

# Quantum information with modular variables

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I am interested in exploring the foundations of quantum mechanics. This I find especially interesting because the very postulates of the theory lead to some striking classically unexpected results which have been verified experimentally, themselves aren't fully consistent; the measurement postulate and the unitary time-evolution. Action at a distance like effects, which arise from quantum correlations slash entanglement therefore are at the heart of the theory. These effects when carefully studied lead to predictions that act as tests for a system to be in a state that can't be described classically [arXiv:0811.2803].

Experimentally these tests have been performed on photonic and atomic systems. However, performing these tests on massive systems is still an area of research. A proposed scheme for such tests is the use of modular variables (which I'll describe shortly) of macroscopic continuous variable systems [Phys. Rev. Lett. 112, 190402 (2014)]. The objective of the project would be to use modular variables to understand the origin of quantum effects, viz. effects peculiar slash characteristic to quantum mechanical objects. These tests may even be used to quantify entanglement in such systems and prove to be an interesting route to studying the foundations of the subject.

Modular variables in simple terms may be understood as variables that are bounded, which makes them 'nice'. In continuous systems, variables like position and momentum ( $x$  and  $p$ ) are unbounded. Use of modular variables such as  $\sin(x)$  and  $\cos(p)$ , which in fact can be measured, maybe used in the aforesaid context instead.