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PREFACE

In this centennial year of Albert Einstein's birth, physicists are inspired more than ever and most enthusiastic to talk about the scientific works and human side of the greatest scientist of all time. Only until two decades ago, the General Theory of Relativity was not included in most university graduate programs - it remained as a separate discipline in physics, to be studied sometime in the future if time could be alloted for it. Albert Einstein regarded general relativity as his greatest achievement in physics compared to all other epoch-making contributions he made, including the discovery of special relativity, photoelectric effect (the concept of photon), statistical analysis of emission and absorption of radiation by atoms in a gas, Brownian motion, and a host of other profound contributions to physics. Now his theory of gravitation described within the framework of general relativity is being recognized with increasing importance with the passage of time.

Einstein is becoming even greater with time. His General Theory of Relativity does, so far, describe successfully the heavenly phenomena associated with pulsars, black holes, 3 degree K fossil cosmic radiation left over from the big bang, expansion of the Universe, quasars, supernovae phenomena, and many other cosmic sequences of events. The fundamental significance of gravitation, the new picture of space and time concepts for the elementary particles, and the possible relation between the smallest and the largest is now being studied with greater appreciation and better understanding.

In this centennial year of Albert Einstein and the 63rd anniversary of the General Theory of Relativity, we still have two distinct fields of physics: one describing purely gravitational phenomena in the large and the other, supposedly, all other physical processes where gravity can be neglected. Gravitation and quantum theory are still as far apart as they were when discovered independently. Clearly, there are two alternatives to unify all of physics: 1) to continue the current efforts in the field of gauge theories, QCD, embracing renormalizability, ambiguous assumptions for the existence of quarks or similar varieties as constituents, as well as the associated symmetries like charm, flavour, etc., hoping that gravitation is somehow forced to comply with the conditions and restrictions of these theories, either by means of so-called supergravity or something else to be discovered in the future; 2) to abandon all of the above attempts and come to the lonely road of Albert Einstein's path where physics could make giant strides with the generalization of the General Theory of Relativity, consisting of the unification of the electromagnetic and gravitational forces. The existing theory, where electromagnetic stress energy density acts as a source of gravitation and the corresponding electromagnetic field is described by Maxwell's equations outside matter, was formulated in 1916. In this sense, Einstein's theory of gravitation in the presence of the electromagnetic field has complete validity as a unified field theory in the asymptotic region, namely outside material particles.

Generalization of this theory yields a third force which has short range and is generated by infinitely stratified distribution of magnetic charges with alternating signs. Thus, the four fundamental particles: proton, electron, electron-neutrino, muon-neutrino and their antiparticles have extended structures with the above magnetic content. In each case, the total magnetic charge content vanishes. In the new theory, the concept of renormalizability has no place. The important idea is everywhere regular solutions of the field equations. The basic principle of the theory is the correspondence principle, which is an all-encompassing idea that is quantified by a fundamental length r_0 of the order of 10^{-33}cm. It measures the deviation of the generalized theory of gravitation from general relativity in such a way that the former reduces to the latter for $r_0 = 0$. At this time, the greater majority of physicists do not subscribe to this alternative approach, and they remain unperturbed with regard to their dedication to the first alternative.

I shall end this preface by quoting from a parting remark made by Albert Einstein to me while visiting with him in his home at 112 Mercer Street, Princeton, New Jersey, the afternoon of November 19, 1953: "I believe that your theory, because of the fundamental length r_0, is more general than mine, but time will show which one of us is right".

Behram Kursunoglu
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