

A variation principle for ground spaces

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A variation formula is presented for the ground space projections of a vector space of energy operators in a matrix $*$ -algebra. We prove that the ground space projections are the greatest projections of the algebra under certain operator cone constraints. The formula is derived from lattice isomorphisms between normal cones and exposed faces of the state space of the algebra, and between ground space projections.

The vector space of local Hamiltonians is in the focus of quantum many-body physics. The variation formula will be demonstrated with two-local three-bit (commutative) Hamiltonians. A future goal is to understand the lattice of ground spaces of two-local three-qubit (non-commutative) Hamiltonians. Both the combinatorics and topology of this lattice are unsettled issues.

REFERENCES

- [1] S. Weis, *A variation principle for ground spaces*, 2017,
<https://arxiv.org/abs/1704.07675>