

# The Quantum Mechanical Frame of Reference

## Glossary

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Terms from the new lexicon are in italics. References are given in the main text.

*A-series*: The sequence of events happening. As McTaggart states: “The distinctions of the [B-series] are permanent, while those of the latter are not. If *M* is ever earlier than *N*, it is always earlier, But an event, which is now present, was future, and will be past.” (1927, pp. 9–10). This quote is from Savitt (2017) where a full account is given.

*Access consciousness*: Block defines access consciousness as the answer to the question: “What makes neuronal representations available for thought, decision, reporting and action?” (2003, p. 8), i.e. that which produces the sensorium, meaning that which gets experienced, the contents of consciousness.

*B-series*: The static sequence of points in time; the structure of 'positions in time' as described by McTaggart (1908).

*Block Universe*: The existence of past present and future as all real and actual, the physical reality of eternalism.

*Class-of-worlds-as-a-world*: The *world superposition* emphasising its second-logical-type nature.

*Correlation*: Quantum correlation means that each of two systems has information about the other. This leads to co-relation of the probabilities of events in the future. This is closely related to quantum entanglement which means there is no separate physical definition of either system.

*Eternalism*: The view that all existence in time is equally real, and actual, forming a block universe.

*Frame gate*: The part of the projector the light shines through. The projector operates so as to place one frame of the movie after another into the gate to produce the succession of images on the screen.

*Individual*: The entity on the inside view, termed the self-aware substructure by

Tegmark (1998).

Inside view: The frame of reference of the individual in physical reality as defined by the record of observations, as defined by Tegmark (1998).

Instant: A specific point in time in the quantum concept of time. See also Moment.

Karma: The spiritual concept of cause and effect, with the overall result that everything you do happens back to you in some way: 'what goes around comes around'.

*Many-worlds reality*: The physical reality of the world superposition.

Mind: The neuro-endocrinal operating system of the body.

Moment: A specific point in time in space-time. See also Instant.

Observer: The physical mechanism that formulates observations, and records them in memory, as defined by Everett (1957, p. 457): i.e. a classical measuring instrument.

Paradigm: The set of familiar concepts in the field, the theories and ideas in use, and the standards for what constitutes legitimate contributions in that field, as defined by Kuhn (1962).

Phenomenal consciousness: The experiencing awareness, sentience, pure subjectivity, as defined by Block (1995) and Chalmers (1996).

Phenomenal perspective: A term used by Lockwood to refer to the contents of consciousness generated by the brain: an experience that "... encompasses the total contents of a given state of awareness" (1989, p. 88).

Physical reality: That which is determinately real in a given frame of reference. On the outside view this is the quasi-classical world. On the inside view this is the world superposition.

Possibilism: The view that the world is a growing block universe, meaning the past is actual, and thus a four-dimensional block, while the future is not actual, but simply possibilities

Presentism: The view that only the present moment, a two-dimensional slice of space-time called a plane of simultaneity, is real and actual.

Proper time: The time as measured by a clock following the worldline.

*Quantum-mechanical frame of reference*: The quantum state of the effective physical environment of the individual on the inside view. This is the quantum state of the world superposition, which is logically equivalent to the relative state of Everett's formulation, defined by the correlations formed by observations made. As is clear from the measurement problem, it operates in a manner totally distinct from the classical frame of reference. The manner in which linear dynamics operates produces an essentially classical, Newtonian frame of reference once decoherence is applied. Only the quantum-mechanical frame of reference follows the collapse dynamics, as

well as following the linear dynamics of course.

**Quasi-classical world:** The essentially classical physical reality that demonstrates quantum indeterminacy at submicroscopic levels of scale.

*Second-logical-type phenomenon:* A phenomenon operating on an entity defined as a set that is inapplicable to an element of that set.

**Time:** The linear dimension of space-time, in which durations of events and the intervals between them can be measured and compared, and along which events may be sequenced. In general use, a measuring system used to sequence and compare events, their duration and so on.

**Time evolution:** The time evolution of a system is the change of the state of the system, as the frame of reference progresses along the time dimension. In the mathematics of physics this simply means advancing the time parameter, usually denoted as  $t$ . In Newtonian mechanics, mechanics, the time evolution of the physical state of the system is the change in the configuration of the matter and energy in space-time, as the time parameter is increased. In the linear dynamics of quantum mechanics, the same thing is defined, within the context of a system with a specific quantum state, but the definition becomes increasingly determinate over time. Time evolution in the collapse dynamics is the change of the quantum state defining this frame of reference

**Universe:** All that exists. In many-worlds theory the totality of all possible worlds.

**World:** As defined by Vaidman: “The totality of (macroscopic) objects: stars, cities, people, grains of sand, etc. in a definite classically described state.” (2008). In Tegmark's classification physical reality on the outside view “... the way a mathematician thinks of it, i.e., as an evolving wavefunction” (2008)

*World hologram:* The perceptual reality, the three-dimensional virtual-reality representation of the record of observations, the integrated record of successive states of the sensorium.

*World superposition:* The physical reality defined by the effective superposition of all worlds in which an individual with a specific world hologram exists.

**Worldline:** The path of an object in four-dimensional space-time, tracing its location in space at each moment in time.