LightMachinery
Excellence in Lasers and Optics

80, Colonnade Road
Ottawa, Ontario, K2E 7L2. Canada

Laser Characterization with Etalon-Based Cross-Dispersion Spectrometers – Part 2

The stability of a 980 nm diode laser was investigated with the HN-8995-2 spectrometer. The full width at half maximum of the instrument response is shown to be 2.35 pm, well suited to capture with fine details the spectral changes observed over a few hours of operation.

May 2024
For questions, contact hyperfine@lightmachinery.com

Introduction. In an earlier publication[1], we discuss in detail the use of LightMachinery cross-dispersion spectrometers to characterize a wide variety of laser light sources. In this brief paper we present measurements on a laser diode module[2] characterized with a LightMachinery HN-8995-2 spectrometer operating in the 980 nm wavelength region.

Measurements. The Thorlabs laser diode module emits a collimated infrared beam at a nominal 980 nm wavelength. The collimated beam was simply aimed at the tip of a 400-um diameter fiber patch cord that was connected to the input of the HN-8995-2 spectrometer. The detected signal was sufficiently intense that exposure times of less than one millisecond were sufficient to capture the entire spectrum of the laser. Figure 1 shows the laser spectrum recorded with an exposure time of 0.3 milliseconds.

Longer exposure times allow weaker laser modes to be displayed in the Spectrum window, as demonstrated in Figure 2. The red and green spectra were taken 2 hours apart and their overlay shows a good example of the spectral changes happening over time.

Conclusion. Figures 1 and 2 demonstrate the ability of the HN-8995 spectrometer to track the changing spectral output of the laser diode over time, and its ability to measure both the FWHM and the intensities of very weak laser modes. Using the same experimental setup, the change in the laser spectrum with alignment could be tracked, as could the rapid switching of laser modes immediately after electrical power was first applied to the laser diode. As the collimated output beam of the laser diode was scanned across the tip of the input fiber, the observed laser modes changed in a similar fashion to the spectral changes observed over time (Figure 2, top).

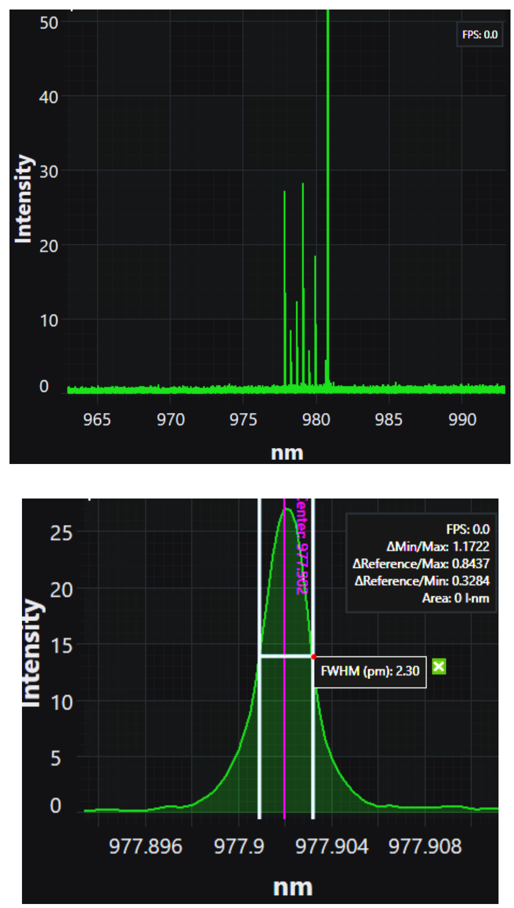

Figure 1. Spectrum of the 980 nm laser diode. The top figure shows several laser modes captured by the full >25 nm simultaneous range (the full range of the spectrometer is 130 nm). The bottom figure displays the high-resolution spectrum of the strongest laser mode. The range/resolution of the spectrometer is >10,000.

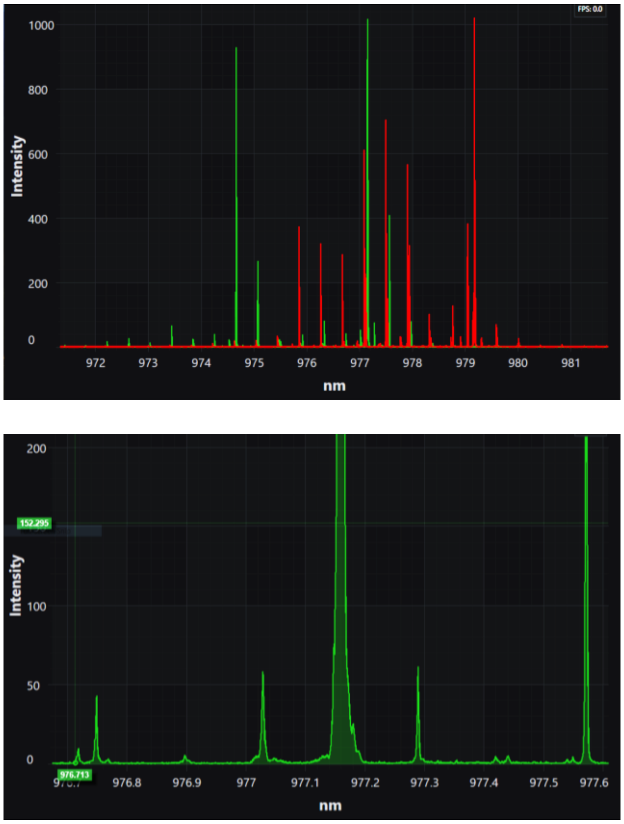

Figure 2 – The top screenshot compares two spectra of the 980 nm laser diode captured two hours apart. It clearly shows the change in the laser diode spectrum over time. The most intense laser modes are saturated at the exposure time of 30 msecs. The bottom screenshot shows a magnified spectrum displaying several sidelobes.

References.

1. https://lightmachinery.com/media/2056/laser-characterization-with-etalon-based-cross-dispersion-spectrometers.pdf
2. https://www.thorlabs.com/thorproduct.cfm?partnumber=CPS980S