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Gaussian quantum discord and the entangling power of a beamsplitter

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A beamsplitter (BS) is frequently used to generate entangled continuous variable states, if at least one of the inputs is a quantum squeezed state. Interestingly, for mixed quantum states, a BS can create entanglement even from two input modes none of which exhibit any local squeezing, provided that they are correlated in a tailored way. These correlations are quantified by Gaussian quantum discord. We demonstrate that such discordant correlations and BS serve as a resource using three protocols: 1) Entanglement distribution by separable ancilla. Here, two modes A and B and the ancilla C are initially in a three-partite fully separable state. C interference on a BS first with A and then with B, consequently A and B become entangled. C remains separable throughout the protocol. The initial state ABC is separable but discordant, i.e., all three modes are correlated in a particular fashion. 2) Recovery of entanglement from the noise-affected squeezed states via interference with a correlated "environmental" mode. 3) Generation of a three-partite entangled state by splitting on a BS a thermal state correlated with a vacuum mode. The created entanglement does not occur between the output modes of the BS but instead it emerges between one output mode and the remaining two modes taken together. This phenomenon is a key element for some of the above protocols, and for entanglement sharing. We will discuss in detail discordant states involved and unveil the seemingly counterintuitive emergence of entanglement in these protocols.

Biography

Natalia Korolkova has completed her PhD in Theoretical Quantum Optics in 1996 from Moscow State University. During 1996-1997, she was a Post-doctoral Researcher at the Palacky University in Olomouc, Czech Republic, in Non-Classical Light and Quantum Cryptography. In 1997, she joined the University of Erlangen-Nuernberg, Germany, as a Humboldt Fellow working on quantum correlations of bright optical beams and fiber solitons. During 1999-2003, she led the Quantum Information group at the University of Erlangen. Since September 2003, she is Lecturer at the School of Physics and Astronomy, University of St. Andrews, UK. She has published over 70 research papers and book chapters.

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