Acousto-optic frequency combs for heterodyne interferometry

Abstract

1. Introduction

2. Layout

3. Experimental results

Figure 1.
additional peaks (corresponding to transverse cavity modes) alternating with the expected resonances. Combining the reference spectrum and the one measured with the FPC enables to infer the intensity and phase FPC transmission functions (Fig. 3). In a second experiment, we evidence the possibility of ultra-high spectral resolution by reducing the comb FSR down to 500 kHz. The resulting comb provides a magnified view of the first resonance peak, located at the frequency $f_0$ (lower plots in Figs. 3a–b). To our knowledge, these results constitute the first demonstration of self-heterodyne spectroscopy in the sub-MHz range, and demonstrate a proof of concept of the potential applications of acousto-optics frequency combs for heterodyne interferometry. More generally, these systems are expected to find applications in both ultrafine self-heterodyne spectroscopy (sub-MHz range) or, by combining two FSLs, in multi-heterodyne (dual-comb) spectroscopy, with tens of GHz bandwidth. Notice that unlike electro-optics frequency combs, acousto-optics frequency combs do not require fast electronic equipment nor complex modulation sequences [9].

Figure 2. a) Measured self-heterodyne spectrum without FPC (reference measurement). b) Measured self-heterodyne spectrum when the FPC is inserted in the system.

Figure 3. a) Retrieved power for the first resonance peak and magnified view of it when the line spacing is reduced to 500 kHz. b) Spectral phase of the resonance peak and magnified view of its central part.

4. References