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Ultrashort pulses from quantum cascade laser combs

In recent years, quantum cascade lasers [1] (QCLs) have matured to become compact, powerful sources of coherent mid-infrared light. While frequency comb operation was demonstrated almost a decade ago [2], the formation of ultrashort high intensity QCL pulses remained illusive. This talk will give an overview on modelocking mechanisms in semiconductor lasers, with an emphasis on self-modelocking observed in QCLs. Contrary to conventional modelocked sources, QCL combs are associated with a strongly frequency modulated intracavity field [3,4], as shown in Figure 1a. The in-depth understanding of the emitted field enabled us for the first time to generate femtosecond pulses from a QCL source using external phase compensation (Figure 1b) [5]. Our configuration is strikingly similar to chirped pulse amplification schemes and may lead to unprecented levels of output peak power from semiconductor lasers in the future. On a different note, we will present first results on fully integrating such a configuration on a chip (Figure 1c) [6].

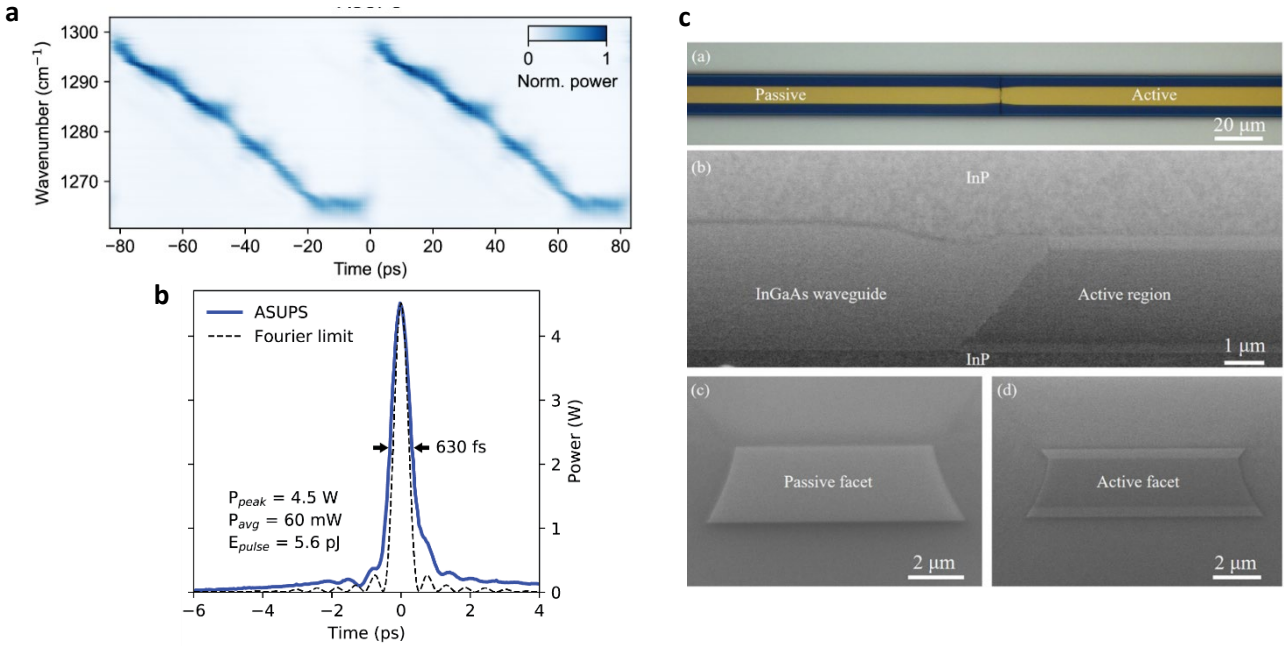

Figure 1: a Instantaneous frequency of a QCL comb. **b** Ultrashort QCL pulse after external phase compensation as measured by optical sampling. **c** Integration of QCL combs with passive waveguides.

References

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