

Medical Applications of Particle Physics



ITW2024 Study Group 1

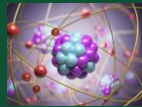




gettyimages
sefa ozel

Potential Students' Conceptions & Challenges

Medical Applications of Particle Physics is the most interesting part in classroom because it relate in our daily life “Learning more about how to treat diseases using particle accelerators 77%” But in classroom student **can't connect between particle physics and medical application** because they don't ever see real medical application



Misconceptions

“Many students are aware that radiation can cause cancer but few are aware of beneficial uses”



Particle physics

Medical application



Curriculum & Classroom Connections

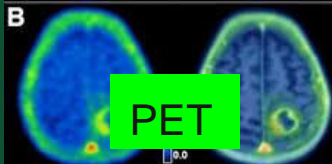
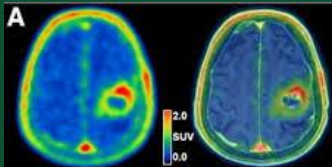
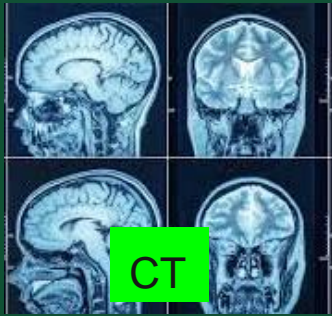


- **Fundamental Physics Principles**
Charged particles in magnetic and electric fields, and the Lorentz force
- **Ionizing Radiation and Its Effects**
Alpha, beta, gamma
- **Applications of Radioactivity**
The use of radioactivity in various fields
- **Medical Imaging and Treatments**
PET scans, proton therapy, radiotherapy, etc.

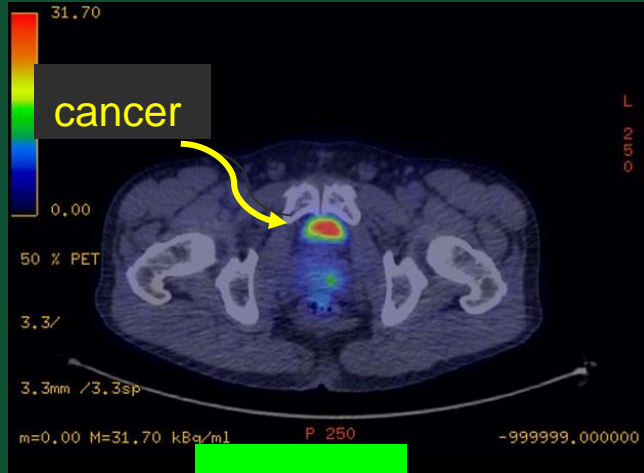


Key Ideas: Particle physics is a critical part of medicine; especially cancer treatment

IMAGING

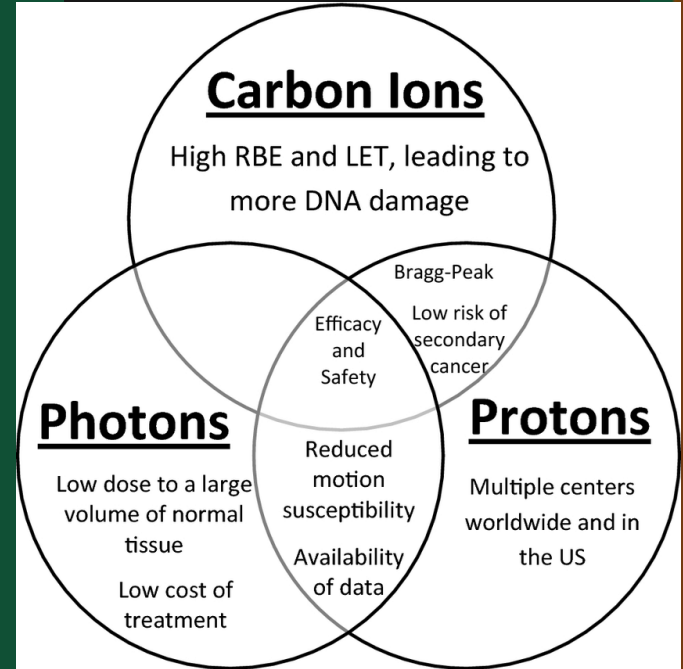


DIAGNOSIS



Revolutionary advances made in last 2 decades

RADIOTHERAPY




Useful Material & Resources

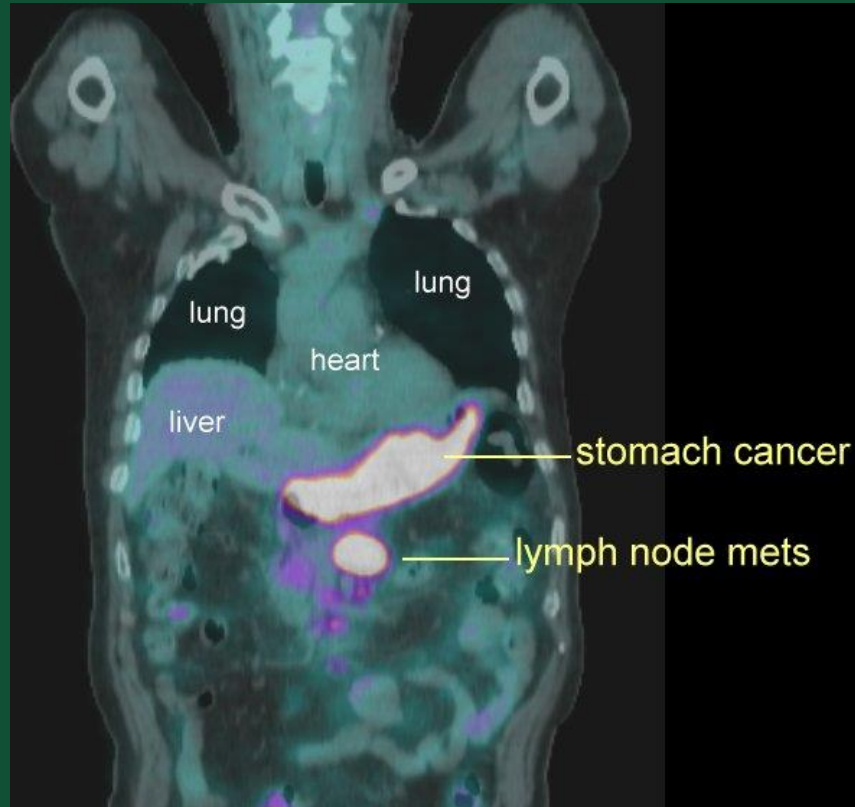
- *Space Medicine: [ESA - Space Medicine](#)*
 - a. [ESA - Human health](#)
- *ESA Resources for classroom: [ESA - Teach with space](#)*
 - a. [ESA - Astrofood - Learning about edible plants in Space | Teach with space PR41](#)
- *IOP Institute of Physics - classroom activities [Collections | IOPSpark](#):*
 - a. [Teaching radioactivity | IOPSpark](#)
 - i. [Teaching Medical Physics | IOPSpark](#)
 1. [Positron emission tomography \(PET\) teacher notes.pdf \(iop.org\)](#)
 2. [Positron emission tomography worksheet.doc \(live.com\)](#)
 - b. [Radiotherapy planning interactive | IOPSpark](#)
 - c. [Inside Story: Physics in medicine | IOPSpark](#)
- **[Classroom Physics | IOPSpark](#)**
- [Teaching radioactivity \(nuffieldfoundation.org\)](#)
- ***RadTown Classroom Materials: Radiation Exposure | US EPA***
- ***6 Activities to Teach Radiation, Conduction, and Convection With Ease (beakersandink.com)***
- [ENVISION - home page \(cern.ch\)](#)
 - a. [ENVISION - outreach \(cern.ch\)](#)
 - b. [Events | THE EUROPEAN NETWORK FOR LIGHT ION HADRON THERAPY \(cern.ch\)](#)
 - i. [Live: From particle physics to medicine \(youtube.com\)](#)
 - c. [Home | THE EUROPEAN NETWORK FOR LIGHT ION HADRON THERAPY \(cern.ch\)](#)
- [ENTERVISION \(cern.ch\)](#)
- [Lesson Plans - Nuclear Science Week](#)
 - a. [Estimate Your Personal Annual Radiation Dose | 5ed97cf591700277c8e6a98b_Radiation_Dose_ChartFINAL2013_1.pdf \(website-files.com\)](#)
- [Radiation Protection | US EPA](#)
 - a. [Calculate Your Radiation Dose | US EPA](#)
- [Home - Radcademy \(asrt.org\)](#)
 - a. [Radcademy MiniCurriculum \(asrt.org\)](#)
- [Radioactivity in the classroom – Science in School](#)
- [Classroom Activity | NRC.gov](#)
- [radteach.pdf \(hpschapters.org\)](#)
- [The Science Behind the Technology - Radcademy \(asrt.org\)](#)
- [Radiotherapy | Irish Cancer Society](#)



Best Practice Example

1. After teaching electric and magnetic  fields, particles, etc ...
2. Ask the students:
3. “Why are we learning all these concepts?”
4. “If someone doesn't want to become a physicist, why do they have to learn about these?”
5. Students work in small groups and brainstorm about all the uses of physics in medicine. They list these on whiteboards.
6. Discuss with the whole class, and emphasize importance in cancer treatment
7. Cancer is growing rapidly globally and with the help of particle physics and science will make our lives better
8. So in classroom teacher should **“use simulation or role play”** for explain about medical application in real life
9. **Surprise!:** [Radiotherapy planning interactive | IOPSpark](#)





PET Scan = advanced gastric cancer
with lymph node spread

ITW2024 Study Group 1

Aleksander (Poland), Paul (United States), Saiya (Thailand), Sevi (Greece), Shafa (Indonesia)

One way in which our thinking has changed...

- CERN requires much more than physicists to be successful
- Collaboration and cooperation in every aspect among lecturers, teachers and program leaders has been the best we have seen in the programs we have attended



The last group picture!!!

Highlights, snapshots, final words...



The teachers in ITW2024 are amazing people!

