Application of the Sturm-Liouville theory to classical and quantum field theory in anti-de Sitter spacetime

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Abstract Anti-de Sitter is not a globally hyperbolic spacetime and, hence, a well-posed field theory on this background is not guaranteed a priori. In general, one needs an appropriate choice of boundary conditions at the conformal boundary such that the classical field equation is well-posed. Moreover, at the level of the standard formulation of quantum field theory, the existence of physical quantum states, the so-called Hadamard states, is only guaranteed (and defined) on globally hyperbolic spacetimes.

In this talk, I consider a scalar field on anti-de Sitter and reduce its dynamics to a singular Sturm-Liouville problem in the upper half plane. This allows us to determine all of the acceptable boundary conditions, including the commonly used Dirichlet boundary conditions as a particular example. I show that both the classical and quantum field theory are well-defined for these choices and, in particular, we can have a natural definition of a physically relevant, Hadamard state for all these choices of boundary conditions.