

October 11, 2010

Red fiber laser (4)

Ike tells me that he has observed single-mode operation at the desired wavelength using the WS7. I will search again today.

Going to try out Ike's recommendations:

- 1) ND filter at the output of the fiber as to reduce backscattered power even further,
- 2) Investigation with WS7.

References:

-- [Conoptics 712A isolator](#)

[[ike](#)]: Also see these articles for information on how the WS7 works (I believe it uses solid fizeau interferometer wedges):



[20101011-232303/NOTES-highfinesse-wavemeter-how-they-work-2004-solid-state-etalons-Article-Wavelength-Meter.pdf](#)

(29 kb)



[20101011-232303/OPTICS-mckay-asseesment-of-a-multibeam-fizeau-wedge-interferometer-for-doppler-wind-lidar-appl-opt-v41-p1760-2002.pdf](#)

(151 kb)



[20101011-232303/OPTICS-reiser-lopert-laser-wavemeter-with-solid-fizeau-wedge-interferometer-applied-optics-v27-p3656-1988.pdf](#)

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To investigate whether optical feedback is causing any strangeness in the spectrum, I put a $od=1.0$ filter immediately at the output of the fiber laser. I tilted the OD so that the specular reflection off the nd filter is not directed towards the laser directly. Reminders:

- Conoptics 712A claims ~ 40 dB rejection in reflection.
 - $od=1.0$ is a 10dB in single pass;
- Total of 60dB rejection through isolator and twice through nd filter.

No immediate change in spectrum as the filter is installed.

Instead let me see again if I can make things worse by examining the spectrum with poor isolation. (Going into spectrum

analyzer directly.)

Yes, indeed if I go to the spectrum analyzer directly (by mechanical coupler to intermediate fiber) I find that the spectrum shape is undeniably sensitive to the mechanical orientation of the coupler, and I can moderately change the relative amplitudes of the various orders (but not really reorder their relative powers). Now, given the insensitivity of the spectrum with respect to mechanical perturbations in the isolator test setup, this implies that the test setup does not suffer from feedback problems.

To take one step further, I even removed the intermediary fiber between laser output and spectrum analyzer and went directly into the analyzer. Now the sensitivity is remarkably extreme. This is truly a qualitative change about the spectral stability of the laser output. (A few qualitative changes, even!) By even a slight stress on the monochromator coupler, the cavity fringe that has the most power, and its amplitude are varying all over the place, over a span of at least a few nm. This surely is the optical feedback problem of laser diodes, and I am now highly convinced that the isolator setup even before the nd has greatly resolved feedback instabilities.

Transferring the setup to the laser table (so far I've been doing all work right next to the cryo) for further testing, including WS7 readings.

Installed rack and moved fiber laser to the optics table. I plan on mounting the setup directly on the table without a separate board. Checked that laser profile is identical to what it used to be (had to turn off temp controller in the move).

There is one more thing that I want to verify for myself today. The WS7 wavemeter -- which apparently is a magical instrument giving $10^{-7\sim 8}$ precision readings -- has some sort of a interference fringe on its output. (By the way, what is the principle of operation behind the WS7? The manual was clearly tight-lipped about this...) We often say that a particularly bad looking fringe pattern is due to laser multimoding or whatnot. I'd like to see what the WS7 fringes look like, as I drive this fiber diode into multimode and singlemode operations.

Interesting, I find that after the move, the tuning characteristics of the diode seems to be significantly different! I will rescan this tomorrow, to see how the characteristics change as the environment is changed.

Hmm. Not a big fan of the projector for wavemeter readings. It can be convenient somewhat, but:

- 1) It hurts my side PMT,
- 2) It's hard to see the fringe patterns of the WS7 readout. I tried the singlemode-multimode variation, but couldn't really see any conclusive (at least not on the projector) differences in the WS7 fringes. Too bad.

Posted by kimt at October 11, 2010 11:05 AM

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