Quantum light from a whispering gallery disk resonator

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Hundred years ago Lord Rayleigh studied the intriguing effect of propagating sound waves along the curved walls of the dome of London’s St. Paul’s cathedral \cite{Rayleigh}. These whispering gallery waves, or modes, have recently found applications not with sound but with light. The small volume and high confinement of these modes inside optical microresonators enables one to reach high energy densities. These conditions sound like optimal prerequisites for the efficient generation of quantum states of light. However, most materials used for those resonators suffered from the fact that they could only provide weak nonlinearities. This prevented the observation of quantum light generated in these devices as the quantum properties could be easily buried in classical noise also present in the system. However, recently we succeeded to leverage the power of second-order nonlinear material in these resonators, that provides for much stronger nonlinear response \cite{Furst}. Indeed, with this system we were able to show the generation of non-classical light inside whispering gallery mode resonators. We used the process of optical parametric oscillations where a high energy photon gets split into two low energy photons, which are then shown to be quantum correlated \cite{Vahala,Furst}. The threshold value of pump power where these oscillations start is more than one order of magnitude lower than in previously known systems. It had been predicted theoretically that not only the two light fields of the low energy photons are quantum correlated, but that also the individual light fields possess noise lower than the quantum noise limit if the pump power rises far above the threshold \cite{Fabre}. The extraordinary low oscillation threshold of the presented system enabled the authors to experimentally directly prove these predictions for the first time.

\begin{thebibliography}{9}
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