

Modern Miracle Medical Machines: A Course in Contemporary Physics for Future Physicians

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Motivations

- Many underlying physics concepts in medical diagnosis
- Need of additional instruction in physics beyond the algebra based physics course
- Quality learning in contemporary physics for future physician in diagnosis

Goals

- Conduct research on student reasoning and mental models related to application of physics to contemporary medicine
- Develop active engagement instructional materials on applications of physics to contemporary medical diagnosis and procedures
- Integrate physics and contemporary medical applications throughout the pre-med physics course

Approach to Science

- Enhancement of physics knowledge – not replacement
- Focus on the physics not the medicine
- Qualitative problem solving
- Frequent visualization

Research on Understanding Application of Physics to Medicine

- Clinical Semi-structured Interviews
 - One-on-one (interviewer & student)
 - Elicit student reasoning & mental models
- Teaching Interviews
 - Small groups of students
 - Enables to probe more deeply into reasoning
 - See the social interactions component of reasoning

Materials Development

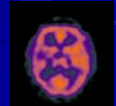
- Design and create the learning materials based on our research
- Pilot test instructional materials with students
- Field test instructional materials

Physics Applications to Medical Process

- X-rays & CT Scans
- Ultrasonic Imaging
- Positron Emission Tomography
- Magnetic Resonance Imaging
- Lasers in surgery

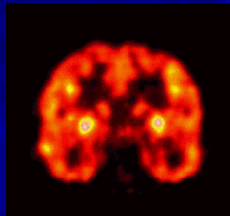
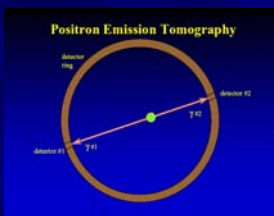
Positron Emission Tomography (PET)

- Positron emitter injected into body
- Positrons annihilate with electrons
- Coincidence of gamma rays determines the location of the annihilation
- Basic brain function can be seen



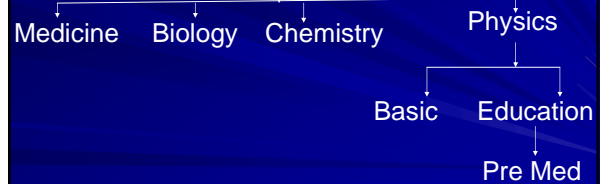
PET

From gamma ray we can see brain function

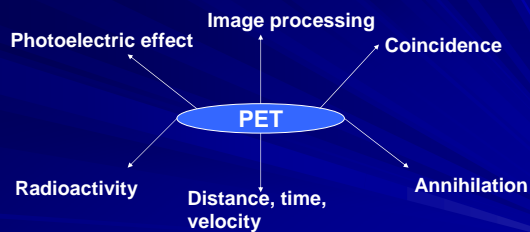


PET

Appears in

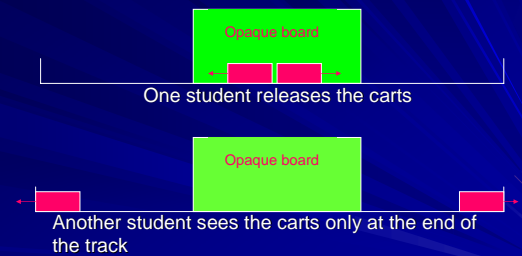


Physics Concepts



PET Exploration

- Coincidence experiment



- Determine where the carts started

❖ Exploration can be done in other physics concepts also

Introduce Throughout the Course

Topic in physics course	PET Concept
Kinematics	Coincidence
Energy	Annihilation & Photoelectric effect
Optics	Image processing
Radioactivity	Positron Emitters

Summary

- Contemporary Medical Imaging a good resource for applications of physics
- Concept learning at a qualitative level
- Can be included throughout the course e.g. PET

Thank you!

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