THE OBSERVER IN THE WORLD-VIEW OF PHYSICS

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ABSTRACT

The ideas introduced by the author in a couple of recent papers on entropy, irreversibility and quantum measurement are first briefly summarized. The meaning of the concept of observer introduced in these papers is developed further and implications discussed. The observer is proposed as being an entity always existing and existing in the singular as opposed to being a living system obeying laws of physics and chemistry.

CAN we, in principle, form a consistent picture of the physical world and the phenomena around us in terms of a set of laws of physics regarded as being independent of the existence or non-existence of an observer who looks at these phenomena and tries to find these laws? An assumed positive answer to this question forms the basis and provides the motivating force for all physical sciences. In a sense, the question has always existed. For example, if one tries to derive the properties of the macroscopic world of tables and chairs from the assumed hypothesis of atoms and molecules, one such property being irreversibility, one has to take recourse to *ad hoc* operations like averaging over macroscopic lengths and time scales. These operations are justified by statements to the effect that we are macroscopic observers, our senses are too crude to sense very small distances and time scales and so on. The problem of explaining why we, as observers, are so restricted still remains. If the entire process of cognition were subject to deterministic physical laws, there would be no room for these contingent elements or randomness. The reason one is able to live with these contradictions in classical physics is that the problems can be swept under the rug by a few simple statements which are not questioned.

After the advent and the remarkable success of quantum mechanics, however, the problem of the relevance of the observer has been posed with much more seriousness. The reason for this is that 'measurement' and 'preparation of a state' are much more central concepts in quantum mechanics than these are in classical physics. The disturbance of the system as a result of measurement on a quantum system is not a small, negligible effect that can be blamed on inefficiency or carelessness; it is fundamental. The existence of states in which not all observables have precise, well-defined values at the same time even in principle, the indeterminate collapse of a system to an eigenstate of the observable being measured, etc., are features peculiar to quantum mechanics. These features lead to several well-known paradoxes, for example, the Schrodinger's cat paradox, the Einstein-Podolsky-Rosen paradox and so on.

Motivated by these problems as well as by the *ad hoc* unaesthetic and artificial nature of the assumption of an external reality existing independently of the existence of an observer, we have, in a couple of recent papers[1,2], proposed a view on the problems of entropy, irreversibility and quantum measurement in which the observer is an indispensable part of a complete description of physical reality. 'Levels of perception' are introduced as a new element in the description. A level of perception is characterized by a set of concepts and assumptions which the observer regards as *a priori*. This set determines the set of all possible states the observer can observe at the given level of perception. Any state that contradicts these concepts and assumptions cannot be observed by this observer and such states must, therefore, collapse to one of the states in the allowed set. This collapse is an irreversible process and it was proposed that such a collapse during any observation by an observer whose perception is limited is the fundamental cause for the irreversibility observed in the universe by such an observer.

It was also proposed that every set of concepts and assumptions considered *a priori* must be assigned a negentropy corresponding to the number of states considered inaccessible by virtue of these constraints. These states would become accessible for a more unrestricted observer, whose conceptual framework or 'level of perception' allows for a larger number of states. It follows that any universe seen by a restricted observer must evolve, since it has a potential negentropy. In the limiting case, an observer who is completely unrestricted and allows for all possible states sees a universe which does not evolve, for there is no potential negentropy.

The above hypotheses would clearly be of little significance if the existence of the postulated observers with various levels of perception were impossible. These would also be of little significance if these levels of perception were unattainable by 'human' observers.

It would be desirable therefore to discuss a little further what we mean by 'observer' and the relation of this observer to phenomena. Clearly, by 'observer' we mean something more than a physico-chemical system obeying fixed laws of physics and chemistry, since this is itself a classical or a macroscopic view, hence only relevant for a particular level of perception. For the same reason, it cannot be looked upon as a spatio-temporally bound system. *The observer is an entity which always exists and exists only in the singular.* There is only one observer! It is the same observer that attains these various levels of perception, including the ones in which it sees itself as many observers. The strongest argument in favour of the view is that *an observer is never experienced in the plural.* The inability to visualize such an observer is no more serious than our inability to visualize quantum mechanical objects, for example electrons. This dissociation of the concept of an observer from 'human-being' or from the 'phenomenon of life' is, we believe, important for the resolution of the age-old question: Would there be a Universe if there were no one to observe it? The answer is No, because the existence of the observer is a fundamental truth—the only truth accessible to direct experience. The concept of an external world and laws governing its phenomena are constructs invented by the observer to put order and meaning into his own experience. These constructs are, therefore, subject to change in the observer's perception, for no set of concepts meaningfully describes the entire experience.

An immediate question that arises is, whether these various levels of perception are attainable by a 'human' observer. The following way of looking at the problem may perhaps be helpful. Let us note that if we accept the more general concept of the 'observer' mentioned above, then for this observer, there is no distinction between mental phenomena like thoughts, feelings, emotions, etc., and physical phenomena like burning of wood. Both kinds of phenomena are parts of the observer's experience. The identification is useful, however, in one respect. In the realm of mental phenomena we explicitly recognize the impossibility of observation of a phenomenon without disturbing or changing the phenomenon. It is very difficult to observe thoughts without changing them. Further, mental phenomena are known to be phenomena which themselves change as a result of their understanding. For example, if repeated performance of a habitual act by a person is looked upon as a phenomenon, we do allow for the possibility that the person may get rid of the habit by conscious effort in the form of introspection. Now if there is no qualitative difference between mental and physical phenomena, both taking place in the observer's mind, one must allow for the possibility that the latter may change as a result of conscious effort on the part of the observer. Physical laws could thus be looked upon as habits, only much more deep-rooted, consequently requiring much greater effort to change.

1. Bhandari, R., *Pramāṇa*, 1974, 3, 1.
2. —, *Ibid.*, 1976, 6, 135.

SPECTROPHOTOMETRIC STUDY OF THE REACTION OF OSMIUM WITH ISONIAZID

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ABSTRACT

Isoniazid is proposed as a new reagent for the spectrophotometric determination of microgram amounts of osimum. It forms an yellow complex with Os(VIII) and Os(VI) in the pH range 3·8–4·5 at room temperature. The yellow complex exhibits maximum absorbance at 420 nm. Beer's law is valid over the concentration range 0·1–6·5 ppm for Os(VIII) and 0·4–7·0 ppm for Os(VI). The sensitivities are 0·013 $\mu g/cm^2$ for Os(VIII) and 0·026 $\mu g/cm^2$ for Os(VI). The effects of time, temperature, order of addition of reagents, reagent concentration and diverse ions are reported.

INTRODUCTION

ISONIAZID, isonicotinic acid hydrazide (INH) is extensively used in the treatment of tuberculosis. It has been proposed for the spectrophotometric determination of vanadium[1] and gold[2]. In the present paper the authors have investigated the colour reaction between INH and the platinum metals and developed INH as a sensitive reagent for the spectrophotometric determination of osmium. The proposed method offers the advantages of simplicity and good sensitivity without the need for extraction.