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Tomographic Imaging: Visualization of the Unseeable

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Tomographic imaging is a noninvasive approach to acquiring information within the subject under study, and it plays an increasingly important role in the improvement of health care by providing valuable information for diagnosis of diseases, for guidance of disease treatment and therapy, and for assessment/monitoring of treatment response. It has also found a wide variety of applications in other disciplines, ranging from molecular imaging to material sciences to security scan to paleontology. Over the last 30 years, biomedical imaging has involved into an important discipline in its own right. Physics and mathematics form the foundation of advanced tomographic imaging. Computed tomography (CT) and magnetic resonance imaging (MRI) represent two well-known tomographic imaging modalities. In this talk, I will first introduce the basic physics and mathematics principles on which some of the advanced tomographic imaging techniques such as CT are based, with an emphasis on what and how physical signals are detected, how they are used for producing images, and what physical information is that can be extracted from these images. I will then touch upon some of the recent exciting advances in tomographic imaging technology, followed by a brief discussion of some of the important applications of advanced tomographic imaging in medicine and other areas.

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