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## Quantum Algorithms on Classical Optical Vector-Matrix Multipliers

*Tuesday, 4 July 2023 11:00 (20 minutes)*

Matrix-vector multiplication is a crucial operation in quantum algorithms such as Deutsch-Josza's, Grover's, and phase estimation. Here we present an approach that uses classical light to perform similar operations. We demonstrate this technique by directing light onto pixelated liquid crystal Spatial Light Modulators (SLMs) that encode information on the spatial pattern of light to create a matrix. When the light beam passes to the next SLM, we can perform element-wise matrix multiplication. The intensity of each element is proportional to the product, allowing for efficient computation. We begin by discussing the fundamental principles behind optical vector-matrix multipliers and show that our redefined element-wise matrix multiplication with a cylindrical lens acting as a summing operator is equivalent to the standard equation describing matrix-vector products, and then present our implementation of several well-known quantum algorithms, demonstrating their effectiveness.

### Apply to be considered for a student ; award (Yes / No)?

Yes

### Level for award;(Hons, MSc, PhD, N/A)?

Msc

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