

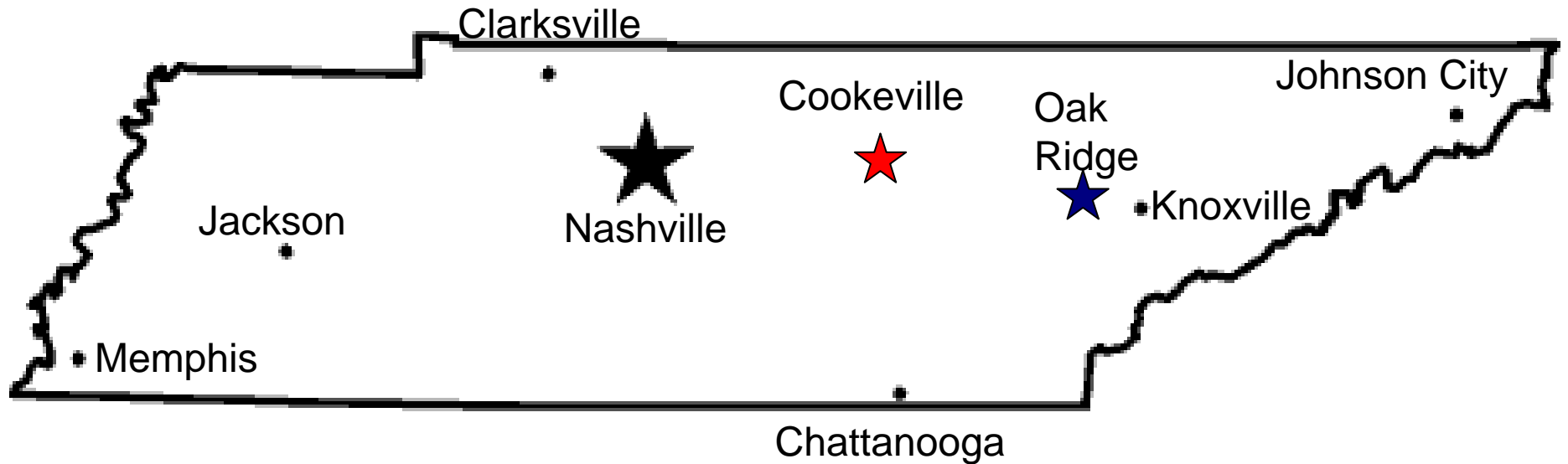
Research in an Undergraduate Physics Department

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- Cookeville population approx 30,000
- Putnam County population approx 70,000
- Center of 14-county Upper Cumberland region

Upper Cumberland region of TN

- Predominantly rural
- Many residents economically disadvantaged
 - Poverty rates by county range from 13.0% - 21.9% (2004)
 - TN rate is 15.0%; US rate is 12.7%
- Education frequently not a strong emphasis
 - Rates of residents over 25 years old with high school diploma by county range from 57.3% to 72.6% (2000)
 - TN rate is 75.9%; US rate is 80.4%

University Information

- Comprehensive public university (one of 6 in Tennessee Board of Regents system)
 - East Tennessee State University
 - Middle Tennessee State University
 - Tennessee State University
 - Austin Peay State University
 - University of Memphis

University Information

- Approx 10000 students
 - 8000 undergraduates
- 94% of undergraduates from Tennessee
- 38% of undergraduates from Upper Cumberland region

University Information

- 5 colleges
 - Arts and Sciences
 - Business Administration
 - Education
 - Engineering
 - Agriculture and Human Sciences (Agriculture, Human Ecology, Nursing)
- Strong emphasis on technology
 - Approx. 20% of undergraduates majoring in engineering
 - Approx. 11% of undergraduates majoring in life sciences, physical sciences, math, or computer science

University Information

- Ph.D. programs in
 - Engineering
 - Environmental Science (Chemistry/Biology)
 - Exceptional Learning (Education)
- Master's programs in number of areas
- No graduate program in physics
 - Only BS offered

Expectations for Physics Faculty

- Standard teaching load is 9 credit hours per semester
 - Toward low end for TTU Arts & Sciences departments
 - Higher than some other colleges
- Introductory labs do utilize student assistants -- both undergrads in science and engineering and some graduate students from engineering
- Research is expected
 - Undergraduate involvement is *strongly* encouraged

TTU and Nuclear Physics

- Mid 1970's: Chairman decides to emphasize nuclear physics; first hires made
- 1978: First DOE grant to Ray Kozub
- First two undergraduates involved in summer of 1979

TTU and Nuclear Physics

- Thru early 1990's: All new hires in nuclear physics
- By 1991 department has 9 faculty (5 experimentalists, 4 theorists) all with background in nuclear physics
- By 1992 six faculty supported by DOE (5 different grants)
- All four funded experimentalists have funds to support undergraduates
- Focus on experimental work from here on...

Scope of Research

- Experimentalists have utilized facilities at Oak Ridge, Brookhaven, Florida State, Argonne, Duke, Montana State, and Institut Laue-Langevin
- Also set up an in-house lab for low count-rate experiments (internal bremsstrahlung)

Scope of Research

- Areas of study have included high-spin states, structure of neutron-rich nuclei, resonances, mixed-symmetry states, neutrinos, and nuclear astrophysics
- Students have been involved in each location and in each area of study

Student Roles

- Have usually focused on summer work
- Faculty member has typically supervised 1-2 students at a time
- Ability to pay students has been critical
- In many cases summer residence at lab has been part of the package
 - (FSU, Duke, ORNL)

Student Roles

- Undergrads don't have the physics background of grad students
- (Freshmen have little physics background at all)
- Projects must be chosen carefully
 - Equipment design/construction
 - Programming/Computational projects
 - Preparation/Setup for experiments
 - Data collection
 - Data analysis
 - Day-to-day functioning of lab when in residence

Student Roles

- Many students work more than one summer
- Sometimes with same person, sometimes not
- Some start with us then go elsewhere for REU program (encouraged)

Outcomes for Undergraduates

- Salary
- Experience & Education
- Coauthor papers
- Conference presentations

We have emphasized student participation in conferences

- National Conference on Undergraduate Research
- Undergraduate sessions at SESAPS meeting
- CEU
 - 29 presentations from TTU students

What have our graduates done?

- 1988 – 1997
 - 18 graduates
 - 14 with research experience
 - 14 attend grad school
 - 6 of those in physics
 - 2 of those in nuclear physics
- 1998 – 2007
 - 22 graduates
 - 16 with research experience
 - 15 attend grad school
 - 9 of those in physics
 - 7 of those in nuclear physics (6 made CEU presentations)

Physics Graduate Programs

- Vanderbilt
- North Carolina State (2)
- Murray State
- Stony Brook (3)
- Yale
- Berkeley
- Notre Dame
- Duke (2)
- Oxford
- Tennessee (2)
- Rutgers

Potential Advantages of Single Field Emphasis

- Colleagues to talk to in your discipline
- Internal collaboration easier
- Greater university recognition in the field
- Greater university recognition when hiring

Potential Disadvantages of Single Field Emphasis

- Administrators sometimes feel it limits teaching capabilities
- Limits pool when hiring
- Some prospective students may see it as limiting

Evolution of TTU Physics

- Department today has 7 full-time faculty
- Four are active in nuclear physics (3 with external funding)
- Two are active in physics education research

Conclusions

- Have performed experiment to test principle of undergraduate department focused on single field of physics
 - Has enhanced department
 - Helped us to provide research opportunities for most of our graduates
 - Has led to culture for the students that makes research a part of the educational process

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