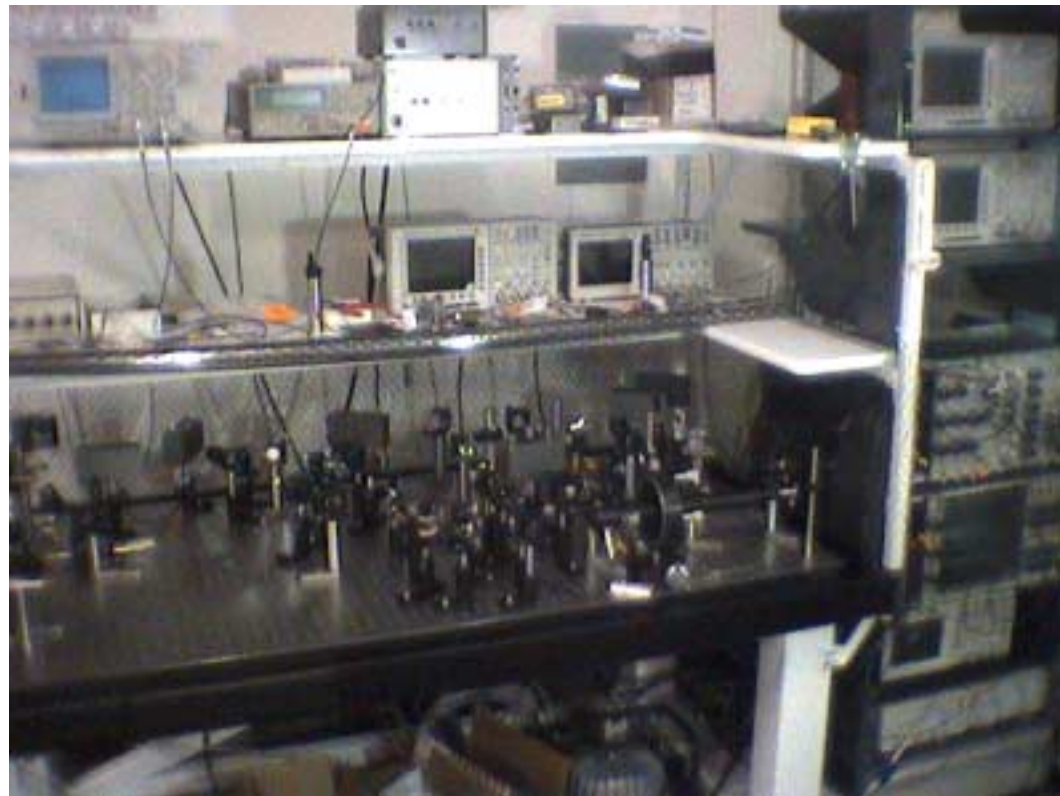


Status report of Polarization RSE

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National Astronomical
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AIC working group
G030113-00-Z



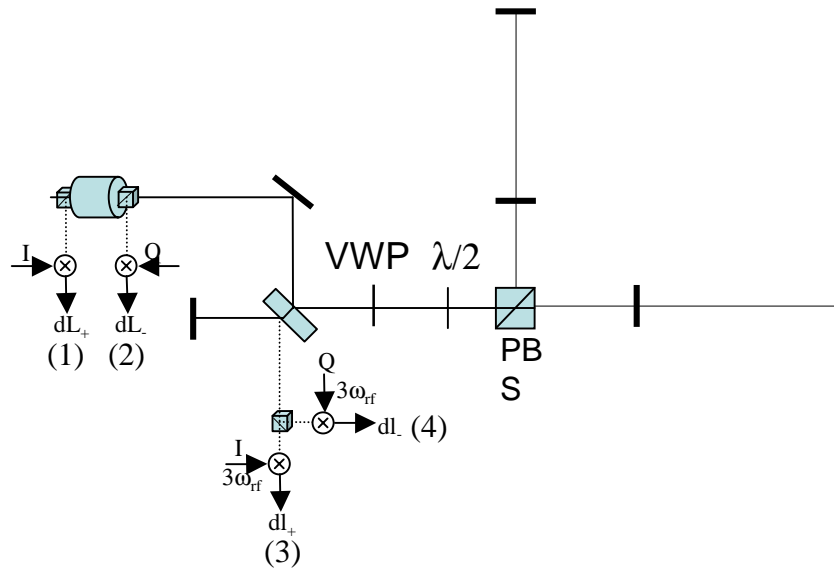
Outline

- Review of polarization RSE.
- Technologies being tested.
- Current status.

Polarization RSE

- Polarization RSE is an RSE interferometer design that uses the control scheme of non-RSE interferometers.
- Polarizing optics allow the signal and power cavities to use the same recycling mirror.
- Polarization sensitive optics in the recycling cavity set the finesse and detuning of the power and signal cavities independently.

Polarization RSE



$$L_+ \rightarrow \rho_0(L_+, l_+) \times \rho_1(l_+)$$

$$L_- \rightarrow \rho_0(L_-, l_-) \times \rho_1(l_+)$$

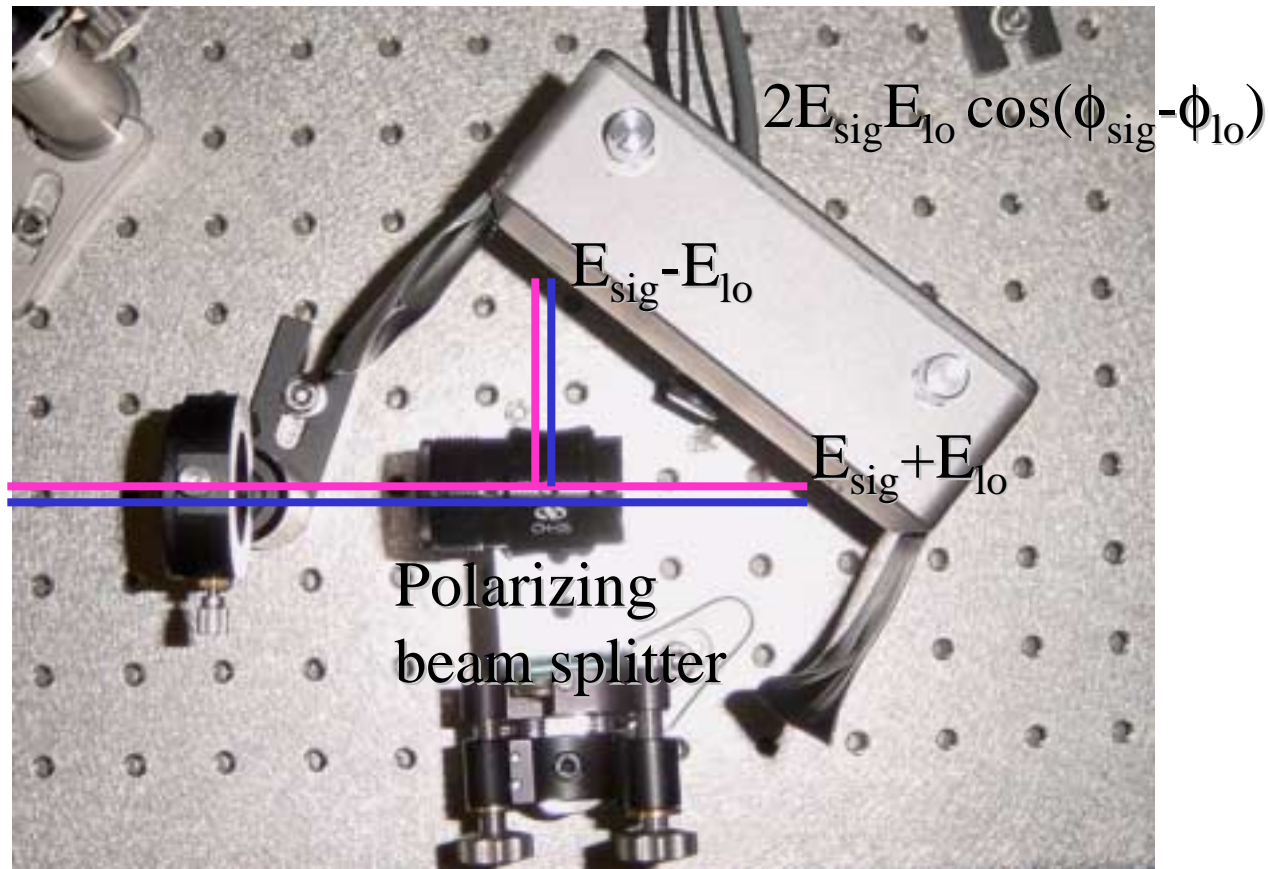
$$l_+ \rightarrow \sigma_1(l_+) \times it_p E_2$$

$$l_- \rightarrow \sigma_1(l_-) \times it_p E_2$$

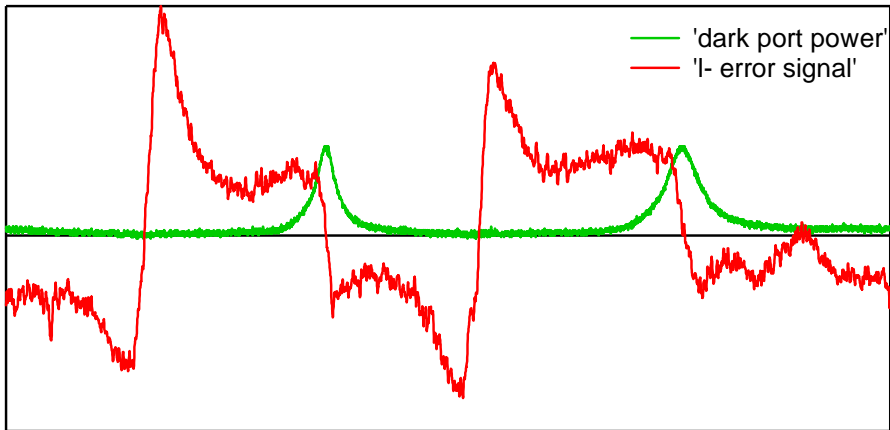
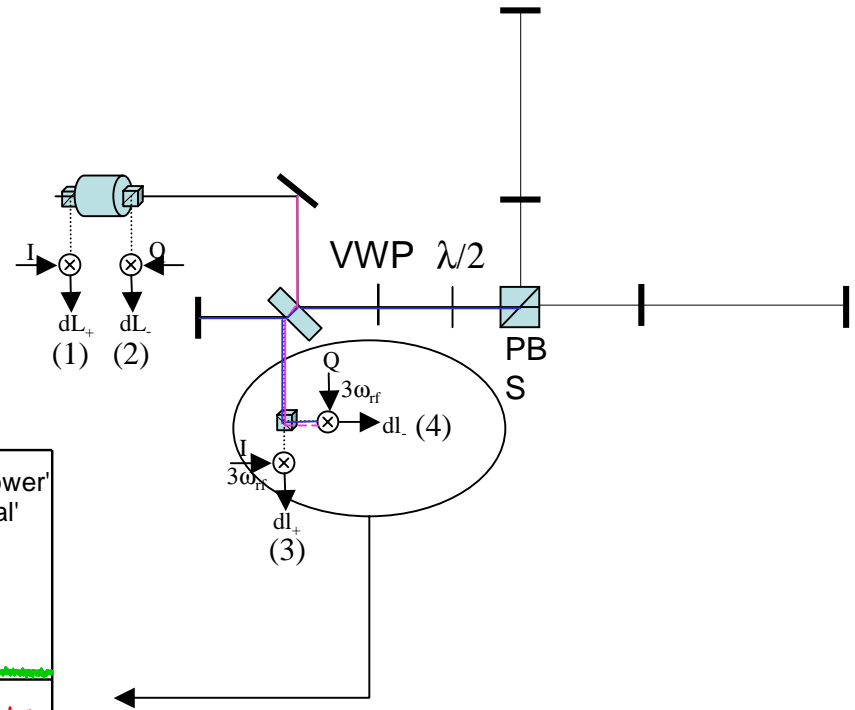
Relevant technologies

- Use of an orthogonally polarized local oscillator
- Controlling a Michelson without asymmetry
- Phase shifting the resonance condition for orthogonal polarization states in a cavity
- Creating polarization sensitive finesse for a linear cavity.
- Generating the appropriate input light spectrum
- Managing seismic “roll noise” from birefringent optics

Use of an orthogonally polarized local oscillator

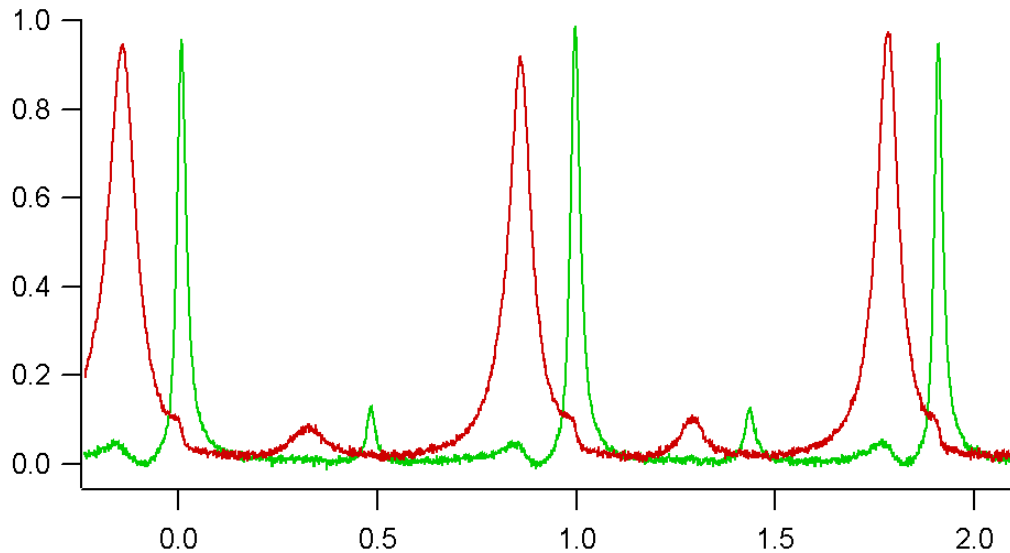


Control of a Michelson without asymmetry

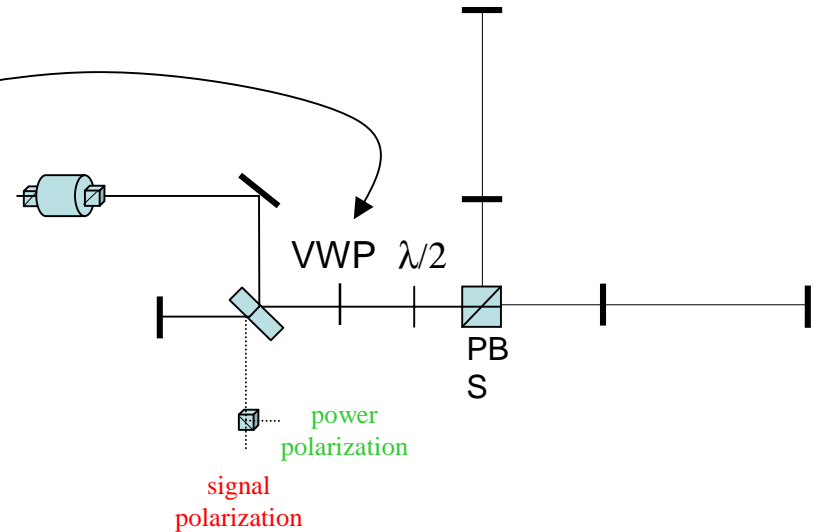


Differential tuning of a birefringent cavity

As the birefringence of this waveplate is varied, the transmission spectra for the two polarization states become detuned

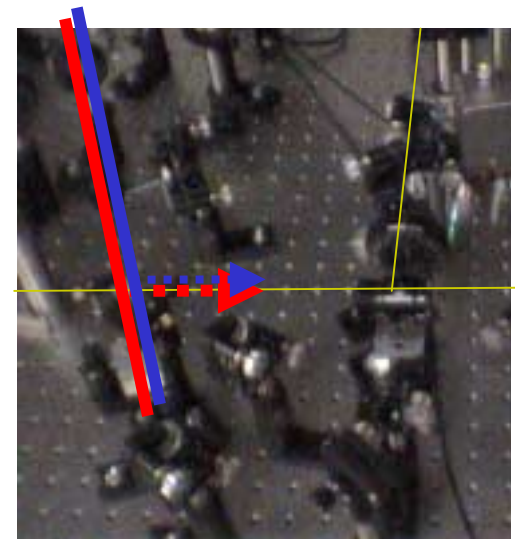
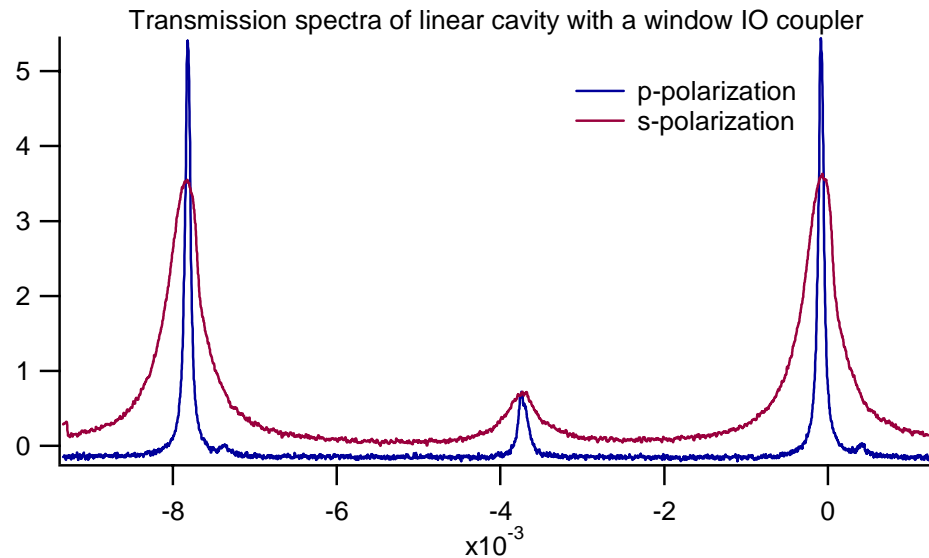


Transmission spectrum of recycling cavity showing both polarization states

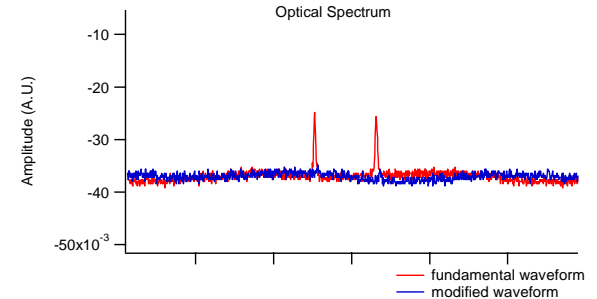
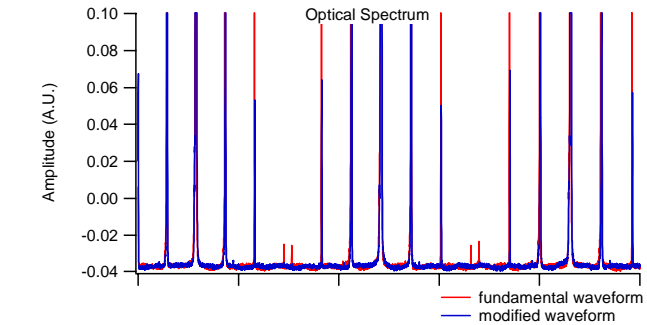
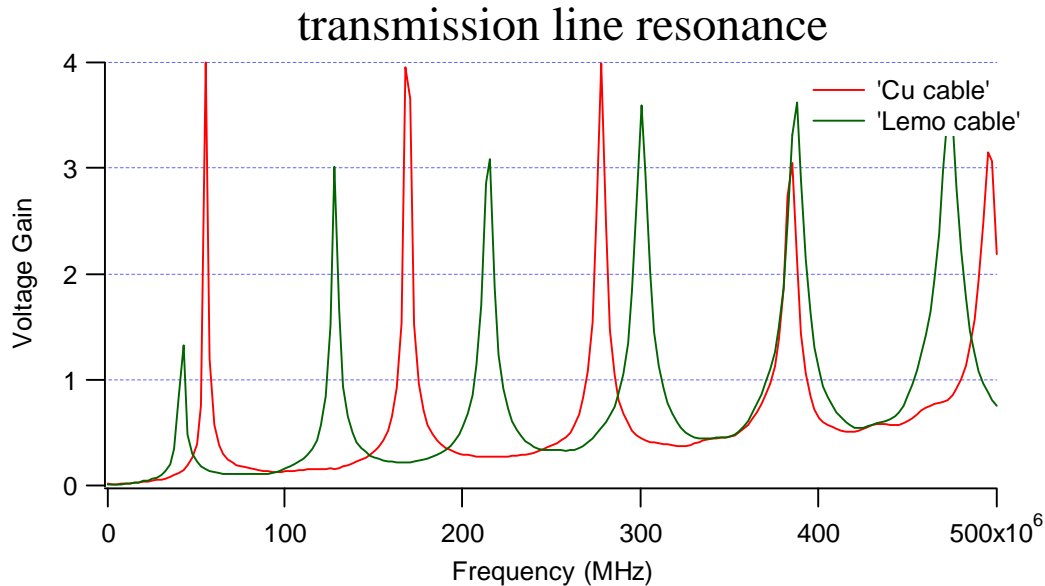
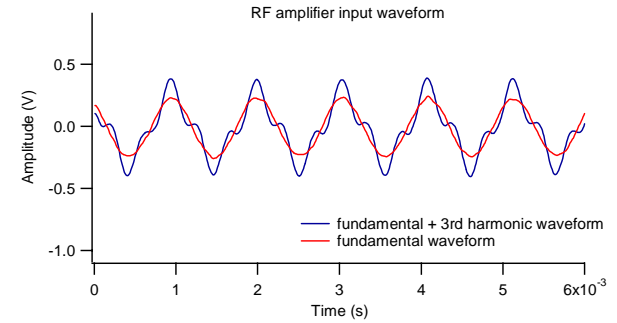
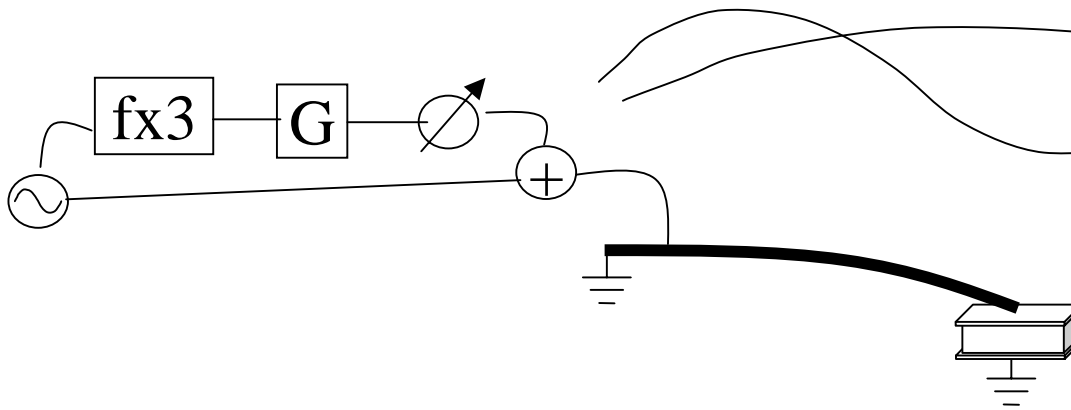


Creating polarization sensitive finesse for a linear cavity.

A non-normal incident window provides different coupling for the s and p polairzation into the recycling cavity



Elimination of 3rd order sidebands



Current Status

- Interferometer is fully built
- All 4 degrees of freedom have been locked
- Robust locking has not yet been achieved – there are still noise and stability issues with the electronics
- l- and l+ control scheme has been validated
- L- and L+ control scheme has not yet been validated
(currently using arm pickoffs rather than bright port signals for arm control)

