Nomic Vagueness

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Upshots:

- The Past Hypothesis (PH) is vague.
- If PH is a fundamental law, then fundamental laws can be vague. (Nomic vagueness)
- To get rid of vagueness of PH, we might have to commit ourselves to an objectionable kind of arbitrary sharpness in nature.
- But the situation is transformed under a new approach to quantum mechanics in a time-asymmetric universe.

(Below is a first-pass version. For more precise definitions and distinctions, please feel free to ask during Q&A or email me for a paper version.)

Main points:

Exact Law A law L is exact if, for any world w, there is a determinate fact whether w is compatible with L.

Vague Law A law L is vague if, for some world w, there fails to be a determinate fact whether w is compatible with L.

Phenomenon of nomic vagueness:

- Vague laws (apparently) have borderline worlds and models.
- Vague laws (apparently) do not have well-defined extensions [in terms of sets of worlds].
- Vague laws are susceptible to sorites paradoxes.
- Vague laws (apparently) come with higher-order vagueness.

PH is vague because it is stated in the language of macro-states and macro-variables.

Classical Versions of PH:

Super Weak Past Hypothesis (SWPH) The universe initially was in a low-entropy state.

Weak Past Hypothesis (WPH) The universe initially had a particular low-entropy macrostate M_0, specified by the macro-variables S_0, V_0, T_0, P_0.

Strong Past Hypothesis (SPH) The initial microstate of the universe belongs to a precise set Γ_0, which is a particular low-volume sub-region of the universe's phase space.

SPH is not microscopically traceable: Most "admissible" changes of the boundary of Γ_0 will not have any effects in the material world.

Quantum Versions of PH:

Quantum Weak Past Hypothesis (QWPH) The initial wave function of the universe is in a low-entropy macrostate M_0, specified by the macro-variables S_0, V_0, T_0, P_0.

Quantum Strong Past Hypothesis (QSPH) the initial wave function is completely inside $\mathscr{H}_0$, where $\mathscr{H}_0$ is a particular low-dimensional subspace in the universe's Hilbert space.

QSPH is not microscopically traceable: Most "admissible" changes of the boundary of $\mathscr{H}_0$ will not have any effects in the material world.

The Wentaculus Package:

- Density Matrix Realism: the quantum state of the universe is objective and impure.
- Fundamental dynamical equations involving the density matrix (W-BM, W-EQM, W-GRW).
- Initial Projection Hypothesis (IPH): the initial density matrix of the universe is the normalized projection onto $\mathscr{H}_0$. That is, $W_{IPH}(t_0) = \mathbb{I}_0/\dim\mathscr{H}_0$

The initial density matrix, $W_{IPH}(t_0)$, plays two roles:

1. Macroscopic: corresponding to a low-entropy macrostate.
2. Microscopic: describing the actual micro-history (by guiding W-Bohmian particles, undergoing W-GRW collapses, giving rise to a branching structure in a W-Everettian multiverse)

Thus, $W_{IPH}(t_0)$, and the initial subspace $\mathscr{H}_0$, becomes microscopically traceable.

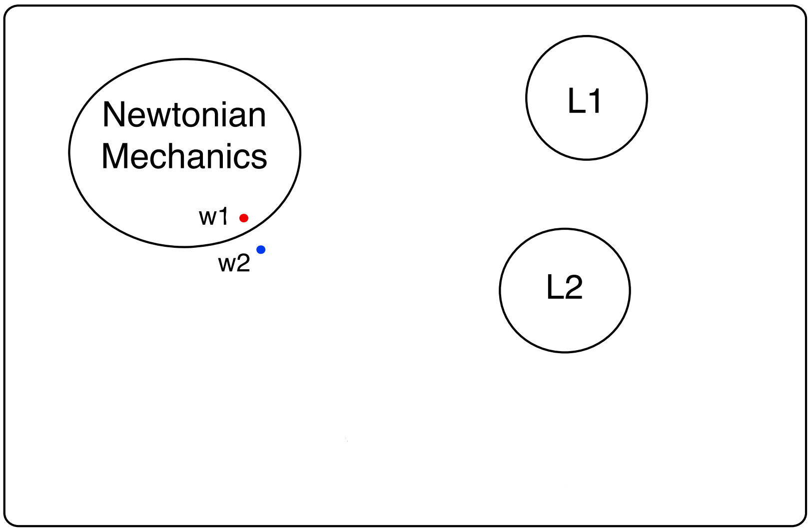
$W_{IPH}(t_0)$ is more like a constant of nature.

- It has an exact value.
- We can measure it with more and more precision.
- It has an objective anchor in the micro-histories.
- The sharp boundary is no longer objectionable.

Nomic vagueness disappears (in so far as time's arrow is concerned).

(For more technical details, and regarding the consequences for wave function realism, empirical equivalence, status of statistical mechanical probabilities, and Humean supervenience, see related papers on arXiv: 1712.01666, 1901.08053, 1810.07010.)

W, the space of all possible worlds



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