

GDD mirror pair. The detailed spectrum (see inset plot), acquired with an optical spectrum analyzer (OSA) further confirms that the individual comb lines become resolvable after filtering. The measured linewidth of the resolved comb lines was limited by the OSA, which has a resolution of ~ 20 GHz.

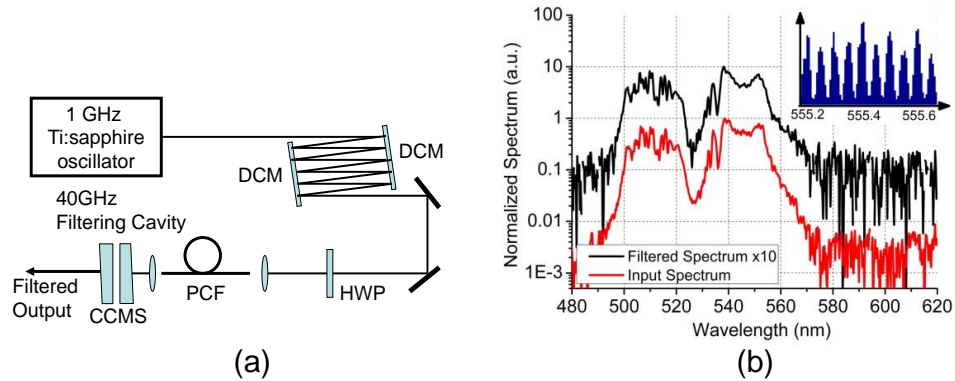


Fig. 4. (a) Experimental setup for generating a 40 GHz green astro-comb for astronomical spectrograph calibration. DCM: doubled-chirped mirrors for dispersion compensation; HWP: half-wave plate; PCF: photonic crystal fiber. (b) Input (black) and output (red) spectra before and after the 40 GHz FP filter cavity based on a zero-GDD mirror pair; inset shows detailed output spectrum near 555.4 nm obtained with a high resolution (~ 20 GHz) optical spectrum analyzer. Fluctuations of the cavity relative to the comb laser are below 5 MHz leading to an overall phase error of < 1 mrad per square root of the number of output astro-comb lines.

6. Conclusions

In conclusion, we have proposed and demonstrated a new approach for broadband dispersion-free optical cavities using a zero-GDD mirror set; e.g., to enable laser frequency combs for pulse repetition-rate multiplication and pulse enhancement. With a first zero-GDD mirror pair design, the construction of a ~ 40 GHz filtering cavity with 100 nm bandwidth for a green astro-comb (480-580 nm) was demonstrated. By proper structure scaling and re-optimization, the spectral coverage of the zero-GDD mirror set can be easily shifted to other wavelength. Further performance improvement can also be achieved by using better manufacturing techniques or materials with higher refractive index contrast since the intrinsic bandwidth of dielectric mirrors is proportional to $(n_{HL}-1)/(n_{HL} + 1)$, where n_{HL} is the ratio of higher refractive index to lower index of the dielectric materials. We believe this technique can also enable many other frequency-comb-based applications that demand large comb spacing or high peak intensity.

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