

8 Nature of Physical Theory!

Introductory Paragraph

used for discussion to put in perspective
all the interps of Q.M.

Essential point: Logical Structure + Correspondence (mathematics) (interpretation)

Example: Model nature quite apparent in new Standard theories, such as gauge theory, covariant models, etc., and various Nuclear --- tends to become obscured with ^{some} ~~new~~ establishment.

Levels of interpretation. Med theory to even get at any
observables beyond direct sense perception --
whole hierarchy -- i.e. when we speak of position of
micro-particle as observable -- obviously nonsense,
only instruments (microscopic) directly observed, require
theory which links these readings to micro theory.
In fact, already using classical theory for instrument to us --

Non-uniqueness - undecidability between theories (empirically)
no such thing as "The correct theory".

alternate criteria (usefulness) - importance of testability
possibility of maintaining simultaneously more than one theory
(no total ordering on "goodness" of theories.)

Criticism of Extreme Operationalism: (Lay it on heavy!)

Example: illegitimacy of changing variables in integration.

From this viewpoint, one cannot reject the various
interps. Hidden Variable interps. of Q.M. If they give methods
for easier solution of any problems (or are more easily
visualized) then they are useful and should be retained. However,
if such is not the case, and they are in all cases more
cumbersome, then there is no clear basis for preferring them.

*Individual
in APP*

- Statements about knowability of whole situation ^{observer} are irrelevant to basic theory.

If we take the view that all elements of the theory must be directly observable, then we must abandon all attempt at unified field theories, elementary particle models, etc.

For example such a view requires that it is nonsense to discuss theories in which elementary particles are wormholes, for example, or which attribute any significance at all to metrics of space time in micro-regions, since clearly no observer can ever obtain direct knowledge of such metrics without completely disrupting the thing he measures. This true classically as well as quantum - for pictures of particles as wormholes, any observer composed of similar particles, since cannot approach closely without totally disrupting metric.

Nevertheless such theories can be fruitful, and in principle are even capable of predicting any such limitations on observation. It would be a mistake then to reject such theories immediately on the ground that they are not comprehensively verifiable by direct observation. The only valid requirement is that statements about what is possible observation, in the theory, shall be verified by experience.

some goes for situation of one observer trying to ascertain state of another. Of course there are limitations upon how well such a process can be carried out without disrupting the functioning of the first observer. Still it is a fact that we can observe some properties without such disruption, (e.g. we do look at one another without causing instant death) and we should be able to have a framework within which it is possible to study such cases. There is

nothing to prevent the choice of a complete framework which contains a complete description of all observer states as our basic theory even though there are basic reasons why one observer might not be able to obtain such a complete description of the other. Such limitations are then properly deductions from the complete theory, not a-priori assumptions.

A theory should not be rejected simply because it itself predicts limitations upon possibility of observer obtaining complete knowledge of all elements of the theory.

Present theory is a complete framework
of such a nature. One can discuss in
monigous manner observation processes, and
can deduce such limitations as exist. It
is only when a theory fails to conform with an
observation, which it predicts, that it can be
brably rejected.

Such a rejection is essentially Alternative 2,
which leads to repugnant situation.

Dependence upon acts of observation destroys a fundamental symmetry property, the idea that all physical systems be subject to the same laws. (Model must then be supplemented with corresp. rule which tells how to distinguish observers from other systems) This is a legitimate criticism of some interps of quantum theory. Criticism based solely on a desire to preserve causal rather than probabilistic laws, (possibly for philosophic reasons), cannot be taken ^{very} seriously. Thus a probabilistic theory, in which the probabilistic changes go on whether or not observation takes place is quite all right (Opp.). Sum. The criticism is not against probabilistic vs. causality, but the ^{desire} which dependence upon "acts of observation". ^{arises from the}

i.e. Want a model which is in principle applicable to entire universe, not containing extraneous "observers" which lie outside its scope. The laws of such a model can be probabilistic or causal.

Now is the time for all good