A "Just Right" Universe[1]

For life to be possible, more than forty different elements must be able to bond together to form molecules. Molecular bonding depends op two factors, the strength of the force of electromagnetism and the ratio of the mass of the electron to the mass of the proton.

If the electromagnetic force were significantly larger, atoms would hang on to electrons so tightly no sharing of electrons with other atoms would be possible. But if the electromagnetic force were significantly weaker, atoms would not hang on to electrons at all, and again the sharing of electrons among atoms, which makes molecules possible, would not take place. If more than just a few kinds of molecules are to exist, the electromagnetic force must be more delicately balanced yet.

The size and stability of electron orbits about the nuclei of atoms depends on the ratio of the electron mass to the proton mass. Unless this ration is delicately balanced, the chemical bondings essential for life chemistry could never take place.

Anthropic Principle

More than two-dozen parameters of the universe must have values falling within narrowly defined ranges for life of any kind to exist. This list was compiled in the mid 1990s, and the number of finely tuned characteristics of the universe has grown since then.

1. **strong nuclear force constant**
    a. if larger: no hydrogen; nuclei essential for life would be unstable
    b. if smaller: no elements other than hydrogen
2. **weak nuclear force constant**
    a. if larger: too much hydrogen converted to helium in big bang, hence too much heavy element material made by star burning; no expulsion of heavy elements from stars
    b. if smaller: too little helium produced from big bang, hence too little heavy element material made by star burning; no expulsion of heavy elements from stars
3. **gravitational force constant**
    a. if larger: stars would be too hot and burn up too quickly and too unevenly
    b. if smaller: stars would remain so cool that nuclear fusion would never ignite, hence no heavy element production
4. **expansion rate of the universe**
    a. if larger: no galaxy formation
    b. if smaller: universe would collapse prior to star formation

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[1] This information is found in *The Creator and the Cosmos*, by Hugh Ross.

5. **entropy level of the universe**
    a. if smaller: no proto-galaxy formation
    b. if larger: no star condensation within the proto-galaxies
6. **mass density of the universe**
    a. if larger: too much deuterium from big bang, hence stars born too rapidly
    b. if smaller: insufficient helium from big bang, hence too few heavy elements forming
7. **velocity of light**
    a. if faster: stars would be too numerous
    b. if slower: stars would not be luminous enough
8. **age of the universe**
    a. if older: no solar-type stars in a stable burning phase in the right part of the galaxy
    b. if younger: solar-type stars in a stable burning phase would not yet have formed
9. **average distance between galaxies**
    a. if larger: insufficient gas would be fused into our galaxy to sustain star formation over an adequate period of time
    b. If smaller: the sun's orbit would be too radically disturbed
10. **average distance between stars**
    a. if larger: heavy element density too thin for rocky planets to form
    b. if smaller: planetary orbits would become destabilized