

Invited Expert Opinion

Indian Philosophy and Fundamental Physics

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Advait – or absolute non-duality – is at the core of Indian philosophy. The truth of Advait is expressed by the word ब्रह्म, and by profound assertions such as तत् त्वम् असि – or that art thou. In its essence, Advait means that all of existence is fundamentally ONE, not a hodgepodge of disparate entities.

As against this, current theories of physics involve four so-called fundamental forces: gravitation, electromagnetism, weak nuclear forces and strong nuclear forces. Attempts to unify these four disparate forces, over many decades, have failed. Three of the four have been quantized; the quantization of gravity, to unify it with the other field theories, has not yet succeeded.

One immediate implication of Advait is that what is perceived as 'reality' is no more than perception. Impressions on the organs of perception, and concepts formed thereby in the brain, do not equate to ब्रह्म – which is unknowable through perceptions and mental concepts. In the common western view, on the other hand, perception is equated with 'reality'.

Modern science progresses by experimental discoveries and theoretical advances, but with one exception. Cosmology – study of the cosmos – does not rely on experiment, because it is not humanly possible to set up experiments at cosmic scales. Instead, cosmology relies on detailed and sophisticated observations and measurements of cosmic phenomena.

The cosmos is most definitely not an experiment! It exhibits infinitely many complex cycles of phenomena, at inter-galactic scales, in which humans play no part. At cosmic scales, it is not possible to identify distinct 'cause' and 'effect' sets of phenomena, and assert that one 'caused' the other.

We understand causality only as defined by experiment; for example, pressing a switch causes a needle to move across a dial. But, because the cosmos is

not an experiment, such causality does not apply at cosmic scale. Arrogant modern science, however, extrapolates to the entire cosmos theories which are based on results from essentially small-scale experiments.

Any theory which speaks of a 'force' is basically a causal theory, because a 'force' is by definition a causal agency. Three of the four so-called 'fundamental forces' in modern physics are defined by man-made experiments. Therefore, as explained above, they cannot be employed directly in theoretical models of the cosmos. Gravitation is the only cosmic phenomenon which is explained from first principles, by Newton and then Einstein, independent of man-made experiments. As we know, 'gravitational force' reduces to motion along geodesics, which are not 'causative agents'.

If we remove causality and 'force' from any theory about the cosmos, only gravitation remains, in the form of the general theory of relativity. All the proven principles and methods of mathematics remain applicable, since they are derived logically from well-defined sets of axioms.

An analogous argument applies to 'time'. As a concept, 'time' is created in the mind though a calculation such as $T_2 - T_1$, where the two measurements T_2 and T_1 are experimental. No such measurement or subtraction happens within reality, or ब्रह्म, and therefore 'time' is not a fundamental concept.

It has been well established in physics that different observers of the same phenomena measure different 'time intervals'. Thus 'time' is not inherent in the phenomena, but is a result of our measurements. There is therefore no logical difficulty in excluding it from the set of fundamental concepts.

Thus, inspired by Advait, we can formulate our fundamental theories without causality, force and time. Instead, we can work with the rich set of purely mathematical and well-established concepts of 4D manifold, tensors, parallel transport, curvature and

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geodesics. Much can be done with these concepts, by way of re-formulating the fundamental concepts of physics.

This area of research has enormous scope, with implications in general relativity, cosmology, foundations of electromagnetism, and quantum physics. Broadly, this research can be described as modern implications of Indian knowledge systems. Recently, the author has initiated collaborative research in this direction with the PG Department of Mathematics, Sardar Patel University, Vallabh Vidyanagar.

