

# 23

## Summary: Call for a Paradigm Shift

### 23.1 Current Paradigm

A set of beliefs, dogmas, postulates and axioms, along with concepts and notions derived from particular interpretation of different physical observations, constitute the paradigm of fundamental physics. Under the current paradigm, it is generally believed that a fundamental theory of Physics need not be based on logical foundation and need not contain causal linkages for physical explanation. However, it is a fact that the current paradigm does not provide logical foundations to the mathematical models which are being projected as physical theories. A paradigm shift – a significant change in the paradigm is needed. Salient features of the current paradigm that need to be revised, are as follows:

- (a) ***Empty Space.*** The void between material particles represents the notion of empty space with the geometrical attribute of volume. There is no distinction between the abstract notion of coordinate space with a specified metric and physical space. No physical properties are believed to be associated with empty space, even though it can get curved.
- (b) ***Spacetime.*** All physical phenomena are believed to occur in a four dimensional world of spacetime. The dimension of time is treated at par with three spatial dimensions in the spacetime. All dynamic phenomena occurring in space can be represented through the geometrical constructs in a four dimensional spacetime manifold. Physical reality of spacetime continuum implies a belief in four dimensional block view of universe, in which three dimensional physical world is assumed to exist at all points on the time axis. Additionally, the spacetime continuum is believed to get curved under gravitation. The curved space representing gravitational field is also believed to store energy. The notion of *curvature of space* and spacetime is a keystone in the current paradigm of Relativity.
- (c) ***Relativity***
  - i. Space and time measurements are *considered* relative and not absolute. A particular value of distance and time measurement will *appear* to be different for different observers in relative uniform motion.
  - ii. The speed of light is *believed* to be a constant ‘c’ for all observers in relative uniform motion. The relativity of space and time stems from this postulate of constant ‘c’ for all observers in relative uniform motion.

- iii. All reference frames in relative uniform motion are considered *equivalent* in all respects and none of them can be regarded as preferred or unique or absolute in any sense that could be practically distinguished. Establishment of any fixed, absolute or universal reference frame is *considered* impossible.
  - iv. All forms of matter and energy are *believed* to influence the metric of spacetime without any physical mechanism.
  - v. The metric of space is *believed* to be a physical property of empty or free space.
  - vi. The ‘fabric’ of spacetime is *believed* to be so deformable that the metric of curved spacetime can also lead to mathematical singularities which are interpreted as physical Black Holes.
- (d) ***Big Bang Cosmology.*** The Big Bang Model is a broadly accepted theory for the origin and evolution of our universe. It postulates that the present universe has expanded from an initial spacetime singularity into the vast cosmos we currently inhabit.
- (e) ***Expansion of space in the Expanding Universe.*** The metric expansion of space is the averaged increase of measured distance between objects in the universe with time. It is an intrinsic expansion – i.e. it is defined by the relative separation of parts of the universe and not by motion "outward" into preexisting space. Metric expansion is a key feature of Big Bang cosmology.
- (f) ***Elementary particles.*** All elementary particles are believed to be point like and structureless particles that are not composed of smaller particles. The elementary particles are assumed to be endowed with special interaction characteristics. We do not know anything about the shape, size and internal structure of any of the elementary particles.
- (g) ***Existence of Fields.*** A field in physics represents a physical quantity that could be associated to each point of space-time. A field is believed to contain energy and momentum. The physical existence of fields make the field concept a supporting paradigm of the entire edifice of modern physics. But how does a field physically *exist* at each point of the space-time? The physical mechanism that could support the existence of a field at each point of space and time, is neither understood nor being explored.
- (h) ***Kinetic and Potential Energy.*** All particles of matter are assumed to be bestowed with specific amounts of kinetic and potential energies. Whereas the kinetic energy depends upon the motion, the potential energy depends upon the position of the particle. The sum of kinetic and potential energy of all particles within a closed system, remains constant invariant.

- (i) ***Exchange theory of interactions.*** All particle interactions are believed to be mediated through the exchange of special force mediating particles called bosons. In particular, electromagnetic interaction among charged particles is believed to be mediated through the exchange of virtual photons.
- (j) ***Probability waves.*** All microscopic particles of matter display a wavelike nature while in motion. The intensity of the wavelet is interpreted as the position probability density for the location of the micro particle. This interpretation implies that probability waves accompany all micro particles in motion.
- (k) ***Uncertainty in the trajectory of micro particles.*** Consequent to the assumption of probability waves accompanying micro particles in motion, the description of their trajectory parameters becomes probabilistic or uncertain to some extent. This uncertainty in the description of trajectory parameters of micro particles has evolved into a fundamental principle of quantum mechanics.
- (l) ***Weirdness of Nature.*** It is believed that the inherent weirdness of Nature does not permit us to mentally visualize the shape, size or structure of all micro particles and their associated fields.

## 23.2 The New Paradigm

- (a) Mathematical representations supposed to describe physical reality are not sufficient to enable us to mentally visualize the associated physical phenomenon. Such mathematical representations must be supported by causal linkages, physical explanations and logical foundations, to adequately describe physical reality.
- (b) It is not the inherent complexity of Nature that prohibits us from mental visualization of fundamental physical phenomenon, but our ignorance of Nature. Just like computer simulations, if we possess sufficient relevant information about certain physical phenomenon, we must be able to mentally visualize the same.
- (c) To understand and comprehend physical phenomenon occurring in physical space or vacuum, we must first attempt to understand the fundamental nature of physical space or vacuum. The physical properties of permittivity, permeability and intrinsic impedance characterize the fundamental nature of empty or free space.
- (d) Apart from a working mathematical model, a physical theory must incorporate causal linkages for logical explanation of associated physical phenomena.
- (e) The popular notion of ‘curvature of space’ actually implies the ‘deformation of space’. The deformation of space can be properly

represented through a displacement vector and a strain tensor associated with each and every point of the space continuum.

- (f) An absolute fixed reference frame, such as the International Celestial Reference Frame (ICRF) can be constructed in any closed volume of space with finite matter content. The concept of an absolute reference frame can be extended to the Universal Reference Frame which can be practically established just like the ICRF.
- (g) In the mathematical model of General Relativity, an abstract notion of spacetime manifold has been used as a graphical template, with differential scaling of its space and time axes, to represent the particle trajectories as geodesic curves. The four dimensional spacetime continuum is not a physical entity in any sense but just an abstract mathematical notion.
- (h) The uncertainty principle of Quantum Mechanics is strictly applicable for certain mathematical representations of the physical phenomenon and not to the phenomenon itself.
- (i) A detailed analytical study of dynamic deformations in the space continuum, through the time dependent displacement vector field  $\mathbf{U}$ , provides a more fundamental level of investigation into the workings of Nature, in comparison to the fields currently used for the purpose.
- (j) All forms of energy and mass fundamentally exist as the strain energy of the dynamic deformation or strained state of the physical space continuum.
- (k) All physical phenomena involving matter particles and fields, represented through various strained states of the space continuum and their mutual interactions, can be mentally visualized as well as mathematically modeled.
- (l) Quantum Mechanics needs to be recast into Bohmian Mechanics after replacing the notion of probability waves with strain waves in physical space continuum. The kinetic energy of a particle in motion is the strain energy stored in the pilot waves accompanying the particle.

### 23.3 Matter Particles and Fields

- (a) All electromagnetic phenomena, energy transportation processes and all wave motion that are believed to be occurring in empty space, are in fact occurring in the elastic space continuum with characteristic properties of permittivity  $\epsilon_0$  and permeability  $\mu_0$ .

- (b) The equilibrium equations of elasticity in the Elastic Space Continuum turn out to be identical to the Maxwell's vector wave equation for the electromagnetic field, as  $\nabla^2\mathbf{U} = (1/c^2) \partial^2\mathbf{U}/\partial t^2$ .
- (c) A closed region of the Elastic Space Continuum in a permissible strained state, satisfying the equilibrium equations & boundary conditions, may be termed as a strain bubble.
- (d) The total strain energy content  $E_0$  of a strain bubble represents its rest mass  $m_0$ , through the well known mass-energy equivalence relation  $E_0/c^2 = m_0$ .
- (e) The electromagnetic field in free space is just a dynamic strained state of the elastic space continuum. Whereas the temporal stress in the continuum corresponds to the electric field  $\mathbf{E}$  in free space, the torsional stress in the space continuum corresponds to the magnetic field  $\mathbf{B}$ .
- (f) Interaction energy, or the conventional potential energy, of two interacting strain bubbles may be defined as the difference between the total strain energy with superposed strain fields and the sum of their separate strain field energies. A negative interaction energy or potential energy will imply the release of a portion of the total strain energy of the two interacting bubbles. The released energy may either transform into another strain bubble wholly or partly and emitted out of the system, or transform into kinetic energy of motion of the interacting strain bubbles.
- (g) The clusters of pure and composite strain bubbles depicting 'elementary particles' are essentially characterized by their 'strain energy content', 'strain wave fields' if any and their interaction properties. In principle, there could be an infinitely large number of different types of strain bubbles occurring in the Elastic Space Continuum, that may be correlated with an equally large number of stable and unstable elementary particles.
- (h) The electron and positron pair is found to be the lowest order spherically symmetric strain bubble solution of the equilibrium equations. This strain bubble consists of a standing strain wave 'core' of about  $1.61 \times 10^{-15}$  m (1.61 fm ) radius, surrounded by a radially propagating phase wave field extending to infinity.
- (i) The unique characteristic features of these radial strain wave fields manifest in the unique charge property of these strain bubbles. Detailed computations of strain energy content show that almost 65% of the total mass energy of the electron is contained in its core and the remaining 35% in its field.

- (j) The nucleon core is represented by an important, lowest order, cylindrically symmetric solution of equilibrium equations. The proton consists of a positron entrapped inside a nucleon core through strong interaction and moving around the core center within a sphere of about 1 fm radius.
- (k) The neutron consists of an electron entrapped inside the outer periphery of a proton through strong interaction and moving around the core center within a radius of about 2.6 fm.
- (l) The strong interaction between two or more strain bubbles or particles is physically effected through the superposition of the strain fields in their cores. The range of strong interaction is small because the physical spread of the core region is small.
- (m) Since the electrostatic wave fields of charge particles physically extend up to infinity, the range of electromagnetic interaction is said to be infinite. Similarly the gravitational interaction between two or more neutral particles is physically effected through the superposition of their neutral ripple wave fields, which too extends unto infinity.

In the grand maze of the unknown, the current paradigm has lead Fundamental Physics to a dead end.<sup>[11]</sup> To come out of this state, we need to change the direction of research and hence, change the current paradigm of Fundamental Physics. This book represents a bold attempt to show inadequacies of the current paradigm and to present a new paradigm of Fundamental Physics. The proposed paradigm shift is expected to enable significant advancements in our fundamental understanding of Nature in the near future.