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The Revolution of Silicon Photonics

Abstract: We are now experiencing a revolution in optical technologies, where one can print and control massive optical circuits, on a microelectronic chip. This revolution is enabling a whole range of applications that are in need for scalable optical technologies and its opening the door to areas that only a decade ago were unimaginable.

In the past decade the photonic community witnessed a complete transformation of optics. We went from being able to miniaturize a handful of devices to being able to define and control the flow of light using thousands of monolithically integrated optical components – all on a silicon chip. The main drive for silicon photonics is the ability to transmit and manipulate ultra-high bandwidth with low power dissipation. Today there are hundreds of products being developed and commercialized towards this goal.

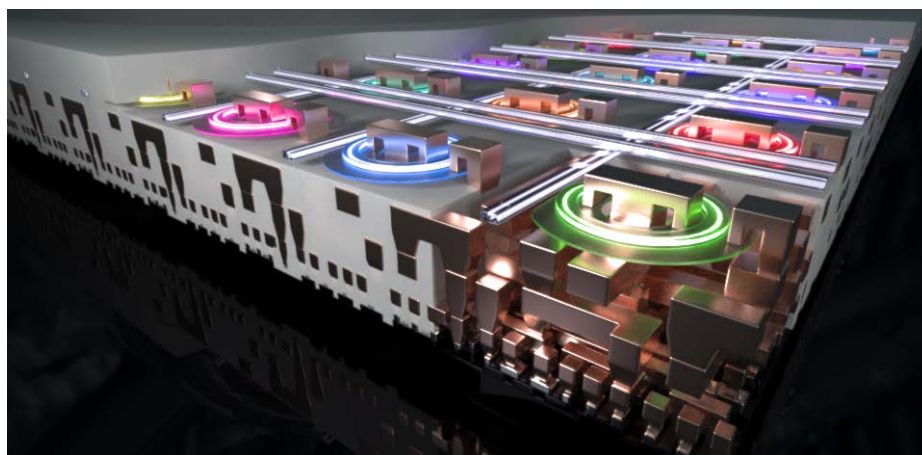


Fig. 1. Artist's view of a massively integrated photonic system integrated on a CMOS microelectronic chip

The field of silicon photonics is rapidly evolving and is now enabling completely new applications, ranging from Lidar to biomedical devices. This is partly due to the development of novel chip-scale technologies, novel devices and novel materials compatible with silicon photonics. Many of these technologies and devices can manipulate light across the whole VIS, IR and the Mid IR spectrum. I will discuss these emerging applications, as well as the advancement brought by these novel devices and materials.

The key challenges of the field relate to the scalability of the systems in bandwidth, size and power. Some of these challenges are fundamental and require innovations that break traditional tradeoffs. Novel approaches for switching, modulating and amplifying light have emerged that can open the door to applications that rely on such scalable systems. I will describe the challenges of the field and some of the recent innovations that can potentially address these challenges.