

# Photonic processor for next-generation communications satellites

Vanessa Duarte<sup>1</sup>, Carlos Ribeiro<sup>1</sup>, João Prata<sup>1</sup>, Miguel Drummond<sup>1</sup>, Rogerio Nogueira<sup>1</sup>

One of the priorities identified by the United Nations for Global progress is to make Internet accessible from any point around the Globe, as closing such a digital divide is very important especially for Education purposes. As fiber cannot reach everyone everywhere, ubiquitous satellite communications are in a leading position for fulfilling such a mission.

A new generation of communications satellites is required. New satellites will be powered by large-scale processors, enabling a dynamic allocation of hundreds of beams with a total capacity beyond 1 Tb/s. However, such an ambitious goal has been deemed as over-ambitious if current RF or digital technologies are used. A technologically disruptive approach to build communications satellites is therefore required.

The main goal of this work was to demonstrate photonics as a key enabling technology for building the new generation of communications satellites. Such a goal was successfully achieved, which also led to many pioneering results, namely the first ever demonstration of a real-time photonic beamformer for processing 4 input Ka band signals (1Gbit/s QPSK at 28GHz carrier), including an array of modulators, a multi-core optical fiber amplifier and a silicon photonic integrated beamformer. In comparison with an RF processor, the demonstrated photonic processor enables a size reduction by a factor of 5000. Such a demonstration was performed live at the optical communications laboratories of Instituto de Telecomunicações, in Aveiro. These outcomes resulted in one international patent (already granted), and multiple publications in top-ranked international conferences and journals, with the last article published in Nature Communications.

Ms. Vanessa Duarte, a PhD student working full time in this work, was also the Academy Winner of the prestigious Altice Innovation Award 2018 as well as of ANI Born from Knowledge Award.

<sup>1</sup> — IT, University of Aveiro

