

“The Role of Physics for New Imaging Modalities” - Examples of Potential Innovations in X-Ray Diagnostics

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Most of the currently existing biomedical imaging applications, which are used in daily clinical routine, emerged from fundamental physics research activities on the past. Examples are the early developments of x-ray Computed Tomography (CT), the work on Magnetic Resonance Imaging (MRI) or the development of the Positron Emission Tomography (PET). Therefore we can expect that basic physics research will also play a fundamental role in the development of novel imaging approaches for future diagnostics applications.

This presentation will highlight one such example of a fundamentally new physics approach to x-ray imaging, namely “phase-contrast” imaging approaches. The conventional approach relies on x-ray absorption as the sole source of contrast and draws exclusively on ray or geometrical optics to describe and interpret image formation. This approach ignores another, potentially more useful source of contrast, namely the phase information. Phase-contrast imaging techniques, which can be understood using wave optics rather than ray optics, offer ways to augment or complement standard absorption contrast by incorporating phase information.

This presentation will review the recent development of phase-contrast imaging in general, and present a variety of experimental physics results that highlight the potential of this novel method for biomedical, clinical, and industrial applications. The presentation concludes with an outlook concerning the use of these advanced radiology methods for future human diagnostics in pre-clinical and clinical practice.

References (selected):

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Biography

2003 Visiting scientist at the University of Illinois, Urbana-Champaign, USA
2003 – 2007 Staff scientist and group leader at the Paul Scherrer Institut, Switzerland
Research and design of a beamline for coherent x-ray scattering
2007 – 2008 Assistant Professor for Physics (tenure track),
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2008 – 2009 Associate Professor for Physics (tenured),
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