AutoQ: Fully Automated Verification of (Parameterized) Quantum Circuits

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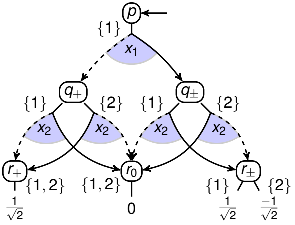

Question

Can you trust your quantum circuit?

precondition *circuit* *postcondition*

$$\{Pre\}\ C\ \{Post\}$$

Bernstein-Vazirani

```
{ 1 |0000> }
BV(101);    // secret: 101
{ 1 |1010> }
```

Grover

```
{ 1 |0000> }
Grover(101);  // secret: 101
{ pH |1010> +
  pL ∑(|i|=4, i≠1010) |i> :
  |pH|² > 7/8,
  |pL|² < 1/8 }
```

GHZ

```
{ 1 |i> : i=0ⁿ }
GHZ;
{ (1/√2)|i> + (1/√2)|j> :
  i=0ⁿ, j=1ⁿ }
```

- combines tree automata and SMT
- quite scalable (Grover 31 qbits $\sim$ 1 min)
- parameterized verif. (BV, GHZ, +, QECC)
- found bugs in QCEC, RUS circuits
- looking for QuantERA partner(s)
- quantum competition (sim./ver./synt.)