

# **Medical Physics: From Fundamentals to Frontiers**

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Medical physics applies the principles of physics to the diagnosis and treatment of human disease. This talk introduces the field by first describing the general career and graduate training pathways. It then goes on to highlight the physics behind major clinical modalities: radiation therapy, diagnostic imaging, nuclear medicine, and MRI physics. Core equations, such as the Beer-Lambert attenuation law, Hounsfield Unit definition, radioactive decay kinetics, and the inner workings of a linear accelerator, the workhorse of radiation therapy, are briefly contextualized as different clinical aspects of the field are introduced.

The second half presents original research from the speaker's doctoral dissertation at the University of Wisconsin–Madison including optimizing quantitative CT reconstruction for airway measurement accuracy in obstructive lung disease, and residency work at UT Southwestern, where 3D gray level co-occurrence matrix (GLCM) radiomic features from diagnostic images and machine learning were applied to classify musculoskeletal soft tissue tumors on MRI. The talk closes with emerging frontiers in the field.