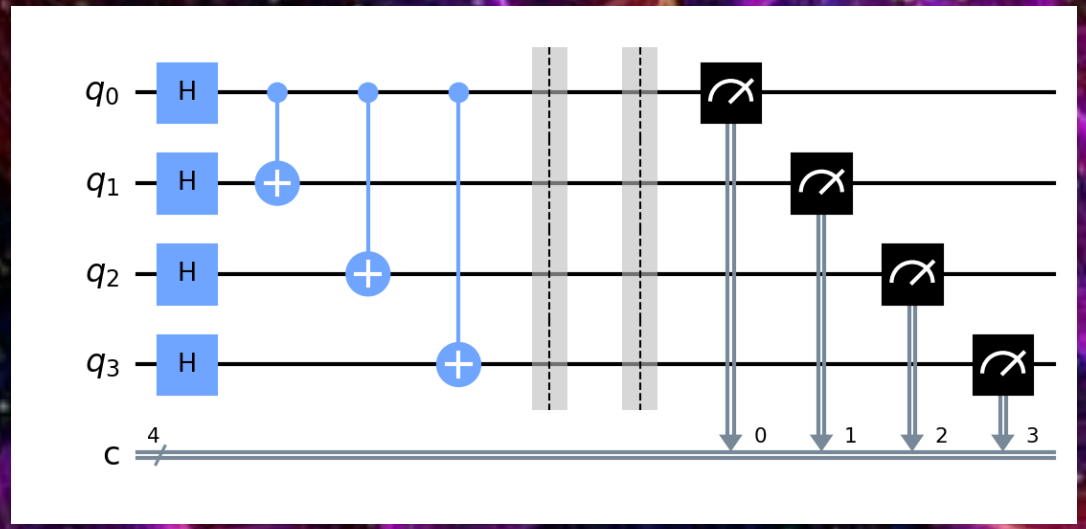
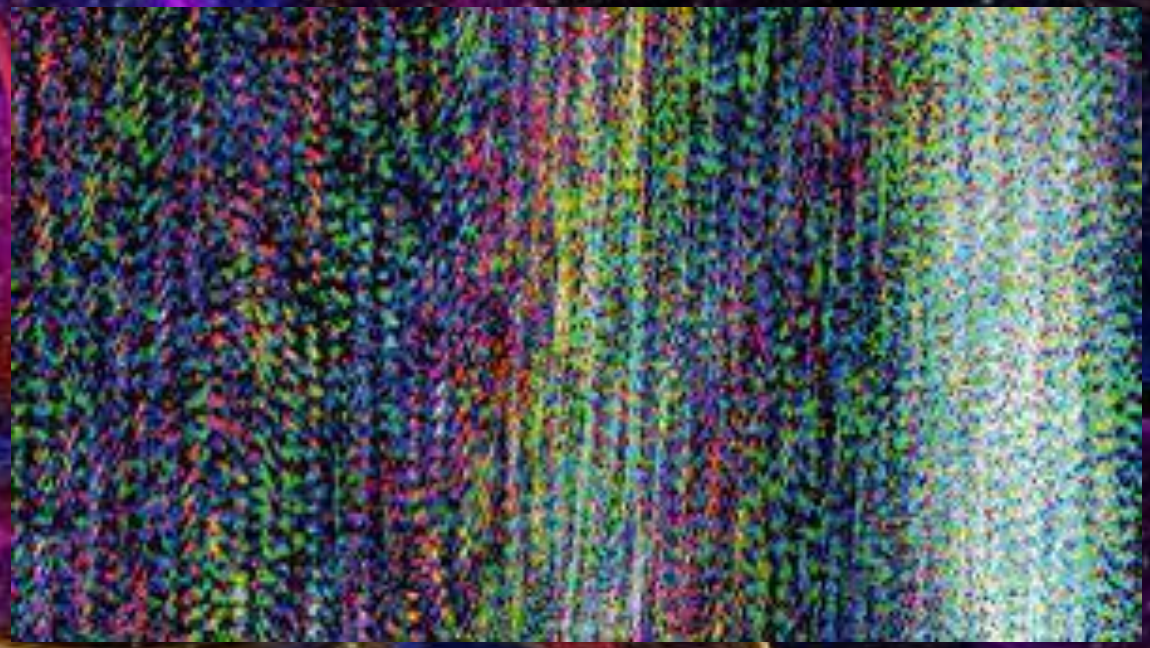
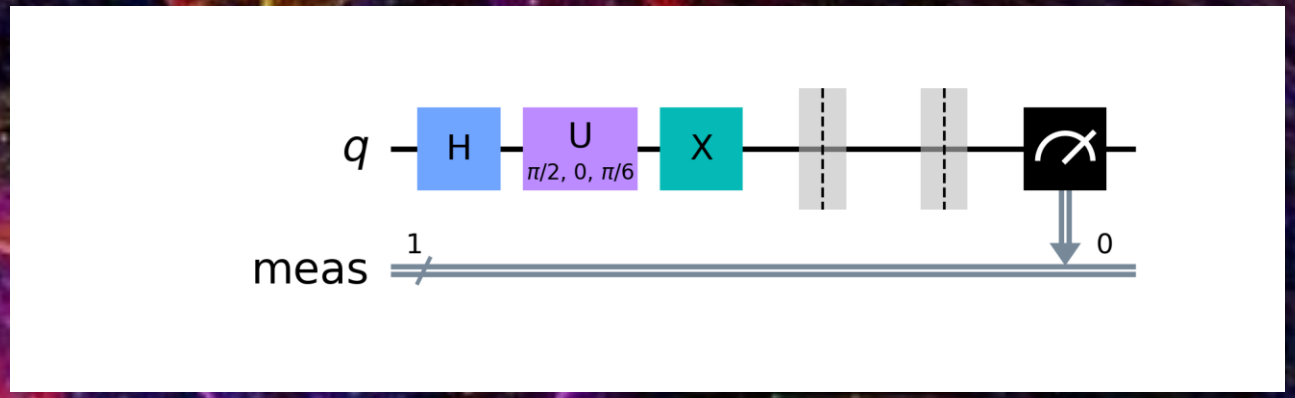
Noise effects on the output of a quantum circuit

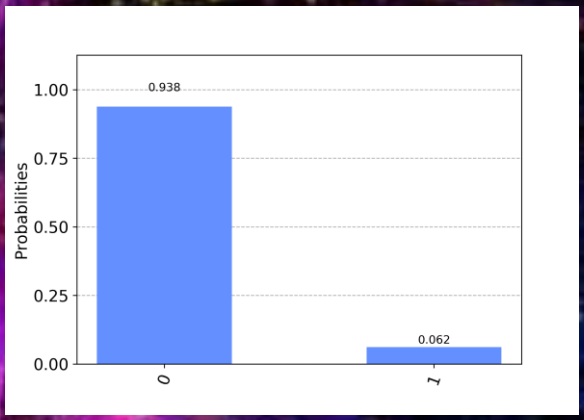


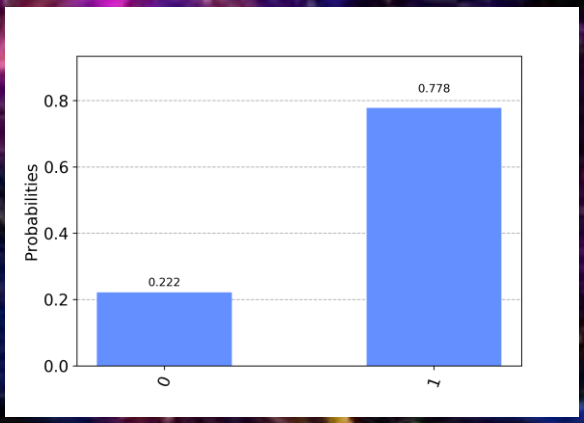


How it works:

- Initialise the system using the quantum circuit pictured
- Output probability to lose of 93%
- Choose what noise you would like to apply to the system that utilises the Qiskit noise module
- Examine the effect of the noise on the probabilities





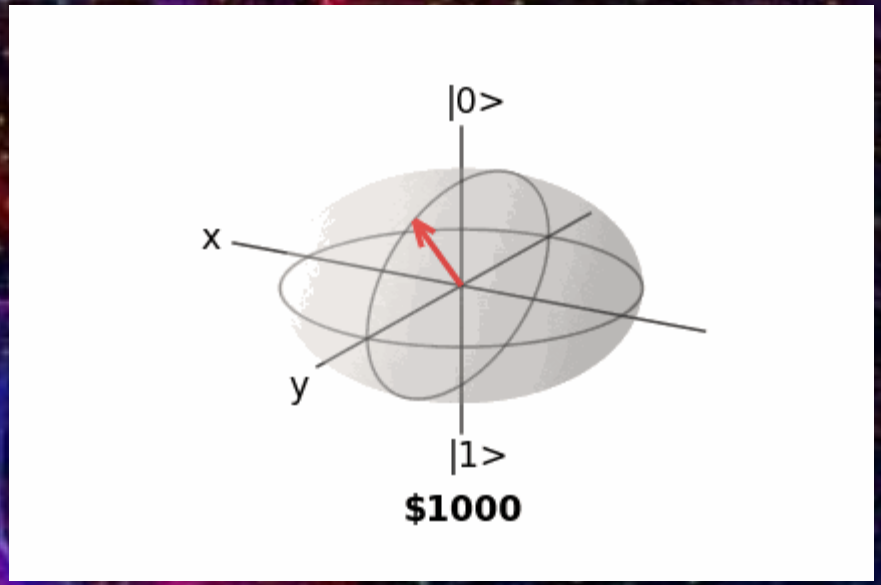


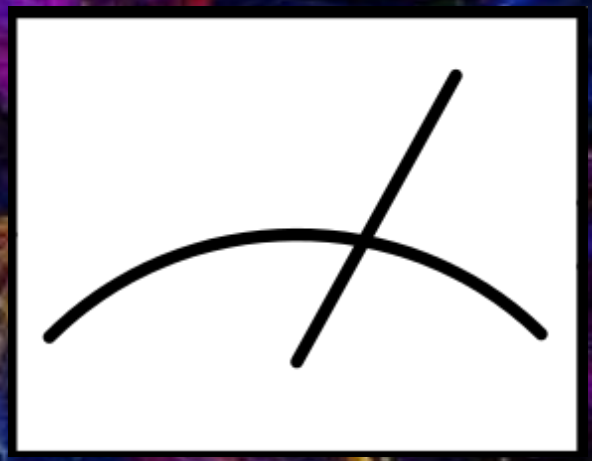
Bit flip error

- Your measurement device is faulty! This caused a **bit flip error**

- This bit flip error is given by implementing a X gate with probability p = 0.8 .

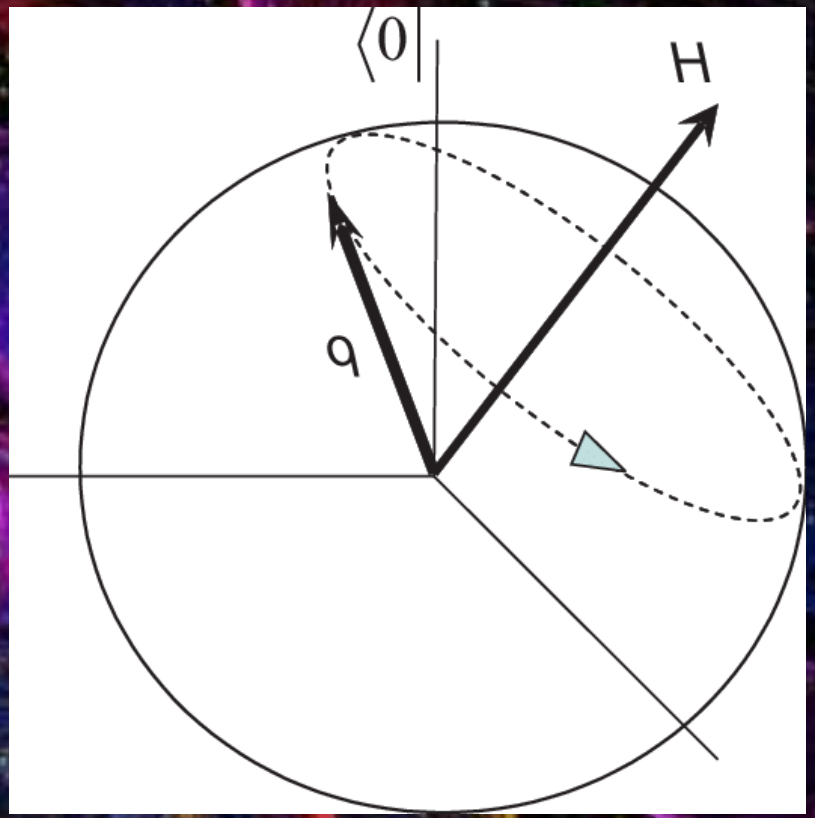
- This rotates 180° about the x-axis.





Phase flip error

- Your qubit interacted with a stray magnetic field **changing its phase,**
- This error is given by implementing a Z gate with probability p
- This rotates 180° about the z-axis



Amplitude damping error

- You induced some thermal fluctuations in your qubit
- This is modelled with an amplitude damping channel. But be careful, this noise might actually favour IBM!
- The amplitude damping channel models the decay of an excited state. The qiskit module drives the state to the |0> state at equilibrium with a decay rate that the user can pick

The future

- Include more noise models to investigate
- Apply multiple noise models at the same time
- Create more intricate circuits (adjust difficulty of the game) – add a qubit
- Use a real device

Conclusion

- Created a useful educational game based on wheel of fortune
- Utilised a quantum circuit to create a probability of winning
- Implemented Qiskit noise models to effect the outcome
- Investigate how different noise can change the outcome probabilities