Universität Stuttgart

Fakultät Mathematik Physik

Universität Stuttgart • Pfaffenwaldring 57 • 70569 Stuttgart
Fakultät Mathematik Physik

**Dekan**
Prof. Dr. Ingo Steinwart

# Einladung

zur öffentlichen Antrittsvorlesung

## von Herrn Privatdozent Dr. Gaël Rigaud

am **Montag, 06. Februar 2023 um 15:30 Uhr**
im Fakultätssaal 8.122, Pfaffenwaldring 57, Universität Stuttgart

zum Thema **„Compton scattering imaging: models, inverse problems and challenges“**

Abstract: Compton scattering imaging (CSI) is a nascent concept based on the Compton effect, i.e. the scattering of a photon by an electron, and the current development of high-sensitive energy detectors. Complementary with conventional computerized tomography (CT), the main idea is to illuminate a specimen, characterized by its electron density, with a gamma source and to use the energy of the attenuated photon beam as a new system variable. This emerging inverse problem reveals itself to be quite challenging to solve. First, the model for the scattered radiation data including multiple-order scattering is nonlinear with respect to the electron density. Too expensive computationally, the model has to be simplified in order to be used in reconstruction techniques which results in model inexactness. Furthermore, the stochastic nature of ionizing sources combined with a limited data acquisition time leads to a significant Poisson noise. Finally, it can be shown by microlocal analysis that the data acquisition from one source position suffers intrinsically from limited data issues. This means that standard scattered data will not fully represent the sought-for quantity and that our inverse problem is by nature incomplete.

This talk will provide a short introduction to the physics of scattering as well as a general model for the scattered radiation. The different aforementioned challenges will be detailed, and analytic as well as data-driven reconstruction strategies will be presented in order to tackle these issues. Finally the task of reconstructing objects in motion will be discussed at the end of the talk.

Hierzu laden wir sehr herzlich ein.

gez. Prof. Dr. Ingo Steinwart (Dekan)