I. METAPHORS AND ANALOGIES

The following consists of two one-word metaphors and a variety of analogies to expand upon and support them.

Entanglement (Metaphrand) → Seesaw (Metaphier)

Entanglement can be described as an occupied seesaw. The two people on the seesaw, let's call them Alex and Bobby, can be in one of two states—up or down. This is presuming the seesaw is well oiled and perfectly balanced (and thus sensitive to even the slightest mass difference), and also that any two people have unique masses down to infinitesimal precision. If Alex is up, we know that Bobby is down, and vice versa. By observing one of the two on the seesaw, without knowing their weights beforehand, we know both their state and the state of their fellow, even if the seesaw is so long we cannot see its other side. This is analogous to the states of two entangled particles—with states 0 or 1—even separated by any conceivable distance their outcomes are correlated. The unknown masses of Alex and Bobby are analogous to the unknown states of a given particle—in both cases, before observation, they are just as likely to be in one state as the other.

Superposition (Metaphrand) → Homonyms (Metaphier)

Superposition is an important phenomenon in quantum physics, describing the capability of particles to be in multiple places at the same time until measured, with a probability distribution used to describe its location rather than a fixed coordinate point. Homonyms, likewise, are described by a single spelling of a word, one defined alphabetical identity, spread across multiple meanings. These meanings are analogous to the multiple locations of a given particle despite its unique identity. The probability aspect of this definition, where a particle is more likely to be one location once measured (at which point the wavefunction will collapse and yield a definite coordinate location) is analogous to the way certain meanings of a homonym are more common than others (i.e. "mean" as in "cruel" is more likely to be used in conversation than "mean" as in "average value"). In this way a sentence (used to infer meaning to a homonym) is analogous to the measurement of a particle in superposition.

II. SCALING STRATEGY

The following consists of two scaling strategies to explain quantum physics-related concepts.

The Hydrogen Atom

The hydrogen atom is an important staple of learning quantum mechanics, as it is one of the only systems that is analytically solvable—its properties can be computed on pen and paper. It consists of a proton and an electron, with the electron kept close to the proton via the electrostatic force and simultaneously repelled by the weak nuclear force. In this way, the electron is both from colliding with and departing from the proton. Though the electron is often depicted orbiting the proton, this is not the case—it exists as a probability distribution surrounding the proton without any true size, it is what's known as a point particle. The probability distribution that represents it is often referred to as an electron cloud. This is a result of the quantum mechanical property of superposition discussed above.

A proton's size (its root mean square charge radius) is about 0.84 to 0.87 femtometers or 0.84×10^{-15} to 0.87×10^{-15} meters. The electron's most likely distance from the proton is the Bohr radius, which was calculated using the aforementioned theory than the electron was at a fixed position, orbiting the proton at a certain radius (which it described). The Bohr radius is about 5.29×10^{-11} meters in size.

If proton was approximately the size of a grapefruit (ten centimeters in radius), the area within its Bohr radius would be a bit greater than that of Isla Vista.

The Runtime of the Quantum Supremacy Experiment

On October 23, 2019, a team at Google led by UCSB Professor John M. Martinis published an article in the *Nature* journal claiming they had achieved quantum supremacy. This meant that their quantum processor—a 53 qubit machine known as Sycamore—had completed a computation in a reasonable amount of time that would take a cutting-edge classical supercomputer an unreasonable amount of time and resources. This computation, consisting of one million samplings of an instance of a complicated quantum circuit, took Sycamore two hundred seconds. It would take one of our most powerful classical supercomputers ten thousand years.

If the process could somehow be instantly computed by combined brainpower, this would mean that if the population representing the Sycamore quantum processor consisted only of one individual, the one representing a state-of-art classical computer would need China's entire population and a third of the US's in order complete the same task in the same time.