High-efficiency optical frequency converter and its application

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I will present a high-efficiency optical frequency converter which works for not only optical frequency down conversion but also up conversion. The scheme is an electromagnetically-induced-transparency (EIT)-based four-wave-mixing (FWM) process in a cold 87Rb atomic cloud, in which a probe and a coupling fields form a L-type EIT configuration, and an additional driving field generates a sum-frequency, i.e. the converted outgoing field, through the FWM transition. The generated signal field is the result of interference between two transition channels, which can be constructive or destructive depending on the one-photon detuning, D, of the driving field. In the measurement, we optimized an efficiency of 75% with an optical density of around 150. Without losing the quantum nature of the EIT effect, the conversion efficiency kept the same even for a single-photon-level coherent state. Our work leads to the applications of quantum multiplexing and de-multiplexing, and it is possible for converting a coherent light source to a quantum light source.