Programa de Pós-Graduação
Processo de Seleção – 1º Semestre de 2020
Exame de inglês

Candidato(a): ____

Curso: ( ) Mestrado
( ) Doutorado

Observações:

- O Exame de Inglês consiste em fazer uma versão em português do texto da página 2.
- O nome completo e a modalidade (Mestrado ou Doutorado) do(a) candidato(a) devem ser assinalados nos campos correspondentes, na capa e nas folhas de resposta do Exame.

O texto a seguir é uma parte de um artigo publicado recentemente na seção News & Views da revista Nature Physics.

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NON-HERMITIAN PHYSICS
Exceptional quantum behaviour

Stefan Rotter

Non-Hermitian systems with gain and loss give rise to exceptional points with exceptional properties. An experiment with superconducting qubits now offers a first step towards studying these singularities in the quantum domain.

Non-conservative physical systems subject to dissipation (loss) and amplification (gain) exhibit degeneracies known as exceptional points (EPs). As a system approaches such a point in phase space, two eigenstates merge into one, giving rise to a plethora of interesting phenomena that recently caught the attention of the physics community. Exceptional points also emerge in the quantum domain, but the practical exploration of the related physical effects is a challenging task – loss and gain, in fact, lead to noise and decoherence too. Writing in Nature Physics, Mahdi Naghiloo and colleagues have now reported an experiment that provides access to EPs in a quantum system by means of modern qubit technology and a clever measurement scheme.

The authors' approach is rooted in the concepts of dissipation and decoherence, which are fundamental in quantum mechanics. Consider, for example, the iconic problem of the spontaneous emission of photons by an atom in free space, which happens as a result of the atom's dissipative coupling with the surrounding electromagnetic modes. The time evolution of the atom in this process is typically described by a master equation, in which the central object is a density matrix of the atom rather than its wave function. This is because the atom decoheres while interacting with its electromagnetic bath and thus cannot be described by a pure state anymore.

Theoretical work demonstrated, however, that a wave function description of the atom in this context is still possible at the expense of introducing randomly generated 'quantum jumps'. For the case at hand, a jump would correspond to the decay of an excited state of the atom accompanied by the emission of a photon. Averaging over many such stochastic wave functions with random jumps can then be shown to be equivalent to a solution of the more involved master equation. One interesting aspect of this stochastic approach is the fact that for times until the first jump occurs, the time evolution of the atom is particularly simple and described by a conventional Schrödinger equation. The interaction with the environment enters this equation only as a dissipative term that makes the atomic Hamiltonian non-Hermitian. This is exactly what Naghiloo and colleagues exploited to study non-Hermitian physics with quantum states.

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Resenha do texto

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