A baby Majorana quantum formalism

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The most basic fundamental concepts of quantum physics are presented by means of a simple and pedagogical example, namely the Euclidean plane viewed as the Hilbert space of quantum states. The pure states form the unit circle (actually a half of it), the mixed states form the unit disk (actually a half of it), and rotations in the plane rule time evolution through Majorana-like equations involving only real quantities for closed and open systems. Because the set of pure states or a set of mixed states solve the identity, they are used to quantize functions on the unit circle and to give a semi-classical portrait of quantum observables. Since the tensor product of two planes, their direct sum, their cartesian product, are isomorphic (2 is the unique solution to x^x= x X x = x+x), and they are also isomorphic to C^2, and to the quaternion field H (as a vector space), I will describe an interesting relation between entanglement of real states, one-half spin cat states, and unit-norm quaternions which form the group SU(2). I will explain the most general form of the Hamiltonian in the real plane by considering the quantization of a magnetic-like interaction potential viewed as a classical observable on the unit 2-sphere. Finally, I will present an example of quantum measurement with pointer states lying also in the Euclidean plane.