Enhanced Backscattering of Quantum Light

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Abstract

When classical coherent light passes through a multiply scattering media, it travels through many different paths which interfere and produce a speckle pattern. Enhanced backscattering is the phenomenon where the paths come in pairs, where every path has a time-reversed counterpart. This results in a similar phase accumulation by those paths, their constructive interference and an intensity peak that is twice as high as the background in the backscattered direction. In this work, we extend this phenomenon known classically to the quantum regime and test it with quantum light – heralded single photons as well as spatially entangled pairs of photons produced in the nonlinear process of spontaneous parametric down conversion (SPDC). We show, in both cases, that passing through a scattering media and back produces the same enhancement known classically.