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RF photonics using hollow core optical fibers

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Radio Frequency (RF) photonics links transmits RF signals on an optical carrier through an optical fibre. The key advantage as compared to transmission over coaxial cables is optical fibre low loss, even at very high RF frequencies. However, when transmitting over longer distances (e.g., >100 m) of interest in multitude of applications such as large telescopes synchronization or military radar, fibre impairments distort the signal. Examples are fibre chromatic dispersion that can cause RF frequency-dependent loss or fibre nonlinearity that causes signal distortion and attenuation, e.g., through stimulated Brillouin scattering. In traditional optical fibres, where light is guided through silica glass material, these limitations are due to the glass-light interaction.

Hollow core optical fibres in which light propagates through the central hole have many unique properties, especially compared to traditional glass-core optical fibres [1]. Up to recently, their main shortcoming for low-loss signal transmission had been their relatively high attenuation. However, today's hollow core optical fibres have attenuation (minimum of 0.22 dB/km [2]) comparable to the glass-core optical fibres (minimum of 0.14 dB/km).

Thanks to the strong suppression of the light-glass interaction in the hollow core optical fibres, they can have simultaneously low chromatic dispersion and nonlinearity, opening new opportunities in multitude of applications, including RF photonics links.

In the presentation, we will review the recent hollow core fibre technology and show how this enables improvement of the performance of RF photonics links in terms of the key RF photonics links metrics such as noise figure and insertion loss. We will also briefly discuss further advantages of hollow core fibres and how they improve existing photonics applications such as stable fibre interferometry.

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2. H. Sakr, T.D. Bradley, G.T. Jasion, E. Numkam Fokoua, S.R. Sandoghchi, I.A. Davidson, A. Taranta, G. Guerra, W. Shere, Y. Chen, J.R. Hayes, D.J. Richardson, and F. Poletti, Hollow Core NANFs with Five Nested Tubes and Record Low Los at 850, 1060, 1300 and 1625 nm, in *2021 Optical Fiber Communications Conference and Exhibition (OFC).* Paper F3A.4, Washington DC, USA, 6-11 June 2021.