Complementarity of representations in quantum mechanics

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Abstract

We show that Bohr's principle of complementarity between position and momentum descriptions can be formulated rigorously as a claim about the existence of representations of the CCRs. In particular, in any representation where the position operator has eigenstates, there is no momentum operator, and vice versa. Equivalently, if there are nonzero projections corresponding to sharp position values, all spectral projections of the momentum operator map onto the zero element.

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