

Course Announcement PHYS 428 3 credits

Applications of Modern Physics in Medicine Autumn 2020- Prof. Miller

Many remarkable medical technologies, diagnostic tools, and treatment methods have emerged as a result of modern physics discoveries—including X-rays, radiation treatment, laser surgery, high-resolution ultrasound scans, computerized tomography (CT) scans, and magnetic resonance imaging. This course describes the fundamental physical principles underlying these technological advances, emphasizing their applications to the practice of medicine.

The medical applications of fundamental principles of physics are presented to students who are considering careers in medical physics, biophysics, medicine, or nuclear engineering.

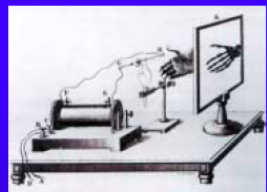
The course will cover aspects of modern physics dealing with propagation of particles—photons, electrons, protons, neutrons and nuclei through matter and the methods used to generate the particles. Properties of atoms and nuclei relevant for medical applications will be reviewed. Explanations of particular physical phenomena will be followed by descriptions of the applications of these phenomena in medicine. The aim is to allow students to understand the physical processes underlying medical applications of modern physics.

Topics include: interactions of particles with matter, applications of X-rays, radiobiology, radiation oncology, use of radioactive sources in medicine, use of protons, neutrons and nuclei in cancer therapy, magnetic resonance imaging.

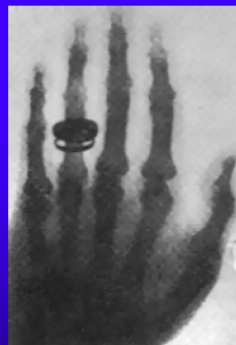
Textbook- Applications of modern physics in Medicine, M. Strikman, K.Spartalian, M.Cole, Princeton U. Press, 2015. Prereq: PHYS225 Method of evaluation: 1 or 2 exams and a paper

W.C. Roentgen discovers X-rays

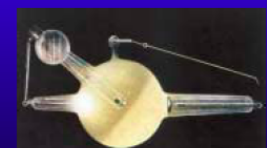
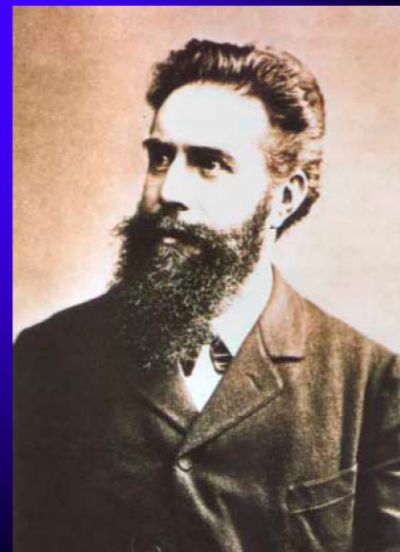
8. Nov. 1895



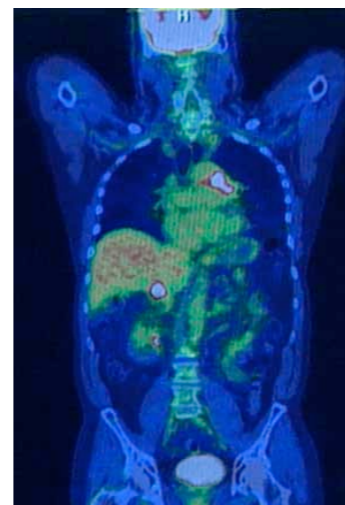
W.C. Roentgen's experiment in Würzburg



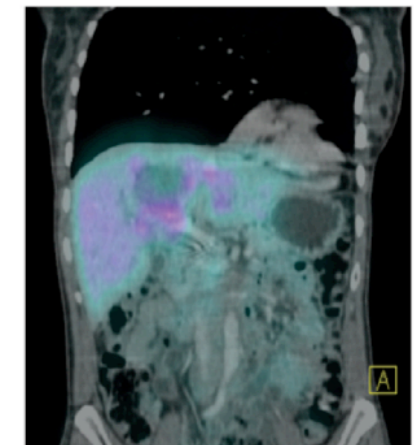
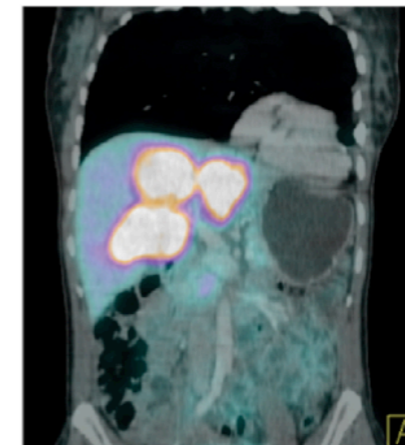
Radiograph of Mrs. Roentgen's hand, the first X-ray image ever taken, 22 Dec. 1895, published in The New York Times January 16, 1896



An early XXth century X-ray tube



PET/CT image



Case II: Response of multiple liver lesions after i.a. therapy with 14 GBq Bi-213-DOTATOC