White Light Lasers

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Broadband multiline frequency combs present a wealth of applications, ranging from meteorology, sensing and measurements to those potentially in the domain of attosecond science. We report here on detailed investigations of a novel process that is accompanied by extreme enhancement of the bandwidth of the generated frequencies – resulting in a *novel white light laser source*. Cavity contexts where efficient broadband multiline generation have been reported include spherical micro-cavities [1], monolithic micro-resonators [2] and so-called 'bottle micro-resonators' [3], in which the cavity quality to mode volume ratio (*Q / V*) plays a dominant role in the characteristics of the device and its constituent whispering gallery modes. Typically, maximum quality and low volume lead to the optimal condition of high *Q / V*. To illustrate distinctiveness from these well-known contexts, we stress that the effects we report can be optimal in either low-*Q* resonators (with very moderate reflectivities) or larger volume cavities (e.g. with longer cavity lengths) – see Figure 1.

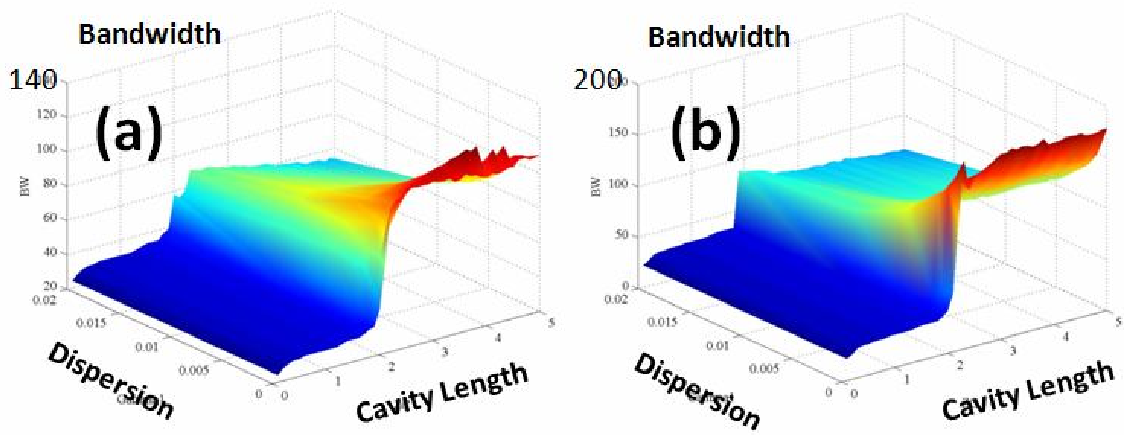

Figure 1: Surface plots showing bandwidths consisting of well in excess of 100 distinct frequencies. Dependencies on levels of dispersion and cavity length are explored. (a) Bandwidth generated with moderate cavity reflectivity 0.93. (b) Higher bandwidth generated at lower reflectivity (*lower Q/V*).

References

[1] Spillane S M, Kippenberg T J and Vahala K J, *Nature* **415**, 621 (2002).

[2] Del'Haye P *et al*, *Nature* **450**, 1214 (2007).

[3] Pollinger M *et al*, *Phys. Rev. Lett.* **103**, 053901 (2009).