

Quark as an “atom”, but in what way? — My philosophical thought on the structure of Quark.

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In the standard model, quarks are regarded as indivisible particles, the true atoms envisioned by ancient Greeks. Besides this symbolic connection, there are surprising similarities between quarks and real atoms. For example, quarks can be classified in families as atoms in the periodic table. Both heavy atoms and quarks can radioactively decay into light ones (1).

Atoms and quarks also share a similar position in structural layers of the universe that is arranged in terms of similarity (Fig. 1). The structural similarity of the solar system to atoms is well known; both the solar system and atoms consist of a large object surrounded by some much smaller objects. However, an atomic nucleus in a way is similar to a planet rather than the sun. One is made of a cluster of protons and neutrons (baryons) while the other is composed of mixture of various molecules. On the other hand, the Sun, primarily consisting of atoms while electrons as a part of the lepton family, are in the same layer as quarks. The baryons and molecules are made of the combination of lower-layer quarks and atoms, respectively.

What do these similarities between quarks and atoms mean? Recently, experimental data that cannot be explained by the Standard Model begin to emerge (2-4). It remains to be seen, though, if quarks are the true Greek atoms or like real atoms that have a solar-system-like internal structure, that is, a small hard center with small particles circled around it.

(1) Abe, F., et al. Phys. Rev. Lett. 77, 438-443 (1996).

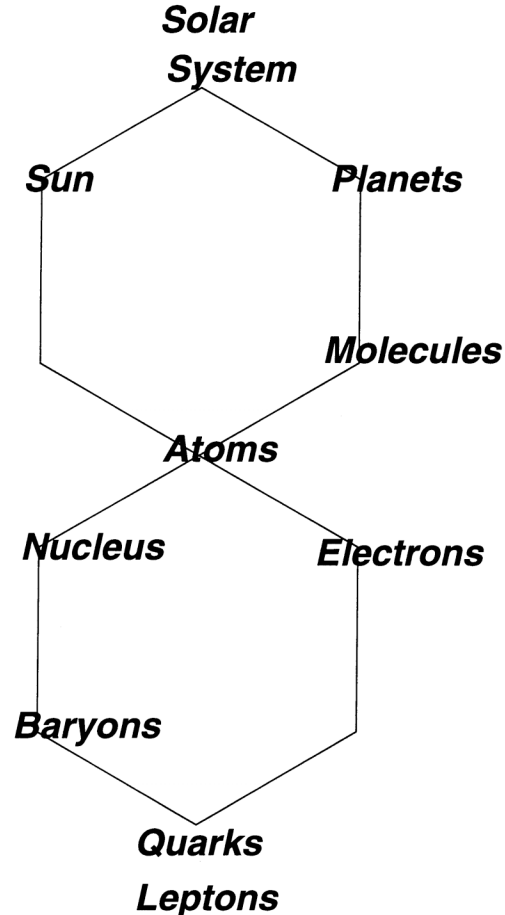


Fig.1 From the solar system to quarks, the structure of the universe can be described as one layer inside another. Although each layer has its own distinct properties, the similarity pattern among various layers suggests a possible unified origin for all layers.

(2) Adloff, C. et al. Zeit. Physik C. 74, 191-205 (1997)

(3) Breitweg, J. et al. Zeit. Physik C. 74, 207-220 (1997)

(4) Breitweg J. et al. ibid, 74, 207-220 (1997)

First written in Chinese at Hefei, China in 1983, rewritten in English in 1997 at Harvard Univ.