Novel White Light Lasers
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Abstract
We report on detailed investigations of a novel self-organizational effect that can convert laser light into an extremely broad comb of multi-colour beams. The importance of this new effect is that it spontaneously gives rise to an extreme enhancement of the output comb bandwidth, and that constituent frequencies may self-synchronize.

Introduction
Lasers typically emit light of one or two, well-defined, frequencies (or 'colours'). However, numerous experiments have shown that much light can be converted into a broad, multi-frequency (i.e. multi-colour) comb of laser beams. Applications range from metrology, sensing and measurements to those potentially in the domain of the emerging research field of Attosecond Science.

There have been several reports of contexts [1-3] where efficient broadband frequency comb generation may be possible. We will demonstrate distinctiveness with regard to these known contexts, and summarize results from an exhaustive exploration of this new effect.

Results
Figures 2 and 3: Spectral bandwidth vs. Medium dispersion (gamma1) and Cavity length (Zc) parameters. The bandwidth is taken at transit number N = 10. This data shows how the values of reflectivity and cavity length affect the bandwidth during the initial growth of the spectrum. It is clear to see from the figure that an increase in reflectivity or cavity length more rapidly generates bandwidth, therefore inferring that the rate of bandwidth growth is related to both the reflectivity and cavity length. As the reflectivity reaches the extreme value of R=0.99 the change in growth due to increasing cavity length is found to be subdued.

Figures 4 and 5: Spectral bandwidth vs. Medium dispersion (gamma1) and Cavity length (Zc) parameters. The bandwidth is taken at transit number N = 10. This data shows how the values of reflectivity and cavity length affect the bandwidth during the initial growth of the spectrum. It is clear to see from the figure that an increase in reflectivity or cavity length more rapidly generates bandwidth, therefore inferring that the rate of bandwidth growth is related to both the reflectivity and cavity length. As the reflectivity reaches the extreme value of R=0.99 the change in growth due to increasing cavity length is found to be subdued.

References:

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