

## Optimal error-tolerant design of universal multiport interferometers

**Suren Fldzhyan\***, Mikhail Saygin, Sergei P. Kulik

<sup>1</sup>*Quantum Technologies Center and Faculty of Physics, M.V.Lomonosov Moscow State University, GSP-1, Leninskie gory, Moscow 119991 Russian Federation*

\*E-mail: apres.suren@gmail.com

Photonic information processing often demands programmable multiport interferometers capable of implementing arbitrary transfer matrices, for which planar meshes of tunable Mach-Zehnder interferometers (MZIs) are usually exploited [1], [2]. However, these MZI-based interferometers require balanced static beam-splitter (BSs) that make them sensitive to manufacturing errors. Here, we abandon the error-sensitive MZI and propose an alternative design that uses a single static BS and a variable phase shift as the building block of the interferometer mesh. Our BS-based design [3] (which strongly utilizes the ideas in [4]) has been shown to possess superior resilience to manufacturing errors, which is achieved without addition of extra elements into the schemes. Namely, the power transmissivities of the static BSs constituent the interferometers can take arbitrary values in the range from  $\approx 1/2$  to  $\approx 4/5$ .

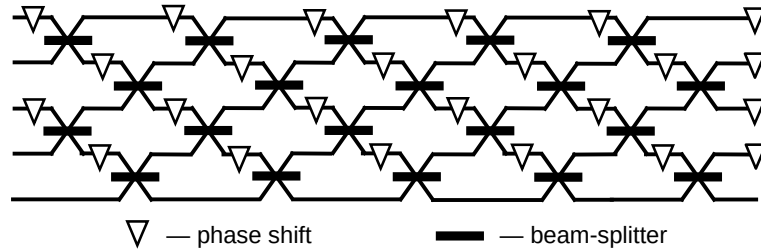


Figure 1: The novel design scheme for  $N = 5$  multiport interferometer. The basic 2-port interferometer transformation consists of invariable BS and configurable phase shift.

This work was supported by a grant of The Russian Federation Ministry of Education and Science.

## References

- [1] *M. Reck, A. Zeilinger, H. J. Bernstein, and P. Bertani, Physical Review Letters 73, 58 (1994).*
- [2] *W. R. Clements, P. C. Humphreys, B. J. Metcalfe, W. S. Kolthammer, I. A., Walsmley, Optica 3, 1460, (2016).*
- [3] *S. Fldzhyan, M. Saygin, S. Kulik, arXiv e-prints, arXiv:1910.13001, (2019).*
- [4] *M. Saygin, I. Kondratyev, I. Dyakonov, S. Mironov, S. Straupe, S. Kulik, arXiv e-prints, arXiv:1906.06748, (2019).*