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*Integrative Research Institute for the Sciences*

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## **IRIS Colloquium**

*On Friday, March 26<sup>th</sup>, 2021, 13:00 – 14:45*

**13:00 Dr. Stijn van Tongeren**

Department of Physics, Humboldt-Universität zu Berlin

*Exactly solvable models and holography*

**13:35 Dr. Emanuel Malek**

Department of Physics, Humboldt-Universität zu Berlin

*Listening to the shape of string theory's extra dimensions*

**14:10 Dr. Markus Krutzik**

Department of Physics, Humboldt-Universität zu Berlin

*Atomic systems for timing and sensing applications*

Zoom-Link: <https://hu-berlin.zoom.us/j/63924542492>

Meeting ID: 639 2454 2492

Interested persons are warmly invited.

Jürgen P. Rabe

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**13:00 Dr. Stijn van Tongeren**

Department of Physics, Humboldt-Universität zu Berlin

### ***Exactly solvable models and holography***

In many areas of physics, our understanding beyond perturbation theory is limited. In special cases we can get considerable insight from exactly solvable models, famously illustrated by e.g. the Kepler problem/Hydrogen atom. I will describe how such models appear in the context of holographic dualities between certain quantum field and string theories, and some of the many things we can learn from there.

**13:35 Dr. Emanuel Malek**

Department of Physics, Humboldt-Universität zu Berlin

### ***Listening to the shape of string theory's extra dimensions***

All applications of string theory, whether in modelling fundamental particle physics interactions or in studying strongly-coupled quantum field theories via holography, require some of string theory's 10 dimensions to be "compactified", i.e. curled up into a small space. The shape of these compactified dimensions determines the physics, such as the spectrum of particles, observed in the remaining large dimensions. This is analogous to how the shape of instruments determines the sound of notes played. However, in practice, computing the spectrum for realistic compactifications reduces to a fiendishly complicated exercise in harmonic analysis. I will present new methods of performing this analysis and what this teaches us about the physics of string theory.

**14:10 Dr. Markus Krutzik**

Department of Physics, Humboldt-Universität zu Berlin

### ***Atomic systems for timing and sensing applications***

Advances in the miniaturization of complex electro-optical systems, together with narrow-linewidth atomic spectroscopy techniques hold great potential for realizing compact devices for time-keeping, field sensing and communication. Their low size, weight and power (SWaP) budgets make them particularly interesting for portable instruments or applications in space. To this end, we are establishing experiments using Rubidium and Strontium thermal and laser cooled gases, to study and benchmark their feasibility towards realizing hybrid-integrated optical frequency references, clocks and atomic memories. In this talk, we will give an overview of our activities.