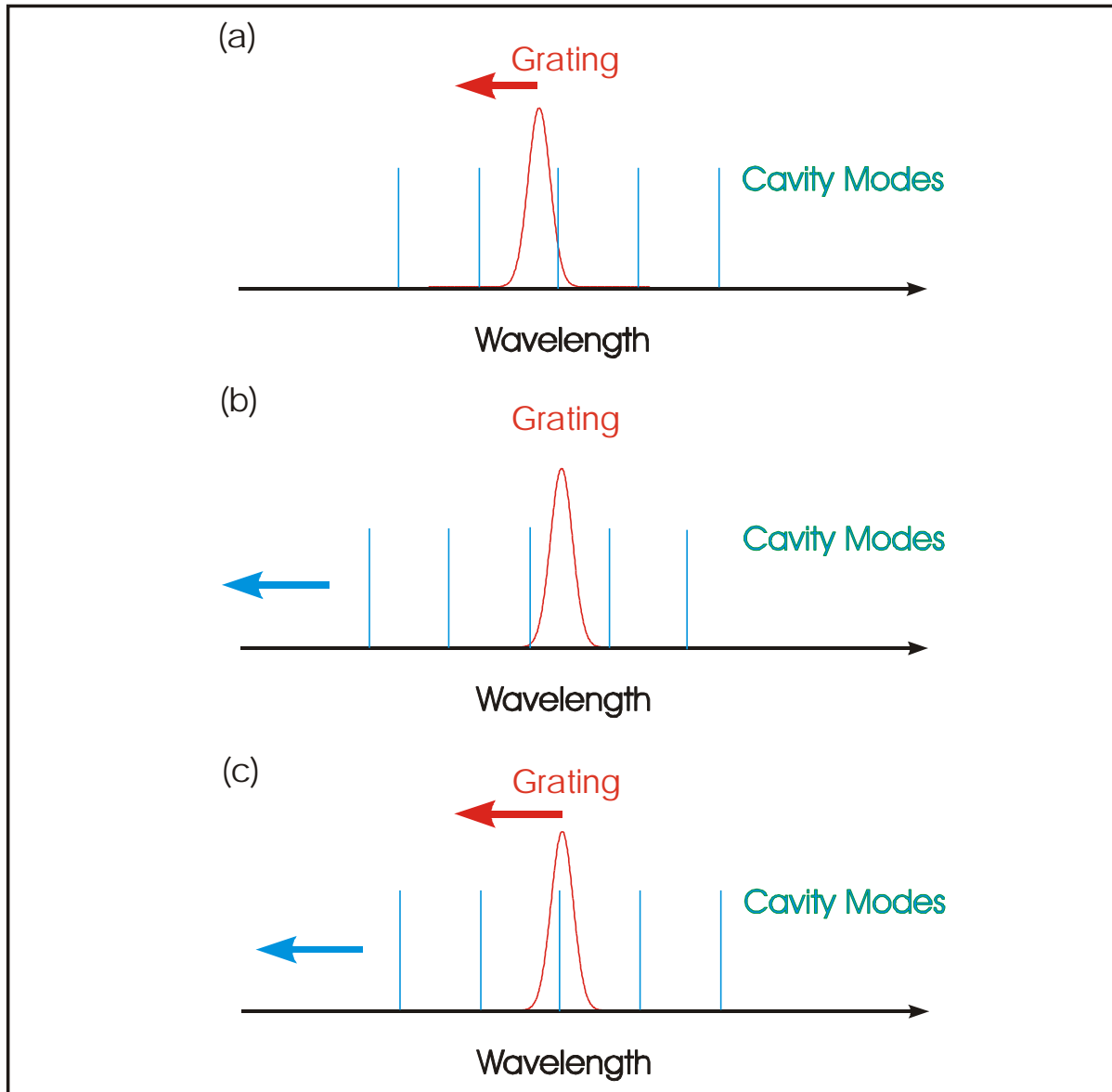


Technical Note – No. 16

Current Compensation Method for avoiding Modehops of External Cavity Diode Lasers



External cavity diode lasers are laser systems which are determined by two frequency determining elements. The first element is the laser cavity. The second element is the laser grating which acts as a frequency filter. A modehop arises if both frequency determining elements are not synchronized. There are three different cases to be distinguished:

- (a) Only the laser grating is tuned and the cavity length remains constant.
- (b) Only the cavity length is changed and the grating angle remains constant.
- (c) The laser grating and the cavity length are tuned in a synchronized mode. Only this method of tuning results in a modehop-free tuning behavior.

Document: <http://data.sacher-laser.com/techdocs/CC.pdf>

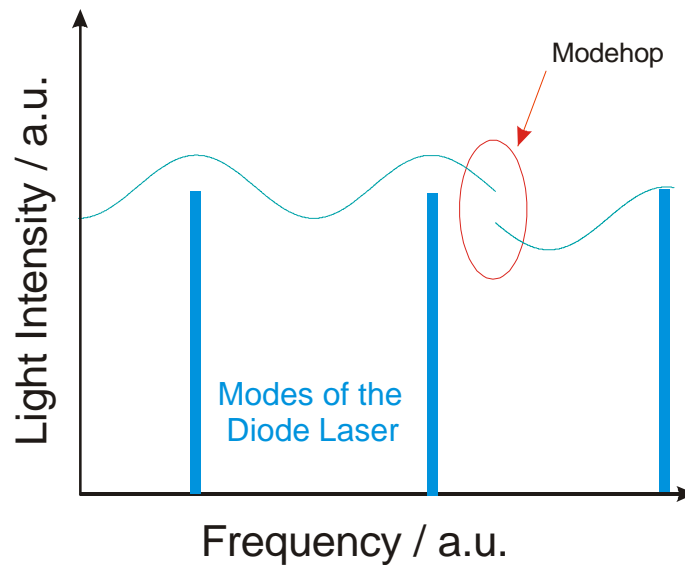
Sacher Lasertechnik GmbH
Hannah Arendt Str. 3-7
D-35037 Marburg, Germany

Tel.: +49 6421 305290
Fax: +49 6421 305299
Email: contact@sacher.de

Sacher Lasertechnik, LLC
5765 Equador Way
Buena Park, CA 90620, USA

Tel.: 1-714-670-7605
Fax: 1-714-670-7662
Email: sales@sacher-laser.com



Where does a Modehop appear during a Wavelength Scan ?

The output power on an external cavity diode laser changes due to the imperfect AR-coating of the diode laser chip. This modulation is a measure for the common products of the quality of the AR-coating and the quality of the external cavity. Even a facet reflectivity of $1E-4$ or less results in a noticeable modulation of the output power during the wavelength scan.

Modehops mostly appear at well defined positions of the modulation curve during a wavelength scan. The most probable position of modehops is in the region with the fastest change of the output power during a wavelength scan. The reason for the modehop is e.g. an imperfect matching between the change of the grating defined frequency and of the external cavity roundtrip frequency.

There is a simple way of fine-tuning of the external cavity roundtrip frequency by changing the injection current of the diode laser. Changing the injection current causes a temperature change of the diode laser and finally results in a temperature induced length change of the diode laser chip.

Most tunable external cavity diode lasers are fine-tuned electrically with a piezo actuator. Providing a coupling between the piezo voltage and the injection current results in a large enhancement of the modehop-free tuning range of external cavity diode lasers.

The laser driver of Sacher Lasertechnik provides an adjustable coupling between the piezo voltage and the injection current of the diode laser. Therefore, the modehop-free tuning range of our Laser systems may be enhanced by a factor of up to 5. For example, if the original modehop-free tuning range is limited to 10GHz, then the modehop-free tuning range may be increased up to 50GHz with Current Coupling.

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Sacher Lasertechnik GmbH
Hannah Arendt Str. 3-7
D-35037 Marburg, Germany

Tel.: +49 6421 305290
Fax: +49 6421 305299
Email: contact@sacher.de

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Buena Park, CA 90620, USA

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Fax: 1-714-670-7662
Email: sales@sacher-laser.com

