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Title:	On the uniqueness of the canonical commutation relations in quantum physics
Authors:	Singh, Satvik. (/jspui/browse?type=author&value=Singh%2C+Satvik.)
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Abstract:	While quantum mechanics tells us that states of a given physical system reside in a Hilbert space and observables correspond to self-adjoint operators acting on that space, it doesn't provide a prescription to uniquely associate a Hilbert space and the relevant self-adjoint observables for any given system. Then, why is the dynamics of a free particle in one dimension always modelled by the space of complex square integrable functions with the position and momentum observables acting as the multiplication and differentiation operators, respectively? It is perfectly reasonable to expect that there may be other choices of the Hilbert space and of the self-adjoint operators linked with the position and momentum observables which serve equally as well to model the dynamics of the free particle. In this thesis, we aim to answer the aforementioned question by providing a self-contained account of the seminal Stone-von Neumann uniqueness theorem for the canonical commutation relation, which shows that it is the nature of the commutation relation between the position and momentum observables that (uniquely) fixes both the choice of the Hilbert space and of the self-adjoint operators linked with the position and momentum observables of the free particle.
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