# Construction of Hadamard states with the fermionic signature operator

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**Abstract** In certain globally hyperbolic space-times, one can introduce the fermionic signature operator as a self-adjoint operator on the Hilbert space of solutions of the Dirac equation. Its spectrum encodes geometric information on space-time. The fermionic signature operator gives rise to a covariant construction of quasi-free quantum states, the so-called fermionic projector states.

In the talk, I will introduce the basic concepts, outline a few general results and explain the construction of the fermionic projector state. In the second part of the talk, I will discuss in various examples (Minkowsi space, a space-time slab, Friedmann-Robertson-Walker, de Sitter and Rindler space-times) whether the fermionic projector state is of Hadamard form. I finally explain how to use methods of perturbation theory to prove that the fermionic projector state in Minkowski space remains Hadamard if an external potential with suitable decay properties at infinity is introduced.

This is joint work with Moritz Reintjes, Olaf Müller, Simone Murro and Christian Röken.