



E I N L A D U N G

im Rahmen des Literaturseminars

zum Vortrag

von

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(Vienna)

über

*„Quantum mechanics and the covariance of physical laws
in quantum reference frames“*

ABSTRACT:

In physics, every observation is made with respect to a frame of reference. Although reference frames are usually not considered as degrees of freedom, in all practical situations it is a physical system which constitutes a reference frame. Can a quantum system be considered as a reference frame and, if so, which description would it give of the world? The relational approach to physics suggests that all the features of a system —such as entanglement and superposition— are observer-dependent: what appears classical from our usual laboratory description might appear to be in a superposition, or entangled, from the point of view of such a quantum reference frame. In this work, we develop an operational framework for quantum theory to be applied within quantum reference frames. We find that, when reference frames are treated as quantum degrees of freedom, a more general transformation between reference frames has to be introduced. With this transformation we describe states, measurement, and dynamical evolution in different quantum reference frames, without appealing to an external, absolute reference frame. The transformation also leads to a generalisation of the notion of covariance of dynamical physical laws, which we explore in the case of ‘superposition of Galilean translations’ and ‘superposition of Galilean boosts’. In addition, we consider the situation when the reference frame moves in a ‘superposition of accelerations’, which leads us to extend the validity of the weak equivalence principle to quantum reference frames. Finally, this approach to quantum reference frames also has natural applications in defining the notion of the rest frame of a quantum system when it is in a superposition of momenta with respect to the laboratory frame of reference.

Zeit: Donnerstag, 11.01.2018, **14:00**

Ort: Arbeitsgruppe Gravitation, Währinger Straße 17, **Raum 218**,
2. Stock

gez.: P. Chrusciel