Pushing the blue side of supercontinuum using photonic crystal fiber

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By utilizing the versatile dispersion properties and enhanced nonlinearity of all-silica solid-core photonic crystal fiber, supercontinnum sources extending from below 400 nm up to the near-infrared have been generated (P. St.J. Russell, J. Lightwave Tech. **24**, 2006, pp. 4729–4749). The spectral range is usually limited by the transmission properties of the material and alternative ways to extend the achievable wavelengths must be found. One possibility is to use exotic glass such as heavy-metal oxide, chalcogenide or fluoride-based glass. Unfortunately, the viscosity of these glasses rapidly changes with temperature and the suitable range of drawing temperature is considerably reduced compare to silica. Microstructured fibers made of such glasses are therefore extremely challenging to produce. On the other hand, they are ideal candidates for ultra-broad supercontinuum because of their very large transmission window (from ~200nm to above 7 µm for ZBLAN). We recently successfully drew ZBLAN PCF. We will present here recent results on the generation of ultrabroad supercontinuum is such fibers.

An alternative to solid-core fibers is to use gas-filled hollow-core photonic crystal fiber (HCPCF). Such waveguides offer the possibility to guide light in a diffractionless manner over distances that far exceed the natural diffraction of a laser beam. Gas-light interactions can then be greatly enhanced. In particular Kagomé-lattice offers broad transmission window and very weak dispersion, which can be readily balanced by filling the fiber with gas. These features make such fiber extremely suitable for nonlinear optics experiments, such as the generation of phase-locked frequency comb (A. Abdolvand *et al.*, Opt. Lett. **37**, 2012, p. 4362) or plasma-related soliton self-frequency blue shift (P. St.J. Russell, *et al.*, Nat. Photon. **8**, 2014, pp. 278-286). Here we will focus of the generation of tunable dispersive wave emission in the deep UV (Joly *et al.,* PRL, **106**, 2011, p. 203901).

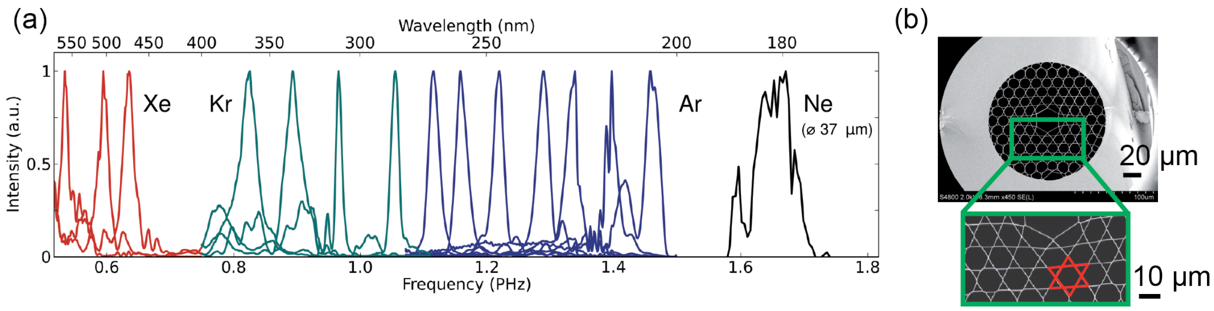

Fig. 1: (a) Experimental generation of coherent pulses through resonant dispersive wave emission in gas-filled kagomé HC-PCF. Each peak is an individually normalized spectrum for a specific combination of gas, pressure and pump energy. All the tuning was carried out in an identical length of kagomé HC-PCF (27 µm core diameter), except in the case of neon, where the core diameter was 37 µm (from K.F. Mak et al., Opt. Express 21, 2013, p. 10942) and (b) Electro-micrograph of a Kagomé-HCPCF used for generation of tunable UV (from J.C. Travers et al., JOSA B 12, 2011, p. A11).