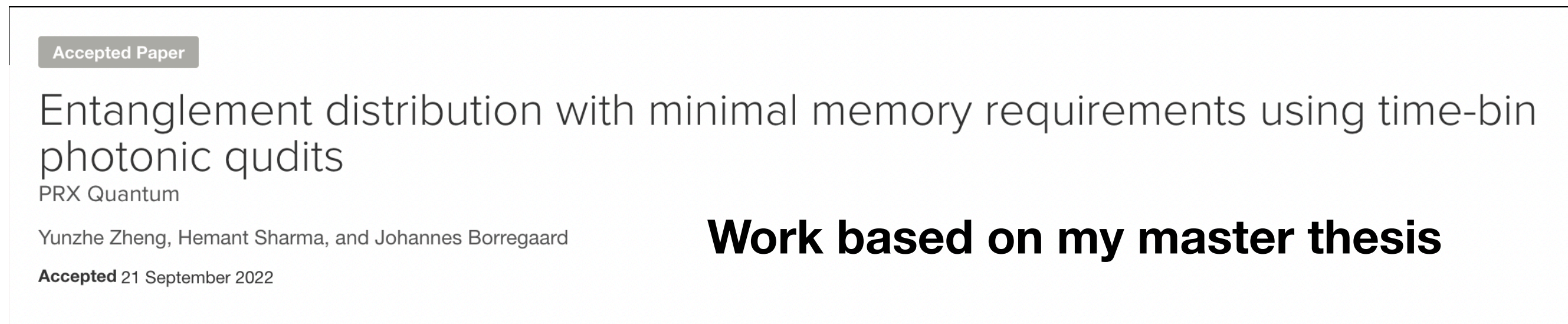


#2 Implement MILP solver within Qiskit Optimization - About us

- I just graduated from TU Delft with a MSc Applied Physics.
 - Interest: Quantum network & Quantum algorithm & Error correction (mitigation)
 - Now an intern @ Qunasys (a Tokyo startup focusing on quantum algorithm)
 - I am a heavy fan for Formula 1 🏎️



- My mentor Takashi is a Research Scientist @ IBM Research -Tokyo



Motivation

$$\begin{aligned} \min_x \quad & c^T x \\ \text{such that} \quad & b_l \leq Ax \leq b_u, \\ & l \leq x \leq u, \\ & x_i \in \mathbb{Z}, i \in X_i \end{aligned}$$

- Mixed-Integer Linear Programming (MILP) solver
 - A powerful solver that allows part of variables to take only integer values.
- *scipy.optimize.milp* come out with Scipy v1.9.0 (July 29 2022)
- Useful for many problems, but not incorporated with *Qiskit Optimization*.

`scipy.optimize.milp`

```
scipy.optimize.milp(c, *, integrality=None, bounds=None, constraints=None,  
options=None)
```

Why we need MILP for Qiskit?

- In qiskit-optimization, we can use CPLEX and Gurobi to solve quadratic problems
 - but they are commercial APIs and limited by free access! (# of variables & constraints)
 - On the other hand: Scipy doesn't ask for you to pay :p.
- Our goal: integrate the MILP solver with qiskit-optimization library.
 - We expect to build a `SciPyMILPOptimizer` class in `qiskit_optimization.algorithms`
 - A tutorial introducing how to use our new optimizer!