

Dual Vector Spaces and Physical Singularities

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Abstract. Though 3-D vector space has no mechanism within itself for creating fundamental particle singularities, this can be accomplished by a commutative combination of two 3-D vector spaces, each of which is dual (in a physical sense) to the other. The resulting combination leads to a nilpotent quantum mechanics / quantum field theory, which incorporates exact supersymmetry and removes the anomalies due to self-interaction. Such spin. for fermions, *zitterbewegung* and Berry phase become natural consequences of the dual space formalism.

Keywords: dual vector space, singularities, Dirac algebra, fermions, *zitterbewegung*, Berry phase

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