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# Einladung zum Vortrag

# Pure States and Projective Measurements – Convenient fictions in a thermodynamic world of incomplete knowledge

**anlässlich des Habilitationsverfahrens**
**für das Fach " Theoretische Physik "**

von


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**Termin:** **Freitag, 11.03.2022, 10:30 Uhr**

**Ort:** **Ludwig-Boltzmann-Hörsaal, Boltzmanngasse 5, EG**


**Abstract:**

Many of the crucial insights of quantum information theory can be formulated in terms of pure quantum states, represented by vectors in a Hilbert space, and projective measurements that leave systems in the pure states associated to the observed measurement outcome. Such a description is often convenient, because it allows for compactly formulated statements about quantum systems without having to figuratively carry along excess baggage of practical imperfections and incomplete knowledge about the respective systems in order to make a point. Yet, the world around us is full of imperfections, lack of complete information, and statistical uncertainties: in its simplest form captured by descriptions of systems in thermal equilibrium. Thermodynamics, and with it assumptions about what one assumes to know or be able to control about a system hence naturally enters the domain of quantum information theory, and vice versa, as I shall elaborate on in this talk. In this context, I will focus on the question: What are the resources that are required to prepare a quantum system in a pure state? There are two options that are usually considered for reaching a pure state: cooling and perfect projective measurements. As I will discuss, neither of these procedures can ever really reach a pure state exactly, unless one presupposes the availability of pure states to begin with or if infinite resources are invested in terms of time, energy or control complexity, a notion that I will examine more closely in the talk.