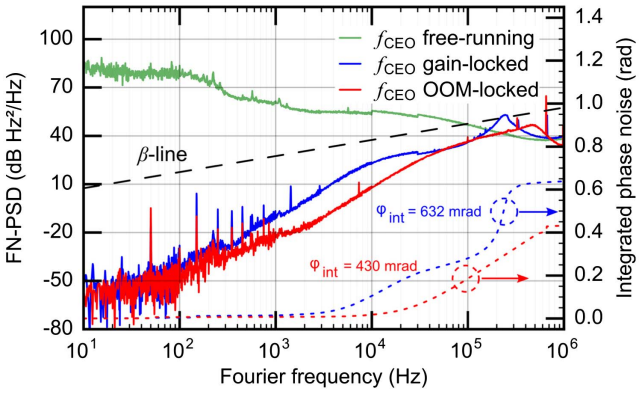

Fig. 4. Frequency noise power spectral density (FN-PSD) of the CEO beat obtained in free-running conditions (green), for the CEO beat stabilized by gain modulation (blue), and by SESAM-OOM (red). The corresponding integrated phase noise is shown as a function of the upper cut-off frequency (right vertical axis).

by more than 30% compared to stabilizing the CEO of this laser via gain modulation, where we achieved 632 mrad. A stabilization bandwidth of 500 kHz assessed from the servo bump in the CEO FN-PSD was obtained with the OOM. This is two times higher than the ~250-kHz bandwidth of the gain-modulation stabilization. Even higher stabilization bandwidths were possible with the OOM, typically up to ~580 kHz; however, the best noise properties were obtained with the 500-kHz stabilization bandwidth shown in Fig. 4.

The RF spectra of the free-running and stabilized CEO beats are shown in Fig. 5. The side peaks present in the

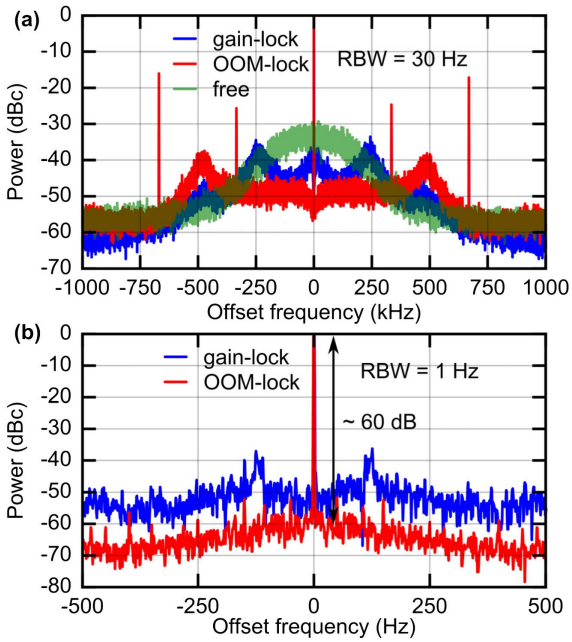

Fig. 5. (a) RF spectrum of the CEO beat in free-running mode (green), stabilized with gain modulation (blue), and with SESAM-OOM (red), showing a twofold enhancement of the stabilization bandwidth. (b) Zoom on the coherent peak over a total span of 1 kHz showing an SNR of 60 dB (1-Hz resolution bandwidth) for OOM stabilization.

spectrum at around ±310 kHz and ±620 kHz are believed to be of electrical origin (they are also present in the CEO spectrum obtained by gain modulation) and have a negligible contribution to the integrated phase noise of the stabilized CEO beat.

In conclusion, we have presented, to the best of our knowledge, the first SESAM-OOM self-referenced stabilization of a GHz DPSSL, overcoming the cavity dynamics limitation and extending the stabilization bandwidth by a factor of more than two. As a result, the CEO residual integrated phase noise was reduced by more than 30% compared to the traditional gain modulation stabilization. These results demonstrate that SESAMs are reliable components not only for mode-locking, but they also can serve as fast loss modulators for frequency comb stabilization, which can overcome the limitations of the standard gain modulation.

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