Case Study: Morehouse Physics & Dual DDEP – We C.A.R.E. Approach

at the

Building a Thriving Undergraduate Physics Program Workshop

of the

American Association of Physics Teachers (AAPT)

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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 3 (of 14): GT, UMich, MS&T/RPI
  - Physics Dept. & DDEP
    - 9 Fac. / 2 Adj. Fac. / 1 Staff
    - Majors: 136 = Physics-56 & DDEP-80
    - 2006-14 Grad. Avg.: ~14
    - Graduating class 2014: 23 (official)
  - Faculty load distribution
    - Faculty: T-60 / S-30 / R-10
    - Physics: T-70 / S-20 / R-20

- **Vision 3X for Physics & DDEP**
  Over the next 5-7 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.
2005 to 2012: Averaged 15 graduates per year
Physics enrollment trend (10 yrs)

Number of students

2003 04 05 06 07 08 09 10 11 12 13

~45% drop
Where are we now?

**URM Undergraduate Physics Degrees:**
**Bachelor’s Degree Institutions 2010-2012**

<table>
<thead>
<tr>
<th>Institution</th>
<th>Average Degrees/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morehouse College</td>
<td>12</td>
</tr>
<tr>
<td>University of PR Humacao University College</td>
<td>5</td>
</tr>
<tr>
<td>Xavier University of Louisiana</td>
<td>4</td>
</tr>
<tr>
<td>California State Polytechnic University Pomona</td>
<td>4</td>
</tr>
<tr>
<td>United States Naval Academy</td>
<td>4</td>
</tr>
<tr>
<td>Benedict College</td>
<td>3</td>
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<tr>
<td>St Mary’s University</td>
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<tr>
<td>South Carolina State University</td>
<td>3</td>
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<tr>
<td>Jackson State University</td>
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<tr>
<td>Tuskegee University</td>
<td>3</td>
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<tr>
<td>California State University-Stanislaus</td>
<td>3</td>
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</tbody>
</table>

Source: APS/IPEDS

www.aps.org

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Where we aim to be?

Highest Number of Physics Degrees Granted

Undergraduate Physics Degrees:
Bachelor’s Degree Institutions 2010-2012

<table>
<thead>
<tr>
<th>Institution</th>
<th>Average Degrees/Year</th>
</tr>
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<tbody>
<tr>
<td>United States Naval Academy</td>
<td>30</td>
</tr>
<tr>
<td>University of Wisconsin-La Crosse</td>
<td>28</td>
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<tr>
<td>St. Olaf College</td>
<td>24</td>
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<tr>
<td>SUNY College at Geneseo</td>
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<tr>
<td>Carleton College</td>
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<td>University of Wisconsin-Eau Claire</td>
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<tr>
<td>Illinois State University</td>
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<tr>
<td>American University</td>
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<td>University of Wisconsin-River Falls</td>
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<td>Bethel University</td>
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<tr>
<td>Murray State University</td>
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<tr>
<td>Harvey Mudd College</td>
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<td>James Madison University</td>
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<td>Whitworth University</td>
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<td>Reed College</td>
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<tr>
<td>Grinnell College</td>
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<td>Kutztown University of Pennsylvania</td>
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<td>Oberlin College</td>
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<td>Rowan College of New Jersey</td>
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<td>Western Washington University</td>
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<tr>
<td>Williams College</td>
<td>16</td>
</tr>
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</table>

Source: APS/IPEDS
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 tracks – Computational, Astronomy, etc.

• **Advisement**
  – Career mentoring (academic, life skills, pipeline guidance, etc.)

• **Recruitment / Retention / Research / Rewards**
  – Pre-collegiate summer programs / Faculty high school visits
  – Saturday Academy / Summer Placements (REUs, Interns, etc.)

• **Extras**
  – Graduate School Tours / Special Speakers
  – Town Hall meetings by SPS / Scientific leadership & citizenship
PHYSICS CORE
1. Math Physics I
3. EM Theory
4. Quantum Mech.
5. Thermodynamics
6. Junior Laboratory
7. Senior Seminar (Capstone)

We C.A.R.E.: Curriculum Refreshed & Relevant
We C.A.R.E.: Advisement/Mentoring with a SMiLE

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

# of hours per week

- Mentoring / Coaching
- Lecture / Laboratory

Student classification

- Freshman
- Advanced Freshman
- Sophomore
- Junior
- Senior
- Advance Senior
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
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
- 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

Graduate School Tours and Summer REUs:
- 1- or 2-day visits (usually Fridays) in Spring
- Led by Morehouse SPS chapter
- Include all science majors (not medical schools)

Saturday Academy for Introductory Physics:
- All-day recitation and problem-solving session with faculty, food and free jokes (???)

Student-focused organizations and activities:
- Support existing organizations (SPS, NSBE, etc.)
- Encourage new interest groups (AERO, RoboTigers, etc.)
Graduate School Tours

Columbia University

University of Iowa

NC State, UNC, & Duke University
REUs & Graduate Schools
International REU Experiences
Questions & Answers ??!!