THE RESOLVENT ALGEBRA OF THE CANONICAL COMMUTATION RELATIONS

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The Weyl algebra is the standard C*-algebraic version of the algebra of canonical commutation relations, but in applications it often causes difficulties. These stem from its failure to admit the formulation of physically interesting dynamical laws as automorphism groups, and that it does not contain important (bounded) physical observables. We consider a new C*-algebra of the canonical commutation relations which circumvents such problems. It is based on the resolvents of the canonical operators and their algebraic relations. The resulting C*-algebra, the resolvent algebra, has many desirable analytic properties. In particular, the resolvent algebra has one–parameter automorphism groups corresponding to a large class of physically relevant dynamics, and it contains the resolvents of many interesting Hamiltonians. It has a rich ideal structure, and in fact its primitive ideal space can detect the dimension of the underlying symplectic space. However, all regular representations are faithful. In applications to canonical quantum systems it has been a substantial improvement on the Weyl algebra, already in the areas of C*-supersymmetry, dynamics of infinite lattice quantum systems and BRST-constraints.

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