**Speaker:** **Benoît Seron, University of Freiburg**

**Title:** **Binned probabilities of Boson Samplers**

**Date:** **Tuesday, February 27th, 11:00 o'clock (s.t.)**

**Place:** **Seminar room 915**

**Title: Binned probabilities of Boson Samplers**

**Abstract:**

In the first part of this talk I will present a recent result about boson bunching. In the celebrated Hong-Ou-Mandel effect, two photons sent on a balanced beam-splitter will always bunch in one of two modes. However, any source of partial distinguishability between the photons (e.g. time-delays, difference in polarization, etc) diminishes this effect, lowering the bunching probability. This fact, together with other physical and mathematical arguments, justify the general rule-of-thumb that indistinguishable photons bunch the most. In our work we disproof this alleged straightforward link between indistinguishability and bunching by exploiting a recent finding in the theory of matrix permanents. We exhibit a family of optical circuits where the bunching of photons into two modes can be significantly boosted by making them partially distinguishable via an appropriate polarization pattern. This boosting effect is already visible in a 7-photon interferometric process, making the observation of this phenomenon within reach of current photonic technology.

In the second part of the talk I will briefly present a new method to validate the correct functioning of a boson sampler, based on how photons distribute in partitions of the output modes. Efficient validation tests are crucial to justify claims of quantum computational advantage. The method we propose is versatile and encompasses previous tests for validating boson samplers based on bunching phenomena, marginal distributions and even some suppression laws. We show via theoretical arguments and numerical simulations that our method can be used in practical scenarios to distinguish ideal boson samplers from ones affected by realistic noise sources.

Finally, I will touch a few words about potential practical applications of boson samplers through binned distributions.