

PHYSICS COLLOQUIUM

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3:50 PM, Room 111, Life Sciences

Associated Particle Neutron Imaging Technology for Medical Diagnostics

David Koltick
Physics Department
Purdue University

While the human body is composed of complex mechanical, chemical and organizational interactions involving molecules with up to 100s of billions of atoms, it is surprising that a measure as simple as localized elemental content presents important diagnostic information on disease presence. It is well known that cancer tumors are hypoxic, in addition anomalous elemental concentrations have been observed to depend on the cancer location for breast, liver, colon, kidney, lung and prostate for concentrations of Fe, Cu, Zn, K, P, S, Ca, Mn, Ni, Se, Rb, Pb, V, As, Br, Sr, Mn, and Hg. For other diseases, Parkinson's disease, Fe overload in regions of the brain appear with associated anomalous concentrations of Mn, Cu, Pb and Al. For Alzheimer's, increases of 5-7 times normal concentrations of Cu, 3-4 times normal concentrations of Zn and 3 times the concentration of Fe are observed. Unfortunately, elemental in vivo information is not presently available as a diagnostic tool.

To this end the possibility of using neutron imaging techniques will be discussed as an in vivo diagnostic tool to take advantage of these elemental disease signatures. The technology of associated particle neutron elemental imaging (API) will be presented. In theory API can produce elemental images with spatial resolution as small as 1-mm. The development of this technology for medical imaging has been minimal and underdeveloped. The talk will discuss the technology of producing neutrons, the behavior of neutrons, the technology of elemental imaging, how the requirements of low dose to patients affects the ability to use the technology, the requirements for imaging and the general direction of research required to develop the technology into a diagnostic tool.