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The Jaynes-Cummings model: 60 years and still counting

To mark the occasion of the 60th anniversary of th Jaynes-Cummings model, the Journal of the Optical Society of America B has published a special issue on this foundational model in quantum optics, highlighting its importance in the field and the evolution of its applications.

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In January of 1963, E. T. Jaynes and F. W. Cummings developed what became known as the Jaynes-Cummings model, which describes a two-level atom coupled to a single mode of the electromagnetic field. Like many of the greatest works of humanity, the model's birth went quite unnoticed. It was only in the second decade of its existence that it began to draw th attention of researchers. The number of mentions of the term ?Jaynes-Cummings' has kep growing since then, showcasing the fact that it has become a deep-routed model in man different areas within quantum physics, especially in quantum optics

The initial change of paradigm around 1973 was sparked by the signatures of coherence i the model, like the appearance of collapses and revivals of atomic inversion for an initia coherent state of light. In the decades that followed, the applications of Jaynes-Cumming physics quickly spread

These applications are reviewed in the special issue recently published in the Journal of th Optical Society of America B by Stockholm University, ICFO researcher **Dr. Themistoklis Mavrogordatos** and colleagues from the University of Auckland, Dodd-Walls Centre for Photonic and Quantum Technologies and the University of Campinas.

The review covers some posterior generalizations of the Jaynes-Cummings model (Tavis-Cummings and Dicke models) and its relevance with respect to a wide variety of topics, including decoherence, cavity QED, non-classical light or quantum phase transitions, among many others.

In addition to its countless applications, this model entails a fundamental importance. i¿½As I started my first steps into quantum optics, I quickly realized that the Jaynes-Cummings model holds the key to the reappraisal of wave-particle duality, a longstanding subject since the development of the old quantum theoryi¿½, explains Dr. Themistoklis Mavrogordato **Dr. Antonio Vidiella-Barranco**, corresponding author of the article, recalls the beginnings of his scientific career as well: i¿½I first heard about the Jaynes-Cummings model during my

PhD. I was awestruck not only by its simplicity but also because it offered a nonperturbative approach, providing significant insights into the fundamentals of light-matter interactioni¿½.