Heralded Storage of Narrowband Single Photons

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Storage of single photons in quantum memories is a key step in many quantum information applications [1]. EIT-based quantum memories have many advantages but require that the stored photons have a very narrow bandwidth [2]. This is a big constraint because typical single photon sources like nonlinear crystals generate photons that are much broader in bandwidth. It has been shown that the bandwidth of generated photons can be decreased by placing the non linear crystal in a cavity with narrow linewidth[3]. Here we show that we can store heralded, cavity-enhanced single photons in an EIT-based memory. We have a type I PPKTP crystal placed inside a cavity with a 5 MHz linewidth. The cavity is pumped with blue light at 397.5nm and the down-converted photon pairs at 795nm are split on a beam splitter. After filtering through two temperature-tuned Fabry-Perot etalons, one photon from the pair heralds the presence of the other and triggers the memory preparation. We report a spectral brightness of $\sim$ 2000 photons per mW per MHz, an improvement from production rates of similar setups.

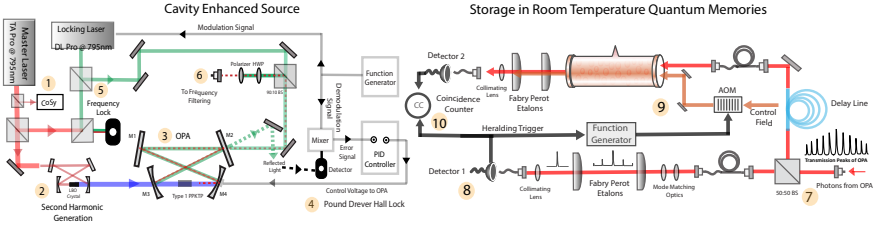

Fig. 1: Setup of the cavity enhanced source (Left) A second harmonic generation unit producing blue light(2) that serves as the pump for the non linear crystal placed inside the bow-tie cavity (3). **Set up for heralded storage of single photons(Right).** Photons pairs from the source are split and one photon heralds the presence of the other and prepares the memory for storage.

References

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