Mathematics > Spectral Theory

A spectral theory of linear operators on rigged Hilbert spaces under certain analyticity conditions

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A spectral theory of linear operators on rigged Hilbert spaces (Gelfand triplets) is developed under the assumptions that a linear operator T on a Hilbert space $\mathcal{H}$ is a perturbation of a selfadjoint operator, and the spectral measure of the selfadjoint operator has an analytic continuation near the real axis. It is shown that there exists a dense subspace X of $\mathcal {H}$ such that the resolvent $(\lambda -T)^{-1}\phi$ of the operator T has an analytic continuation from the lower half plane to the upper half plane for any $\phi \in X$, even when T has a continuous spectrum on $\mathbf{R}$, as an X'-valued holomorphic function, where X' is a dual space of X. The rigged Hilbert space consists of three spaces $X \subset \mathcal{H} \subset X'$. Basic tools of the usual spectral theory, such as spectra, resolvents and Riesz projections are extended to those defined on a rigged Hilbert space. They prove to have the same properties as those of the usual spectral theory. The results are applied to estimate exponential decays of the semigroups of linear operators.

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