Recent development in integrated photonic solutions for THz systems

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THz technologies are continuing to develop for a wide set of applications and photonic is seen as a key technology for their development [1,2]. This is mostly due to their relatively high power, coherence and tuneability as well as, through through the development of optical communication, high speed modulation. However, despite these advantages it is clear that for many application and the development of THz technology a smaller footprint and lower power consumption will also be essential. While photonic solutions using discrete components have shown promising results [3], it remains essential to solve these remaining problems. To do so will require integrated photonic solutions as it will naturally offer smaller footprint while some of the losses within a discrete element system could be better managed thus enabling lower power consumption.

In this presentation we will discuss mainly integrated solutions for photomixing and review the different photonic integration techniques and their advantages. In particular we will show details of an integrated source that could be controlled to offer high frequency stability in the range up to 1 THz, as well as solutions based photonic intgrated chips foundries [4].

In more details the typical heterodyne coherent system that we are discussing is shown in figure 1. While dual laser source can offer tuneability of several THz in order to abtain high frequency stabilitiy across the range one would use an optical frequency comb generator (OFCG) used to lock the heterodyne source on a microwave reference. Finally the photomixer or potentially photoreceiver are essential part of the system. The discussion will thus concentrate on the integration of these different components.

We will then present solutions as sources and receivers for frequencies up to 1THz with a source frequency linewidth better than 10 Hz in the range. In particular we will look at a foundry based dual laser source that could be locked on a comb for frequency up to a THz and a fully integrated chip including two lasers and a uni-travelling carrier photodiode that has been used both as an emitter and receiver for frequencies up to 100 GHz. As an other essential part of the system would be an integrated comb generator we will also discussed a set of solution and in particular the use of FM lasers and recirculating loops to offer a compact and efficient wide comb source.

We will finally discussed different demonstrations of applications of these integrated technologies in particular for THz spectroscopy and wireless communication.

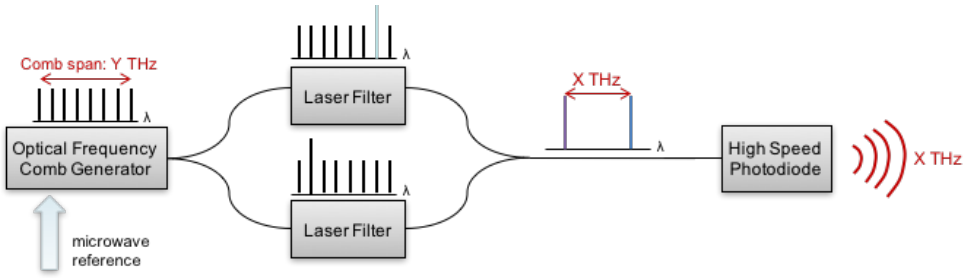

Fig. 1: Schematic of a typical heterodyne THz source.

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