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Quantum Turing Machines From Microscopic Research to Cosmic Calculations

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Introduction

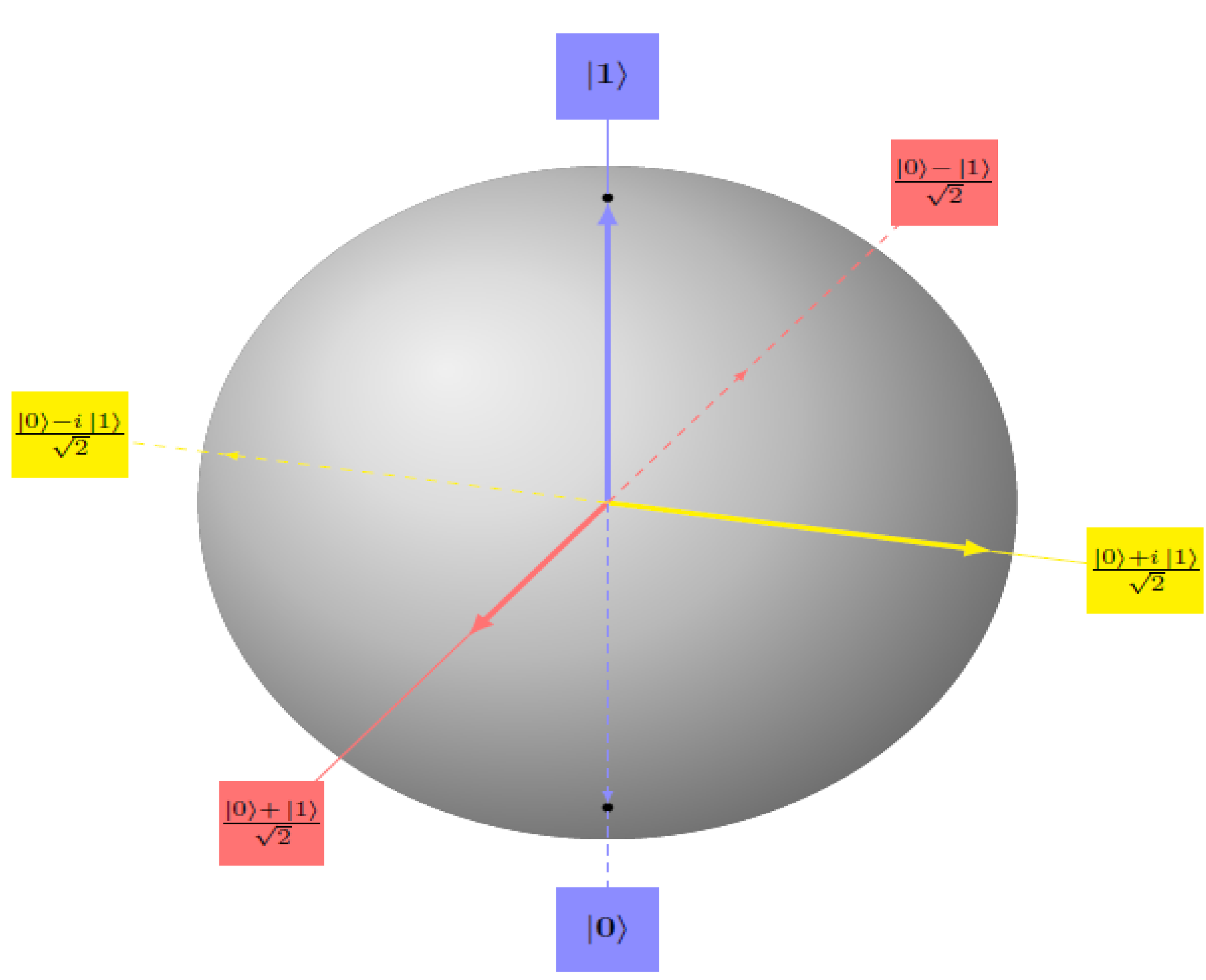
Quantum Turing Machines exist as abstract designs and theoretical models. However, as our world continues to progress, a physical manifestation of Quantum Computers is needed. Quantum Computers work similar to Standard Computers, only they rely on quantum states for their computations. The Quantum Turing Machine is a Universal Quantum Computer that allows us to implement any Quantum Computing Model that we have theorized.

Problem Description

Existing Computation Problems have become larger and more complex to perform.Examples of such problems include Integer Factorisation and RSA Encryption. Larger numbers are used while applying said techniques and this has resulted in more time consuming calculations that produce ineffective results. Thus, we need to use quantum computational power in addition to logical and arithmetic computation to meet our requirements.

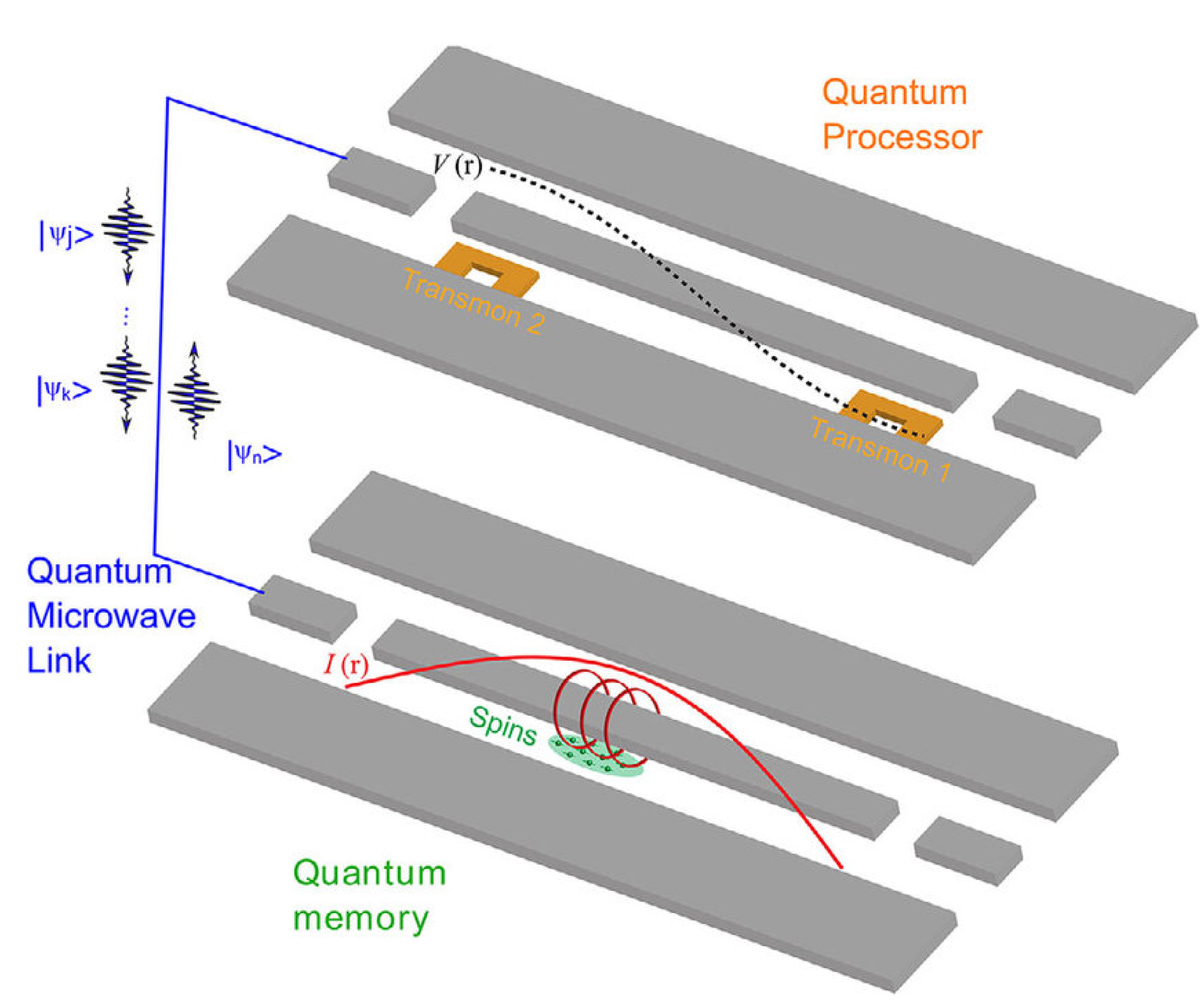
Objectives

This idea will allow humankind to achieve many objectives. As we delve deeper into the world of particle physics, The Quantum Turing Machine will allow us to quantify the attributes of new particles that we discover. This is of utmost importance as we are looking for new ways to generate energy. Additionally, we can also use the Quantum Turing Machine to develop new forms of Encryption. This is required today since cyber-security in the digital space is gaining increasing traction.We can also use the Quantum Turing Machine to reduce the time complexity of complex analytical models that can make Big Data Processing more efficient.



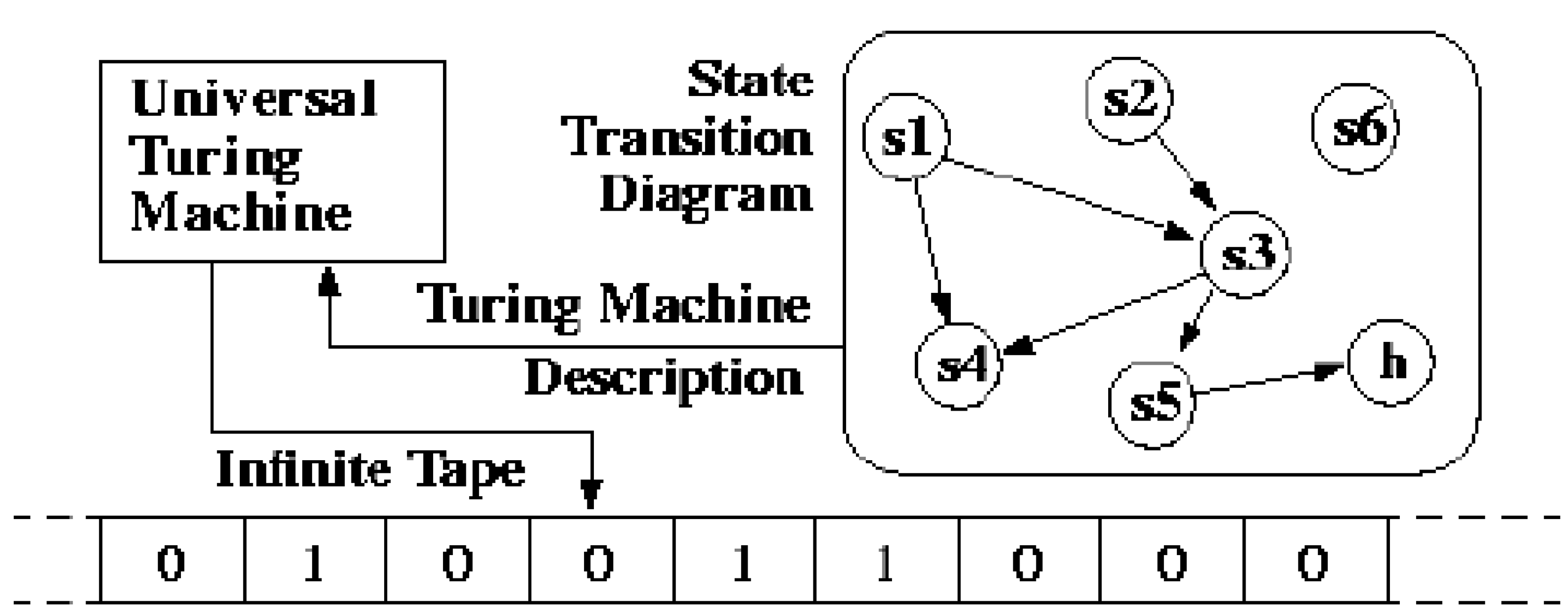
Structural Design and Architecture

Quantum Turing Machines use Qubits (Quantum Bits) instead of regular bits for their calculative purposes. Qubits function similar to regular bits, however, they have quantum states.These states can take values of 0 and 1 and alternate between the 2. This is similar to how regular bits in our daily computers can store values of 0 and 1. Thus, qubits allow quantum computers to perform basic calculations like regular bits. The qubits in the Quantum Turing Machine can be processed and utilised using Quantum Logic Gates. The Quantum Logic Gates are managed and maintained within the Quantum Processor available in our proposition. In order to materialise the qubits, we can use Ion Traps and Transmons. Thus, all our blueprints and algorithms that we have developed using the abstract bits can be implemented in the real world. Our Model will have multiple Transmons (2 or more). This will allow the machine to handle 'spins' of different quantum particles. Thus physical properties of the particles such as its rotational logical quantities - angular momentum, angular velocity and Torque will also be conserved. This will ensure that data is not lost during expansion and compression while we try to transfer information in the form of states from one Quantum Turning Machine to another. The Ion Traps and Transmons that work in correlation with the Quantum Processor (that has the Quantum Logic Gates) will communicate using the Quantum Microwave link. The radio waves here, as the name suggests, use the Microwave Frequency. This allows for faster and wider transmission of data. With further research and development, they can also work wirelessly and promote connectivity in larger devices. In contrast to regular devices that use magnetic, electro-manetic or flash memory to store data, the Quantum Turing Machine will use Quantum Memory. Quantum Memory is different from the other forms of memory storage since it will allow the quantum state of a photon to be stored. This ensures that the volatile information state of the photon cannot be lost or overridden and used to perform calculations as and when required. This memory can be received and released with easy to the processor.



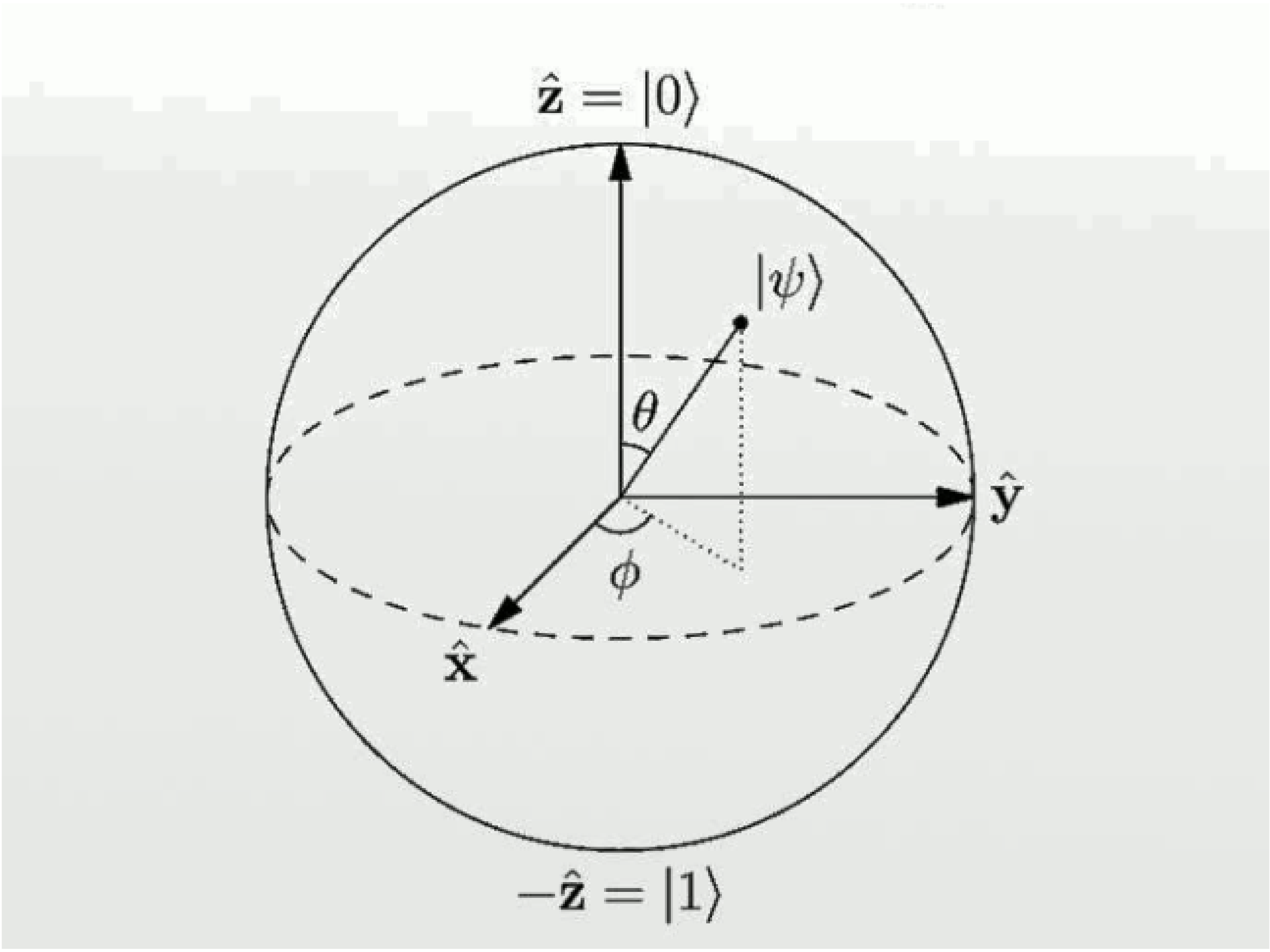
Practicality of the System

The Quantum Turing Machine has not been applied in the past due to improper error correction. Particles in their quantum states are not as stable as regular particles.Their values can change unknowingly and improperly. This can be an issue, especially when dealing with large numeric values and collections of values. Thus, we need to stabilize the state of the particles so we can allow for effective error correction. To do this, the propose system can ensure decoherence of noise. Through, this, the outliers can be isolated and the bits with redundant states can be identified. We can, thereby, correct the bits as we need to and ensure that the data points remain intact. The ideal circuit components mentioned in the design above can also be used in the right proportions alongside well versed combinations to prevent nanoscopic changes in noise that will further mitigate the need for error correction.

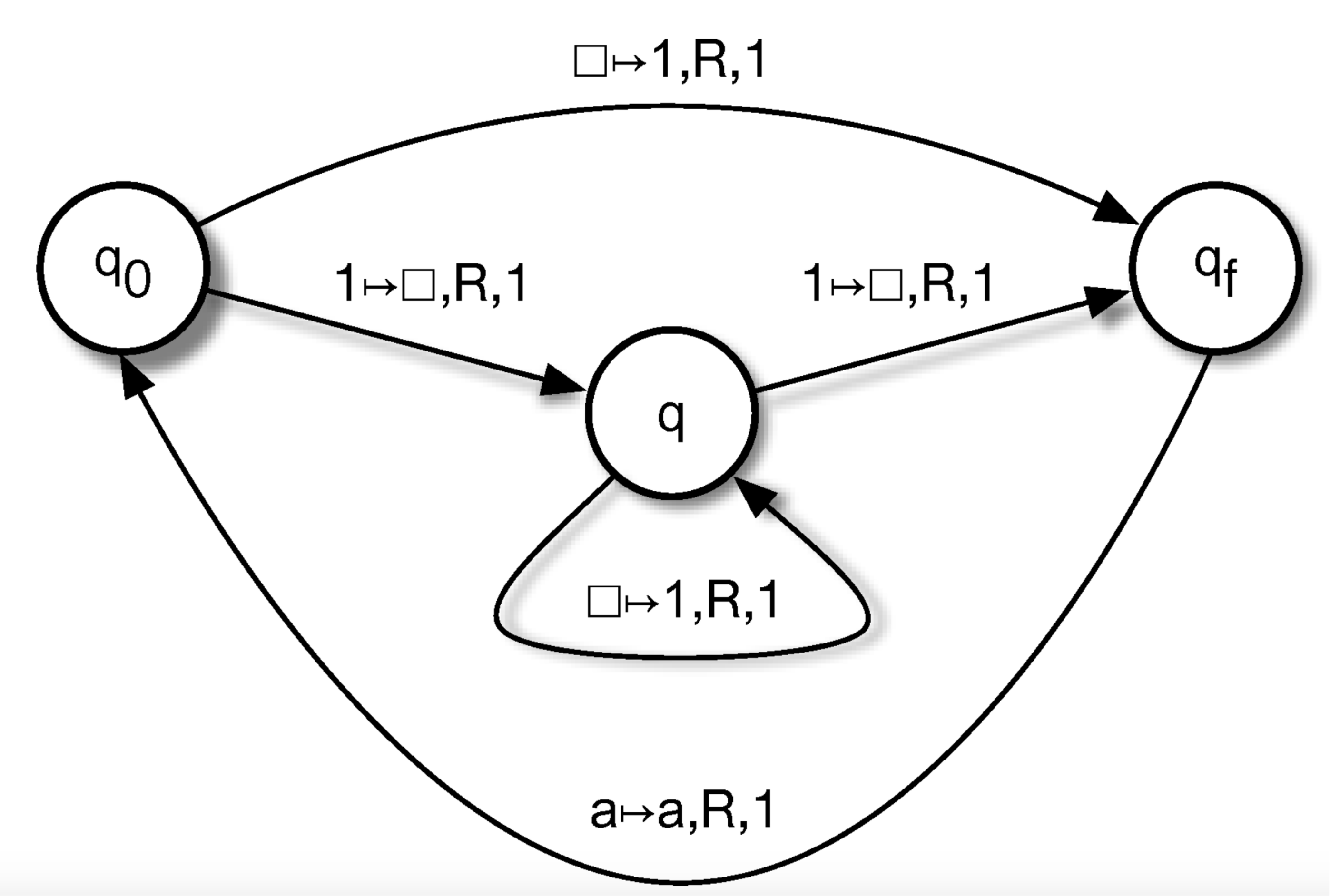


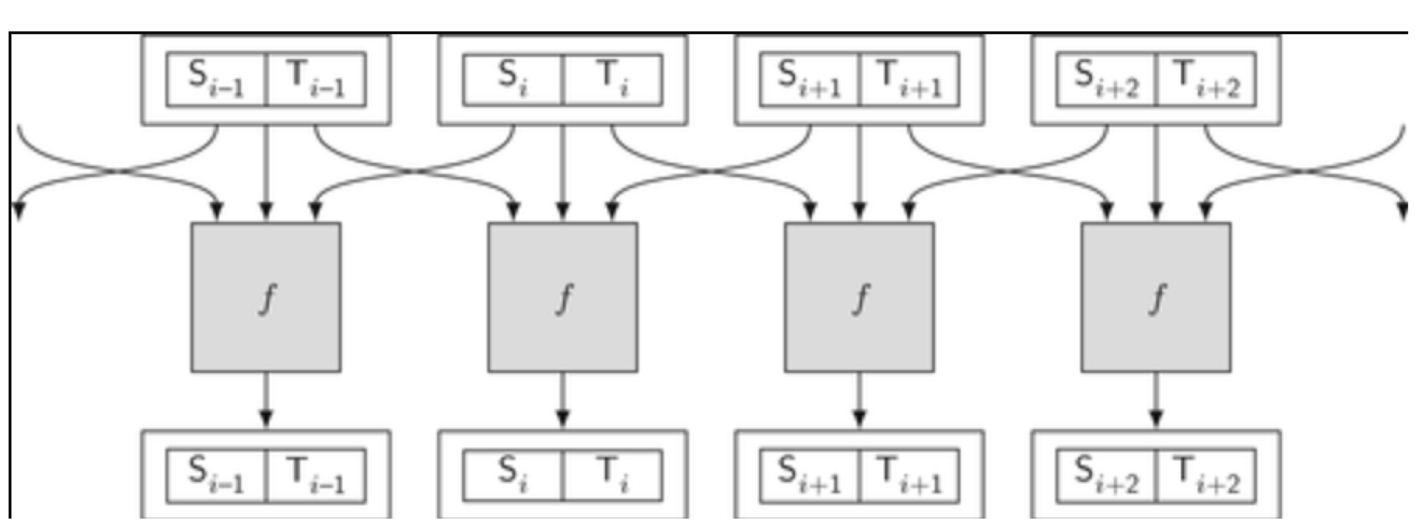
Intrinsic Nature of the Model

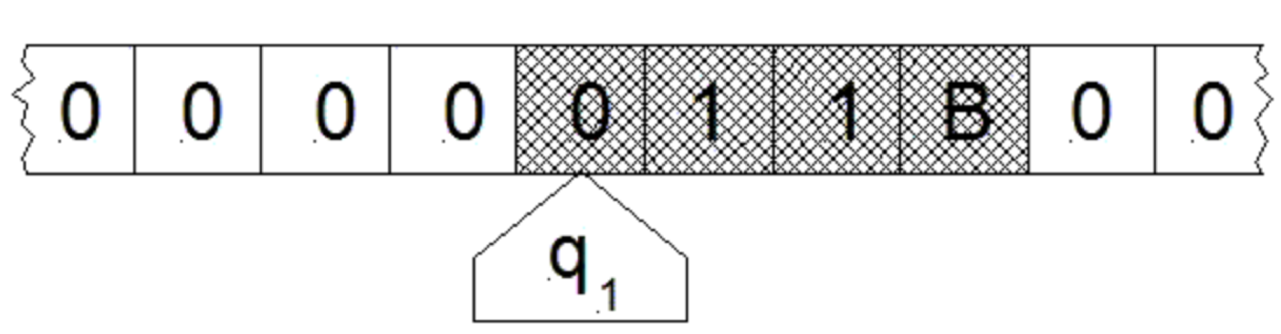
The intrinsic nature of the model leaves scope for infinite exploration. However, fundamentally, the quantum states lie on a 3 dimensional plane that allows the particles to traverse. Similar to how particles such as electrons would traverse though silver, copper, or aluminium wires in a traditional computer. Since the scope of traversal is 3 dimensional in a quantum computer, the plane needs to be larger and accommodate the necessary traversal patterns. It can do so using hypo-geometric pinpoint measures across a plane. It can also treat the position vectors of the particles as 1 and 0 depending on whether their values are positive and negative. For instance 0 can be the positive z coordinate vector and 1 can be the negative z coordinate vector. The other 2 points i and j, in correlation with the angles to the point from the center help determine the magnitude (absolute value) of data stored.



Memory Control







The diagrams above highlight the access control in a quantum computer. Since, we have a quantum computer, our qubits have infinite states as demonstrated in the first diagram. Their memory location shifts its position from q_o to q_f as part of its ever changing state. The hierarchy of memory storage works similar to how the Random Access Memory works in a standard computer. There will be caché that stores our immediate data usage based on what we have open and not. Additionally, the system can organise the data into blocks and so we can access them using the aforementioned microwaves (as shown in the second diagram).In our Turing Machine in particular, the data can be stored in blocks (as shown in the third diagram) and accessed using pointers to the memory, since it is always in a dynamic state.

Final Considerations

The power of a Quantum Turing Machine is immense. It can be harnessed for several purposes, some of which may be exceedingly nefarious. The device however is meant to be utilised only for meaningful purposes, to push the limits of human research and exploration and to strive to improve the lives of the general populace.

Conclusion and Further Scope

Due to our ever growing technological needs, Quantum Turing Machines will be the next big thing in technology. Any Quantum Model that is developed can be intrinsically applied using a Quantum Turing Machine. Looking forward, we can make this system commercially viable. We can also look to power said machine with alternative sources of energy and ensure its size is diminutive so it can work with wearable technologies.