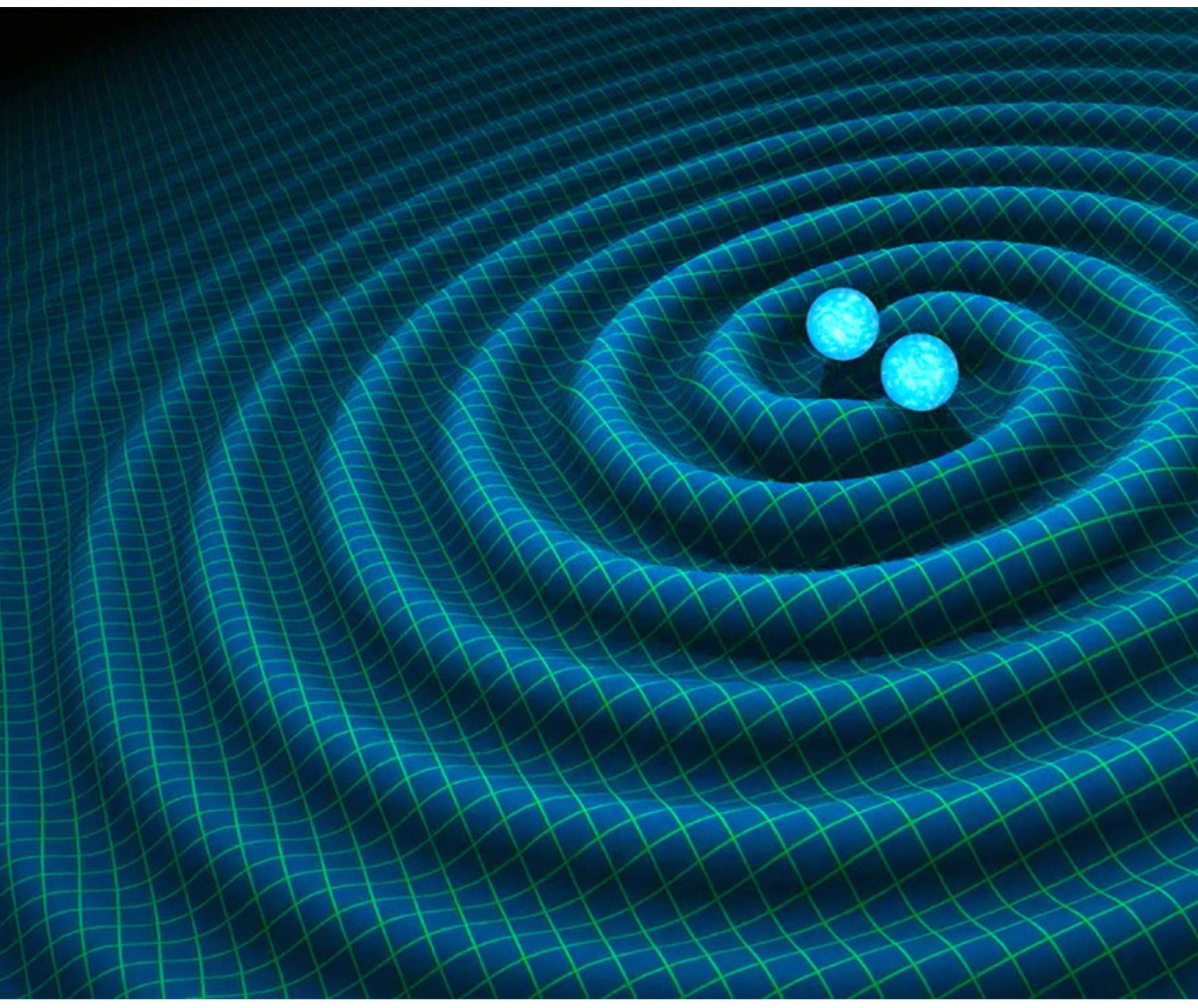
Ant Man's Quantum World

If you have watched Marvel's Ant-Man, I'm sure you are curious how the suit can manipulate space and matter to alter Ant-Man's size. Also, I'm sure you're curious to know if the physics behind it is even possible. Therefore, let us explore some of these concepts and implications.

Ant-Man's suit uses theoretical "Pym" particles to shrink the space between matter, therefore adjusting the particles that make up his body. These Pym particles would have to carry a force that could change an electron to a muon, while keeping its electric charge constant. Leptons are currently categorized as the six subatomic particles that do not experience the strong force, including the electron. These particles vary in mass with the Muon being 200 times heavier than the Electron which is 0.5110 MeV/c^2. Therefore, the Pym particles could condense or expand a lot of "free space" by changing the Leptons that make up his body. As he shrinks down smaller then a hydrogen atom, he reaches a size of less then 1.06*10^-35m, This means that the elementary particles occupying space have shrunk to the universal limit of 1.616255*10^-35m, known as Planck's constant.



At this point, if Ant-Man were to get even smaller, he would be pushing space into another dimension. At the microscopic scale we experience reality in three dimensions, with the moment through time being our fourth. However, in the quantum world the universe behaves quiet differently and there is opportunity to interact with more dimensions. String theory predicts there to be ten or eleven dimensions, therefore making plenty of space for Ant-Man to manipulate his mass. Without these extra dimensions, Ant-Man would eventually meet a limit of how small he could go.

Fundamental Force Particles

Force	Particles Experiencing	Force Carrier Particle	Range	Relative Strength*
Gravity acts between objects with mass	all particles with mass	graviton (not yet observed)	infinity	much weaker ↓
Weak Force governs particle decay	quarks and leptons	W^+, W^-, Z^0 (W and Z)	short range	
Electromagnetism acts between electrically charged particles	electrically charged	γ (photon)	infinity	
Strong Force** binds quarks together	quarks and gluons	g (gluon)	short range	much stronger

The Quantum world acts strangely and because of this, Ant-Man and his theoretical "Pym" particles could indeed travel through the Quantum World. Experiencing anomalies that theoretical physicist could only imagine in terms of the standard model and the mathematics of quantum state probabilities.