A Comparison of Boson Sampling and Quantum Circuits in Interferometry

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***Abstract*—Interferometers are devices which use light, or more generally superimposing waves, using interference to extract information. We propose a method by which quantum information can be obtained and used as a benchmark for quantum circuits, as well as modelling non-linear interferometers. We simulate these with traditional classical methods, then show quantum circuit variants, finally showing how these circuits can be used as benchmarks for qubit coherence.**

I. Introduction

II. Mach-Zehnder Interferometer

The Mach-Zehnder interferometer determines a relative phase shift variation between two collimated beams of light. It also has the property that each light path is only traversed once. It consists of two beam splitters, and a mirror.

In our classically computed photonic model, an MZI is a 2-mode interferometer.

To encode this as a quantum circuit REF HERE, we use Hadamard gates to represent the 50/50 beam splitters, a single qubit as the initial single photon input, and a unitary operation U(phi) to represent some phase shift.

III. Michelson Interferometer

IV. Ramsey Interferometer and Benchmarking