



Oklahoma's Premier Student Centered Regional University

580/559-5394

<http://www.ecok.edu/physics>

Medical Physics

What is medical physics?

Medical Physics is a field that utilizes physics, biology, and mathematics to solve problems in one or more of the subfields of medical physics. They are physicists trained in the application of physics to the medical field. Most work in hospitals, cancer therapy centers or imaging facilities. They are called on to contribute clinical and scientific advice and resources to solve the many and diverse problems that crop up in various medical areas. Licensed medical physicists often work in teaching hospitals where they teach the radiologists and radiation oncologists (MD's) as well as participate in research. There are four main subfields of medical physics. They are described below.

Radiation therapy comprises the largest number of persons called medical physicists (76%). These persons prepare treatment plans for those with cancer and other diseases that require radiation. Gamma knife, brachytherapy, and IMRT (Intensity modulated radiation therapy) are finding increasing applications in radiation therapy. Oncologists (medical doctors that treat cancer) direct medical physicists to design and deliver a treatment plan that kills cancer cells while sparing as much normal tissue as possible. Medical physicists employ computer simulations to design and deliver such life-saving treatment. They must perform calibrations using phantoms (man-made parts that simulate human tissue or organs) to ensure proper amounts of radiation are emitted from the equipment.

Diagnostic imaging comprises 15% of all medical physicists. They primarily deal with the imaging aspect of medical physics such as CT, MRI, Ultrasound, PET (positron emission tomography) and Xray. They must calibrate the instrumentation so that the images delivered are accurate representations of the patient's anatomy or physiology in the case of the PET and SPECT. They must periodically use phantoms of known anatomy/physiology to ensure accurate images and troubleshoot the equipment when images do not represent accurate representations of phantoms.

Nuclear medicine comprises 3% of all medical physicists and deals with the the applications of radionuclides for therapy and imaging. Many tests such as upper and lower GI's, heart stress tests, thyroid scans, etc. require the injection or ingestion of radionuclides. Nuclear medicine physicists are persons who measure the quantities of radionuclides delivered, capture the images from the radionuclides, and work on the equipment that produces the radionuclides and the detectors that capture the images.

Medical Health physicists comprise about 4% of medical physicists . They determine the safe use of all radiation and radionuclides. If you like regulations, compliance, and paperwork, this subfield is for you.

Many of these fields overlap one another. All involve the safe use of radiation and its application to help patients. You must work well with others in the hospital or clinic and enjoy working with computers and equipment in a healthcare setting.

Statistics from AAPM 2004 Salary Report (www.aapm.org)

What can you do with a medical physics B.S. option from ECU?

There are a few jobs in dosimetry that can be obtained with only a BS in medical physics. However, the purpose of this degree is to best prepare students for entry into a masters program in medical physics. There are about ten CAMPEP accredited institutions in the U.S. and Canada. There are many other non-accredited institutions. The University of Oklahoma Health Science Center is the closest MS/PhD medical physics granting institution and the only one in Oklahoma.

After obtaining the MS or PhD in medical physics, a three year period of employment is required to prepare you to sit for the licensure exams either by The American Board of Radiology or the American Board of Medical Physics.

Salaries of medical physicists are quite high compared to many physicists. According to the AAPM 2009 calendar year report averages were:

M.S. no certification \$118,000
M.S. with certification \$172,000
PhDs no certification \$130,000
PhDs with certification \$184,000

The average total 2009 income for the Oklahoma medical physicists was \$177,600 while the median was \$175,000. It is a field that is in high demand as newer modalities are approved for use and as many retire.

(Statistics from http://www.aapm.org/pubs/protected_files/AAPM-Salary09.pdf)

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ECU Physics Faculty

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Dr. Karen Williams , Professor

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Interests: Photothermal deflection spectroscopy in flames, Physics Education, Medical Physics

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Courses taught: GPS, GPI/II, GPI/II Labs, Modern Physics, Optics, Nuclear Physics, Jr. Phys Lab, Xray and Nuclear Lab, Optics for Optometrists, and Medical Physics

Dr. Bruce Weems , Professor

Dean, School of Math & Science

PhD Oklahoma State University, 1972

Phone: 580/559-5549

Courses taught: GPI, Mechanics, Quantum Mechanics, Math Physics

BS: PHYSICS-Medical Physics Option

I. General Education (45 hrs.)

17 Hrs. (MATH 1513, CMPSC 1113, COMM 2253, BIOL 1314, and CHEM 1114) counted in Major . Other hours needed 28

II. Concentration in Medical Physics

A. Required Concentration 30hrs.

PHYS 2115 Engineering Physics I
PHYS 2225 Engineering Physics II
PHYS 3013 Modern Physics
PHYS 3222 Medical Physics
PHYS 3411 Junior Physics Laboratory
PHYS 3713 Thermodynamics
PHYS 4222 Xray & Nuclear Physics lab
PHYS 4313 Intro. to Nuclear Physics
6 hours of Physics Electives (3000-4000 level)

III. Related Work (61 hrs.)

A. Required General Education(17hrs)

BIOL 1314 General Zoology
CHEM 1114 General Chemistry I
CMPSC1113 Computer Programming I
MATH 1513 College Algebra
COMM 2253 Communication in the Workplace

B. Required Related Work(44 hrs.)

BIOL 2184 Human Anatomy
BIOL 3634 Human Physiology
CHEM 1214 General Chemistry II
CHEM3114 Organic Chemistry I
ENG 3183 Technical & Professional Writing
MATH 1713 Trigonometry
MATH 2825 Calculus & Analytic Geometry I
MATH 3025 Calculus & Analytic Geometry II
MATH 3033 Calculus III
MATH 3513 Mathematical Statistics
MATH 4113 Differential Equations
Select one of the following:
HIM 2113 Medical Terminology

IV. Minor (not required)

V. Electives 5hrs.

VI. Total Hours Required : 124

Society of Physics Students

The Society of Physics Students is a national professional physics association of physics students, teachers, and alumni whose goal is the dissemination of physics knowledge to the community at large. National dues include the journal *Physics Today*. The ECU Chapter has over 8 "Outstanding Chapter Awards" nationally. Dr. Karen Williams, advisor, is a former President of the National SPS.

Membership in SPS enables you for a free student membership in AAPM (American Association of Physicists in Medicine) for your first three years as a member in SPS. AAPM does sponsor internships nationally in medical physics each year paying \$4000 for the summer work.

Scholarships/Finances

Brown Mackin and Edward M. Smith Memorial Scholarship are annually awarded. Many of our students also receive ECAMP and Foundation money or work in the physics department. The Carlock Scholarship also is available for those sophomore students from the OK counties of Carter, Love, Marshall, Murray or Jefferson . The ECU Foundation has raised more money towards academic scholarships than any other regional university in Oklahoma.* ECU offers a non-resident tuition waver program.**

(*Source:<http://www.ecok.edu/prospective/whyecu.htm>)

(** Source: <http://www.ecok.edu/prospective/nonresidentwaiver.htm>)

ECU Mission Statement

East Central University's mission is to foster a learning environment in which students, faculty, staff, and community interact to educate students for life in a rapidly changing and culturally diverse society. Within its service area, East Central University provides leadership for economic development and cultural enhancement.

Why should you major in medical physics at ECU?

ECU is the only institution in Oklahoma with a medical physics bachelors option. Take the medical physics course and you may be convinced this is the field and major for you.

In 2009, a proton cancer therapy center opened in OKC metro area. There are only 5 such centers in the U.S. As a result, the demand for medical physicists in Oklahoma will increase dramatically.*

ECU has small classes compared to the comprehensive universities. The 2006 tuition at ECU was \$3497 for 30 hours compared to \$4997 at OSU and \$5110 at OU.**

(*Source: *Daily Oklahoman*, "City Group Investing in Cancer Center", Dec. 20,2006 online at <http://www.newsok.com/article/2988203/>)

(**Source: *Daily Oklahoman*, "Undergraduate Tuition and Fees for Residents" 6/30/06).

About ECU

ECU faculty care about their students. There are over 80 clubs and organizations at ECU, including four fraternities and three sororities.

ECU is in the NCAA Division II with varsity sports offered in 13 sports. ECU Central has a diverse student body presently from 36 countries and 31 different states helping make up the university's student body.

(Source: <http://www.ecok.edu/prospective/whyecu.htm>)

Affirmative Action Compliance Statement
East Central University, in compliance with the Title VI and Title VII of the Civil Rights Act of 1964 (as amended), Executive Order 11246 (as amended), Title XI of the Education Amendments of 1972, Sections 503 and 504 of the Rehabilitation Act of 1973 (as amended), the Americans With Disabilities Act of 1990, the Civil Rights Act of 1991, and other federal and state laws, does not discriminate on the basis of race, color, national origin, sex, age, religion, disability, or status as a veteran in any of its policies, practices or procedures. This includes, but is not limited to, admissions, employment, financial aid and education services.

Cost Statement: This document was published by East Central University as authorized by the Board of Regents of Oklahoma Colleges. A total of 250 copies were printed at a cost of \$25.