SPECTRAL CHARACTERISTICS OF NONLINEAR PULSE COMPRESSION IN SEMICONDUCTOR BRAGG GRATINGS

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We present here an experimental investigation of nonlinear pulse compression in AlGaAs waveguide gratings. In contrast to previous experiments[1] we have been able to characterise the compressed pulses both spectrally and temporally. This is due to the high nonlinearity of AlGaAs which allows high repetition pulse sources to be used.

The gratings used were fabricated using a single step electron beam technique described earlier[2]. The gratings were 8mm long and were approximately 99% reflecting. A number of identical gratings were fabricated on each AlGaAs wafer to allow comparison between gratings. Incident upon the gratings was a 100kHz 415ps transformed limited pulse source at 1536nm. The peak power launched was 600W. We tuned the pulse source to lie in the centre of the bandgap and our results are shown in Fig. 1. As can be seen the pulse compresses from 415ps to 80ps (detector limited) while at the same time the spectrum broadens considerable. Importantly the spectrum is now asymmetric with the majority of the energy lying on the short wavelength side of the grating. This indicated that in the nonlinear regime a significant fraction of the energy has been switched out of the grating's bandgap. In other experiments we measured a 10dB increased in the transmissivity[2].

We have modeled these experiments using the standard nonlinear coupled mode equations and have obtained qualitative agreement with the experiments. We expect to obtain better agreement using a more accurate model. In conclusion we have observed for the first time spectral features associated with the formation of solitons in nonlinear Bragg gratings.

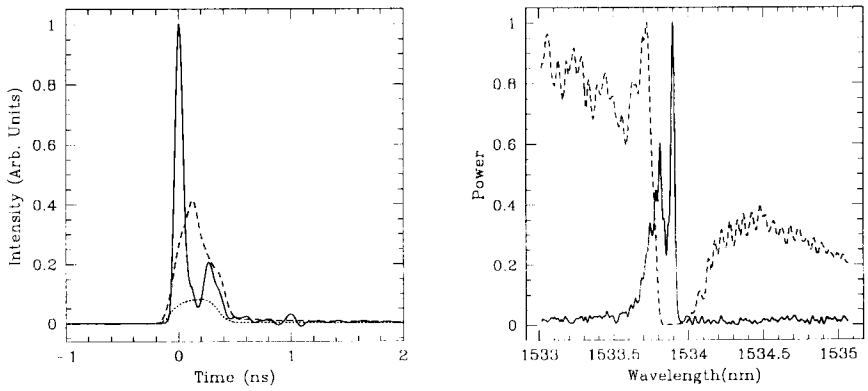

Figure 1: Output temporal and spectral profiles for an input 415ps transformed limited Gaussian pulse.

References

[1] B. J. Eggleton, *et al.*, Phys. Rev. Lett. **76,** 1627 (1996).

[2] P. Millar, *et al.*, Opt. Lett. **24,** 685-687 (1999).