

# An introduction to boson-sampling

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## I. INTRODUCTION

## II. MOTIVATION FOR LINEAR OPTICS QUANTUM COMPUTING

## III. INTRODUCTION TO LINEAR OPTICS QUANTUM COMPUTING

## IV. WHY IS LINEAR OPTICS QUANTUM COMPUTING HARD?

## V. INTRODUCTION TO BOSON-SAMPLING

### A. The model

### B. Sampling problems vs. decision problems

### C. Why is boson-sampling so much easier than linear optics quantum computing?

## VI. WHY IS BOSON-SAMPLING COMPUTATIONALLY HARD?

### A. The connection with matrix permanents

### B. The complexity of matrix permanents

### C. Errors in boson-sampling

Discuss the  $1/\text{poly}(n)$  bound

## VII. BOSON-SAMPLING AND THE EXTENDED CHURCH-TURING THESIS

Why experimental boson-sampling will not elucidate the ECT thesis

## VIII. BOSON-SAMPLING WITH OTHER CLASSES OF QUANTUM OPTICAL STATES

## IX. HOW TO BUILD A BOSON-SAMPLING DEVICE

### A. Photon sources

SDPC

### B. Linear optics networks

Reck et al. Waveguides Discrete elements

### C. Photo-detection

don't need to be number resolving

## X. CONCLUSION

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