

## Quantum Physics

# Classical and Quantum Mechanics from the universal Poisson-Rinehart algebra of a manifold

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(Submitted on 7 Jan 2009)

The Lie and module (Rinehart) algebraic structure of vector fields of compact support over  $C$  infinity functions on a (connected) manifold  $M$  define a unique universal non-commutative Poisson  $*$  algebra. For a compact manifold, a (antihermitian) variable  $Z$ , central with respect to both the product and the Lie product, relates commutators and Poisson brackets; in the non-compact case, sequences of locally central variables allow for the addition of an element with the same role. Quotients with respect to the (positive) values taken by  $Z^* Z$  define classical Poisson algebras and quantum observable algebras, with the Planck constant given by  $-iZ$ . Under standard regularity conditions, the corresponding states and Hilbert space representations uniquely give rise to classical and quantum mechanics on  $M$ .

Comments: Talk given by the first author at the 40th Symposium on Mathematical Physics, Torun, June 25-28, 2008

Subjects: **Quantum Physics (quant-ph)**; Mathematical Physics (math-ph)

Cite as: [arXiv:0901.0870v1](#) [quant-ph]

## Submission history

From: Giovanni Morchio [[view email](#)]

[v1] Wed, 7 Jan 2009 16:54:45 GMT (18kb)

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