Programmable Optical Interferometers for Matrix Multiplication

S A Fldzhyan[1,2], M Y Saygin[1,3], N A Nemkov[3], I V Kondratyev[1], N N Skryabin[1,2], I V Dyakonov[1,2], and S S Straupe[1,2,3]

[1] *Faculty of Physics, Lomonosov Moscow State University, Moscow, Russia*
[2] *Russian Quantum Center, Moscow, Russia*
[3] *Sber Quantum Technology Center, Moscow, Russia*
Contact Email: straups@yandex.ru

Programmable photonic circuits offer new possibilities for computing providing means for fast and energy-efficient matrix-vector multiplication. Fastest and most convenient realizations are based on linear integrated photonics. We will discuss several approaches to the design of integrated matrix multiplication cores with an emphasis on coherent architectures based on programmable interferometers. We will present several architectures approaching the limits of lowest interferometer depth and resilience to fabrication and programming errors. Current technology limits the achievable scale of integrated optical circuits posing challenges and trade-offs for their adoption as multiplication cores in hybrid opto-electronical tensor processors. In the case of coherent interferometers programming these devices to implement specified matrix operations may also be challenging. We will raise the question of programmability for integrated interferometers and the required computational overheads.