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**Directorate of studies
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Physics**

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To all members of the
Faculty of Physics

Vienna, 10 December 2024

Invitation to the public defense of the doctoral thesis

“Quantum Reference Frames in Spacetime”

by

Viktoria Sophia Kabel

Tuesday, 17 December 2024, 15:00 p.m.

Seminarroom A, 2nd Floor, Währinger Straße 17, 1090 Vienna

This thesis explores the interface between quantum theory and gravity through the lens of quantum reference frames (QRFs). The study of QRFs centers around the idea of incorporating the quantum properties of the reference systems we inevitably use to describe the physical world. This concept finds its motivation across various areas of physics, from quantum foundations and quantum information to quantum gravity, making QRFs a natural point of convergence between these fields.

The first part of this thesis focuses on extending existing theoretical tools for modelling QRFs and transformations between them to superpositions of semi-classical spacetimes. The second part of the thesis is concerned with the connections between QRFs and similar concepts in general relativity and quantum gravity: edge modes and geometrical clocks.

Defense committee:

Renato Renner, ETH Zürich, CH (reviewer)

Laurent Freidel, Perimeter Institute for Technical Physics, CA (reviewer)

Caslav Brukner (supervisor)

Thomas Pichler (chair)