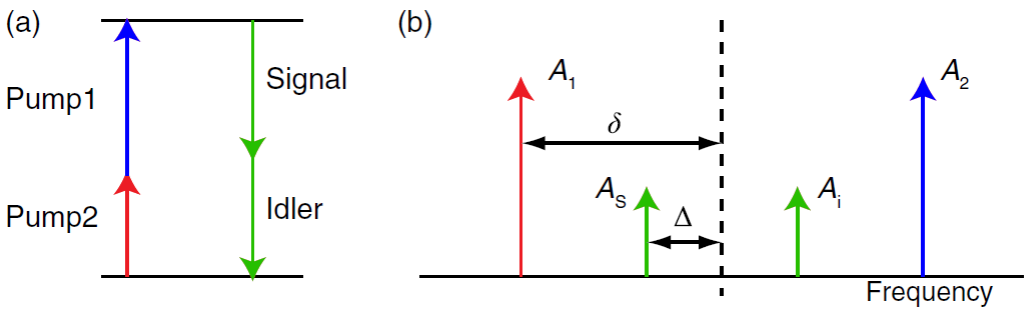
Master assignments 3

Quantum fluctuations of a degenerate double Optical parametric Oscillator

A normal (single) Optical Parametric Oscillator (OPO) is a device that takes a pump photon and converts it into two other photons (called signal and idler) whose energy add up to the energy of the pump; you might say the OPO splits the photon into two separate photons so that $\omega_p=\omega_s+\omega_i$. A *doubled* OPO takes two pump photons and redivides that energy over a signal and an idler so that $2\omega_p=\omega_s+\omega_i$. A double degenerate OPO (or inverse double OPO) starts from two pumps. Each of these produce OPO action. You can arrange it such that their actions coincide exactly in between their frequencies. On a frequency axis that looks like the picture below.



When the actions from both sides coincide, you get a degenerate state. This state has two possible phases with respect to the pumping fields. The phase is a free parameters that should be determined by fluctuations. Ruben Grootes has create resonators that should be able to create these fields. This was not easy (it is made in thick SiN which tends to crack). Hopefully Ruben can still measure something in these chips but there will eb a lot left such as the determination of the phase of the field when the DOPO starts working. If you are interested in quantum fluctuations and practical optics experiments on chip this could be your project.