

CWM QNWG related research

Eugeniy E. Mikhailov

The College of William & Mary, USA

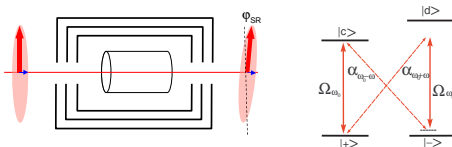


QNWG telecon, 22th May 2014

Economical Atomic squeezer development

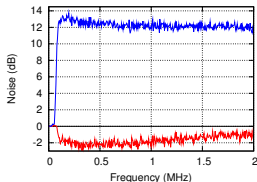
Status: atomic squeezer is ready but further improvements are possible

Polarization self-rotation based squeezing with Rb at 795 nm

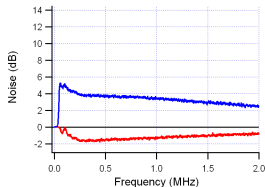


$$a_{out} = a_{in} + \frac{igL}{2}(a_{in}^\dagger - a_{in})$$

Pyrex cell with Rb without coating



Coated cell



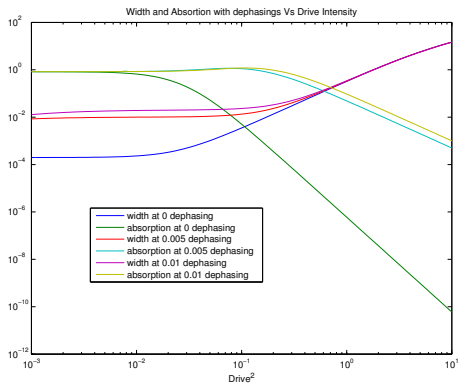
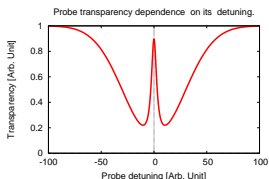
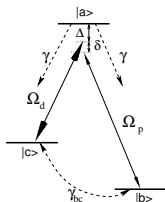
The PSR based squeezer still generates quite small noise suppression (about 2.5 dB max) but the coated Rb cell produces much cleaner squeezed state. Potentially there is more but we have a technical limitation with available coated cells.

Squeezing amplitude filters with atoms

Status: simple model show feasibility of narrow-band high transmission filters, extended model needs several months, experiment is ongoing but more time needed

Now it is possible to up and down convert frequency of squeezed state, so atomic filters might really shine.

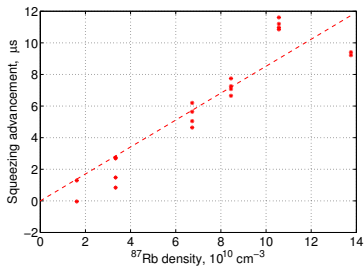
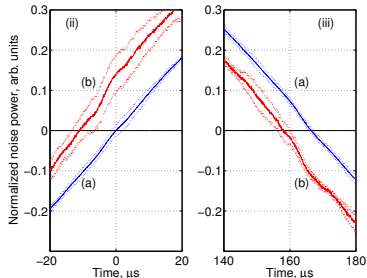
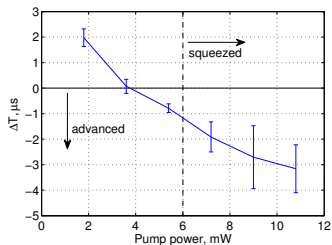
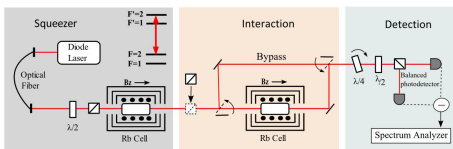
Question: it is possible to get narrow band transmission filter with atomic ensembles **and** have it with 100% transmission.



Advancement/delay line for squeezing with atoms

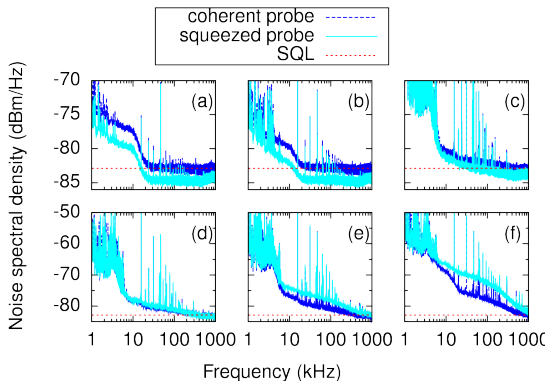
Status: proof-of-principle experiments are completed, the applications are feasible

Tunable advancement/delay
 $\sim 10 \mu\text{S}$ after interaction region
with length of 7.5 cm



Quantum noise modification by atomic ensembles

Status: proof-of-principle experiments are completed, more detailed study are ongoing

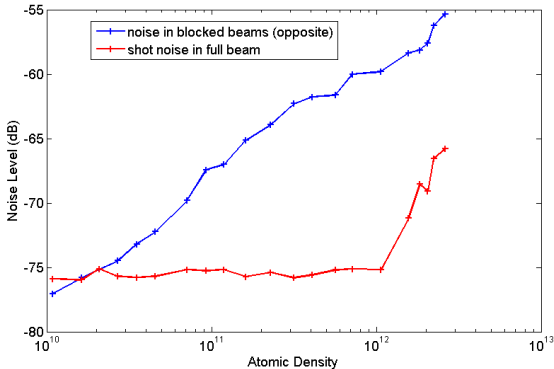
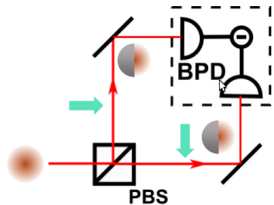


As atomic density increases the resulting squeezing state is contaminated after interaction with atoms. However there is a range of atomic densities, where useful manipulation on squeezing could be performed.

Extra: spatial dependence of quantum noise

Status: detailed study are ongoing

We study spatial dependence of coherent state after propagation through the atomic ensemble



Bottom line

- 1 **Economical Atomic squeezer development**
 - Status: atomic squeezer is ready but further improvements are possible
- 2 **Squeezing amplitude filters with atoms**
 - Status: simple model show feasibility of narrow-band high transmission filters, extended model needs several months, experiment is ongoing but more time needed
- 3 **Advancement/delay line for squeezing with atoms**
 - Status: proof-of-principle experiments are completed, the applications are feasible
- 4 **Quantum noise modification by atomic ensembles**
 - Status: proof-of-principle experiments are completed, more detailed study are ongoing
- 5 **Extra: spatial dependence of quantum noise**
 - Status: detailed study are ongoing