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Locally Covariant Quantum Field Theory on Causally Compatible Sets

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In this talk I describe the mathematics required in order to provide a description of the observables for quantum fields on low-regularity spacetimes. The first step involves constructing low-regularity advanced and retarded Green operators as maps between suitable function spaces. In specifying these we need to use graph norms on Sobolev spaces to ensure that the Green operators are well-defined inverses. The causal propagator is then used to define a symplectic form on a topological vector space $V(M)$. A key point is the way in which the causal propagator on a (non-smooth) globally hyperbolic spacetime restricts to the causal propagator on a smaller causally compatible submanifold and therefore induces a symplectic map between the vector spaces. This property enables one to provide a locally covariant description of the quantum fields in terms of the elements of quasi-local C^*-algebras on which one may define canonical commutation relations. I end with a brief discussion on the choice of Sobolev micro-local spectrum condition used to single out the physical states in the low-regularity setting.

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