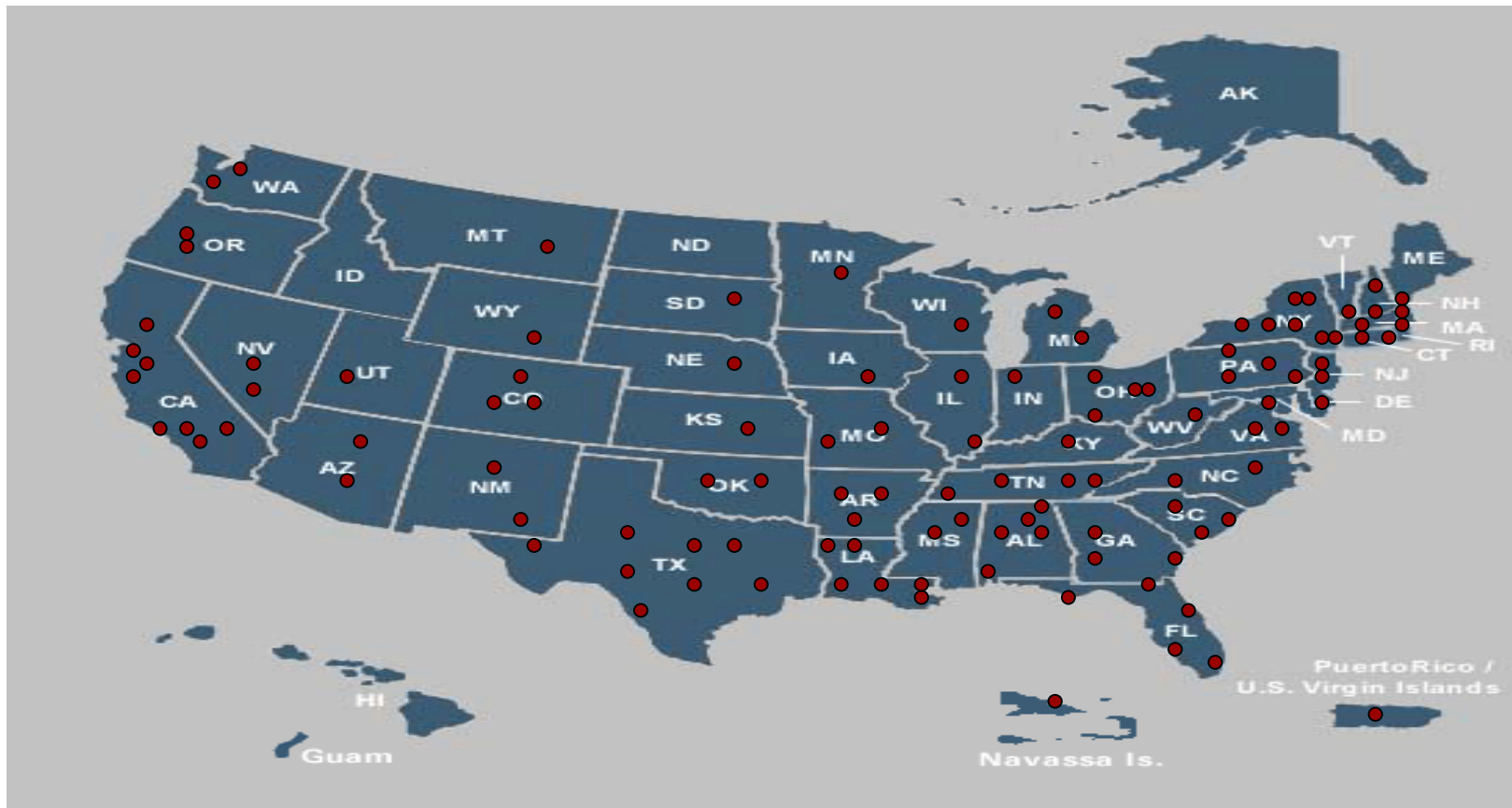
Future Tech Masters

December 13, 2014 | [www.21STEM.org](http://www.21STEM.org)





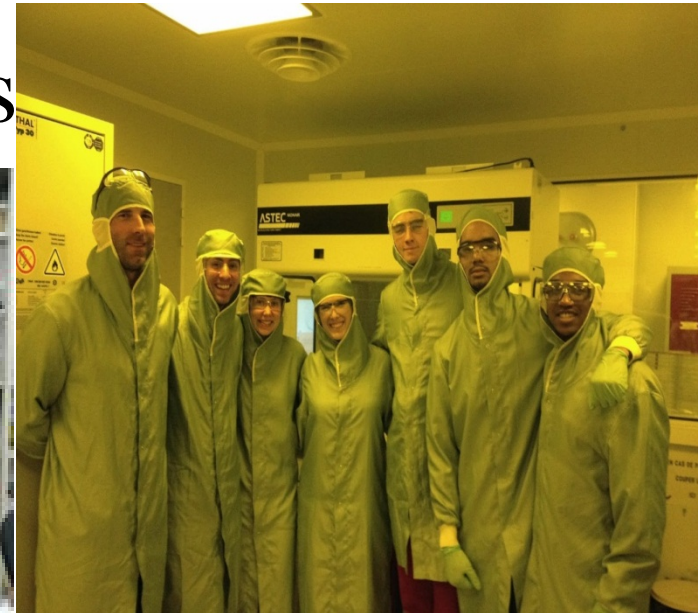
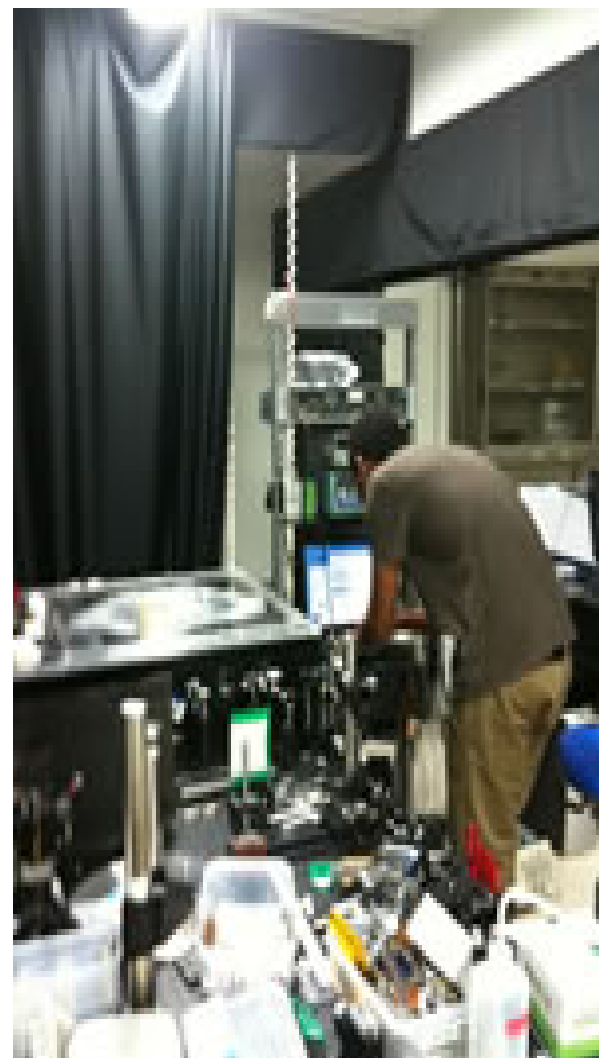
## REUs & Graduate Schools







# International REU Experiences





# Graduate School Tours



**Columbia University**



**University of Iowa**



**NC State, UNC, & Duke University**





**THANK YOU**





# Questions & Answers ??!!