Quantum Entanglement in Photonic Systems

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Abstract. This article explores the intricate phenomenon of quantum entanglement within photonic systems, emphasizing its potential applications in quantum computing and secure communications. We examine the theoretical framework and experimental evidence supporting entanglement, addressing current challenges in manipulating entangled states. The study highlights recent advancements and proposes future research directions.

Keywords: Quantum Entanglement, Photonic Systems, Quantum Computing, Secure Communications, Experimental Methodologies

Introduction

Quantum entanglement is a fundamental aspect of quantum mechanics that has far-reaching implications for the development of quantum technologies. This paper delves into the entanglement properties of photonic systems, which are pivotal for advancing quantum computing and communication protocols. We discuss the theoretical underpinnings of entanglement and review experimental methodologies that have successfully demonstrated entangled photonic states. Despite significant progress, challenges remain in terms of scalability and error correction. We provide insights into recent breakthroughs and suggest potential pathways for future research to overcome these obstacles and harness the full potential of quantum entanglement.

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