

Silicon Photonics: The Bumpy Road Toward Industrial Success

Gianlorenzo Masini

Luxtera/Cisco

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Abstract: In the sizzling Roman summer of 1997, Giovanni, Lorenzo, and I hijacked the home-brewed CVD chamber in the Physics Department of University Roma Tre to deposit our first relaxed Ge on Si sample. The lab Director was on vacation (as every Italian holding a permanent job position in the month of August would be), so he could not stop us from fully draining a (very) expensive GeH₄ cylinder for our crazy experiment: building an NIR photodetector right on top of a silicon chip. Surprisingly, the device worked right away: certainly leaky but fast and responsive - almost good enough for making transceivers. This is just one of the stories, accumulated over the many years, that has grafted a new and unique 'species' into the silicon mainstream industry tree: a branch that is finally bearing fruits in the form of state-of-the-art high-speed transceivers, and will likely soon diversify into other areas (AI, Automotive to mention a couple). Growing has not been easy: the only remarkable quality of Si, from an integrated optics standpoint, is its high index. Everything else is dismal: indirect bandgap, no linear absorption in the telecom bands (but strong two-photon absorption), small, or non-existing electro-optic coefficients, and the list goes on and on. But then there is the silicon manufacturing knowledge and infrastructure: decades and hundreds of billions invested in the development of an industry that is capable today of delivering devices with features just a little larger than a few atomic radiuses to billions of customers. That was the bet: directing the CMOS beast to tame silicon into riding with optics. Today, we can say with some certainty that it was a good bet. This seminar will elucidate a few of the key milestones, mistakes, and achievements along the road, as seen by someone that was lucky enough to ride on it for the last couple of decades.

Bio: Dr. Gianlorenzo Masini earned his Laurea and Ph.D. degrees from the University "La Sapienza" of Roma, Italy in 1991 and 1993, respectively. From 1994 to 2004 he taught and performed research at the University "Roma Tre". While there, he pioneered the use of relaxed Ge on Si in high-performance photodetectors for the near infrared. In 2004 he joined Luxtera, a California startup dedicated to the development of Silicon Photonics optical transceivers. At Luxtera, eventually acquired by Cisco in 2019, he contributed to the development of several aspects of the technology and of the devices used in its best-selling transceivers. Dr. Masini co-authored more than 150 papers, 25 granted patents, and 3 book chapters.