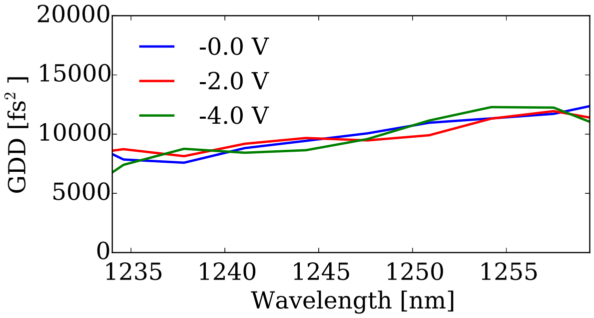

Fig. 5. The group delay dispersion spectra of the ground state for a current injection of 300 mA in the gain section and a reverse bias of 0, 2 and 4 V.

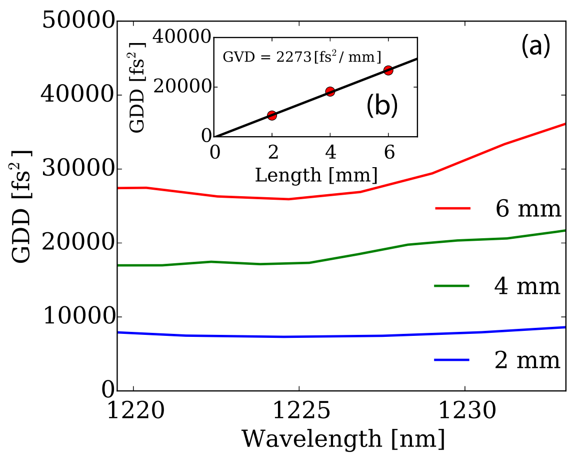

Fig. 6. (a) The group delay dispersion spectra of the ground state for a bias current of 100 mA is displayed for all devices. (b) A clear linear relationship is obtained and a value of 2270 fs^{2}mm^{-1} is deduced for the group velocity dispersion of the ground state.

of $\simeq -2$ fs^{2}mA^{-1}mm^{-1}. This shows that the gain induced dispersion is non-negligible.

The effect of the absorber on the dispersion was therefore analysed as well. A constant current of 300 mA was f rst injected in the gain section and the bias applied to the absorber was successively varied from 0 V to -4 V. When the reverse bias was applied the signal from the excited state was too low to deduce its GDD. The GDD spectra of the ground state are displayed in Fig. 5. The GDD stays constant for the different biases. This shows that no intra-cavity gain induced dispersion compensation effect is induced by the absorber and conf rms that the inf uence of the absorber on the pulses dispersion is indeed due to its operation as saturable absorber.

In order to deduce the group velocity dispersion, a 6 mm and a 4 mm long two-section laser chips from the same InAs/GaAs QD structure were measured in the same experimental conditions. Both devices have a 6 μm wide ridge waveguide and an absorption-to-gain section length ratio of 1:3. The front and back facets of the laser chips were anti-reflectio (∼2%) and high-ref ection (∼99%) coated, respectively. The group delay dispersion spectra of the ground state was measured for all devices with a homogeneous bias current of 100 mA. It would be favourable to compare measurements performed at an equal current density. However, for high currents the longer devices operate above threshold and for low currents the shorter device luminescence emitted is too low in order to resolve the dispersion spectrum. Therefore, in this analysis, we neglect the variation of the dispersion due to the different pumping levels. The results are displayed in Fig. 6 (a). As expected, the GDD is proportional to the length of the device. The group delay dispersion at 1225 nm is also displayed as a function of the device length in Fig. 6 (b). A clear linear relationship is obtained and a value of 2270 fs^{2}mm^{-1} can be deduced for the group velocity dispersion of the ground state.

III. Conclusion

To conclude, in this letter we have analysed the chromatic dispersion of InAs/GaAs QD lasers by measuring subthreshold luminescence spectra under a homogeneous bias or applying a forward bias to the gain section and a reverse bias to the saturable absorber section. These measurements allow to deduce that the main contribution to the GDD is the dispersion of bulk GaAs and the group velocity dispersion of the ground state is as high as 2270 fs^{2}mm^{-1}. However, the gain induced dispersion is non negligible and varies with the injected current at a rate of $\simeq -2$ fs^{2}mA^{-1}mm^{-1} whereas the GDD stays constant when the absorber bias is varied. These results suggest that the implementation of intra-cavity dispersion compensation by means of an external cavity [17], a Gires-Tournois coating [10] or by waveguide engineering [11] could reduce the pulse duration of these lasers in the mode-locked regime to the level of a few hundreds fs [2]. These investigations will be the subject of future works.

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