

Temporal naturalism: Time and laws in cosmology

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Time
Reborn
Lee
Smolin
From the Crisis of Physics
to the Future of the Universe

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Forthcoming:

The singular universe and the
reality of time

Roberto Mangabeira Unger
and LS



Why these laws?

Why these laws?

Why these initial conditions?

Why these laws?

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Who ordered that? II Rabi

Why these laws?

Why these initial conditions?

Who ordered that? II Rabi

“To suppose universal laws of nature capable of being apprehended by the mind and yet having no reason for their special forms, but standing inexplicable and irrational, is hardly a justifiable position. Uniformities are precisely the sort of facts that need to be accounted for. Law is par excellence the thing that wants a reason.....” C S Peirce

Fundamental physics and cosmology is in a crisis because of our inability to answer these questions

Theorists say: grand unification, supersymmetry, extra dimensions, technicolor, preons, strings, branes, loop quantum gravity, eternal inflation, multiverse, anthropic principle....

Fundamental physics and cosmology is in a crisis because of our inability to answer these questions

Experiment says we live in a very simple no-frills universe:

No proton decay, but dark energy, dark matter and neutrino masses.

LHC sees the Higgs only, no sign of further unification, extra dimensions etc.

PLANK sees evidence for the simplest inflation model. No bubble collisions.

FERMI and AUGER see Lorentz invariance is good up to the Planck scale, no evidence for spacetime discreteness.

Fundamental physics and cosmology is in a crisis because of our inability to answer these questions

Clearly we need to start over.

The main theme of this talk:

The method which has worked so well for physics up till now, has broken down because it is only suitable for explaining phenomena of subsystems of the universe. The questions we now face are cosmological and we need a new approach to them. This new approach must begin by embracing the inclusive reality of time.

Definition of naturalism:

Naturalism is the view that all that exists is the natural world that is perceived with, but exists independently of, our senses or tools which extend them.

A warning: naturalism is tricky. It can sometimes turn into its opposite.

Beware of statements of the form: *“Our sense impressions are illusions, and behind them is a natural world, which is really X”*

This can be innocuous when X is some testable hypothesis, for example *“made of atoms.”*

It can lead to fallacies when X is a big metaphysical fantasy such as *“a mathematical object.”* (either generic or particular.)

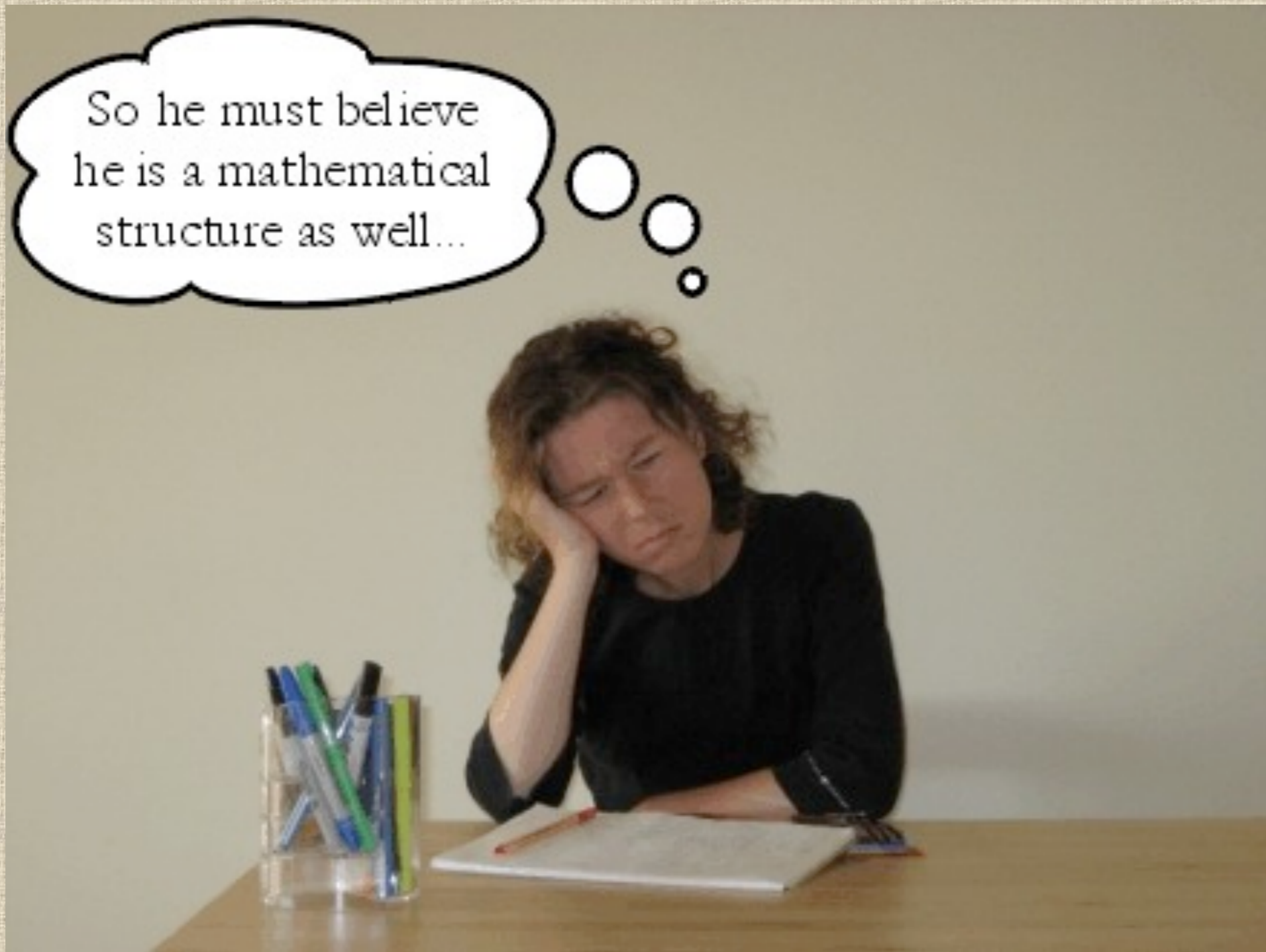
These arise when X contradicts the natural fact that we have sense impressions in the first place.

“The transcendental fallacy.”

Sabine Hossenfelder wonders:



So he must believe
he is a mathematical
structure as well...





... and I am a
mathematical structure
too.



Kinds of naturalism with respect to time:

Kinds of naturalism with respect to time:

Timeless naturalism holds that the experience of moments of time and their passage or flow are illusions. What really exists is the entire history of the universe taken as a timeless whole. “Now” is as subjective as “here” and both are descriptions of the perspective of an individual observer and there are similarly no objective facts of the matter corresponding to distinctions between past, present and future.

Timeless naturalism is closely related to the block universe interpretation of general relativity.

Temporal naturalism, holds that all that is real (ie the natural world) is real at a moment of time, which is one of a succession of moments. There are no timeless objects, truths, facts, laws....

The future is not real and there are no facts of the matter about it.

The past consists of events or moments which have been real, and there is evidence of past moments in presently observable facts such as fossils, structures, records etc. Hence statements about the past can have truth values. Some of these can be evaluated based on present evidence.

Kinds of naturalism with respect to time:

Barbour's instantaneous naturalism: Timeless quantum cosmology according to which what exists is a vast collection of moments, which exist all together timelessly.

This is not just a rerun of the presentist-eternalist debate because the key point is what the different conceptions of time imply for the nature of laws, and the key issue is what kinds of laws will be adequate to address cosmological questions within science.

Time and laws of nature:

Let us characterize the common structure of the main laws of nature from Newton to QM to GR: The Newtonian paradigm.

I will argue that while ideal for the description of subsystems of the universe it is inadequate for cosmology.

A new methodology is needed for cosmology.

The standard for explanation in physical science is the Newtonian paradigm.

It encompasses classical mechanics, quantum mechanics, general relativity, quantum field theory, quantum gravity, computer science models

The key is the separation of explanation into two parts:

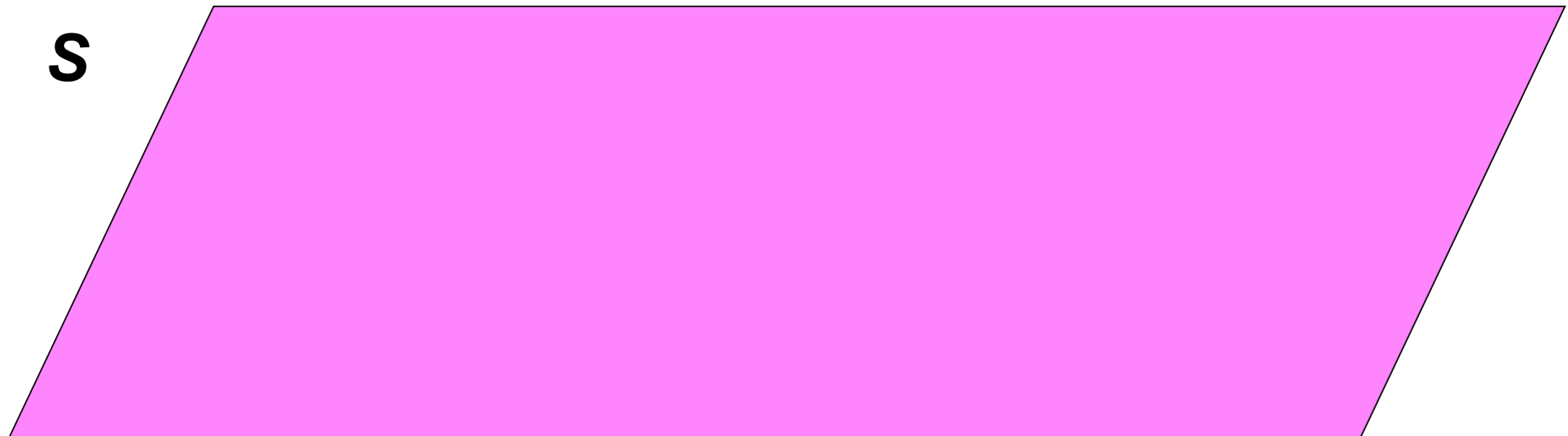
Laws and initial conditions.

To set up a theory in the Newtonian paradigm
answer two questions:

- What are the possible states or configurations of the system at a fixed time?
- How do these states change in time?

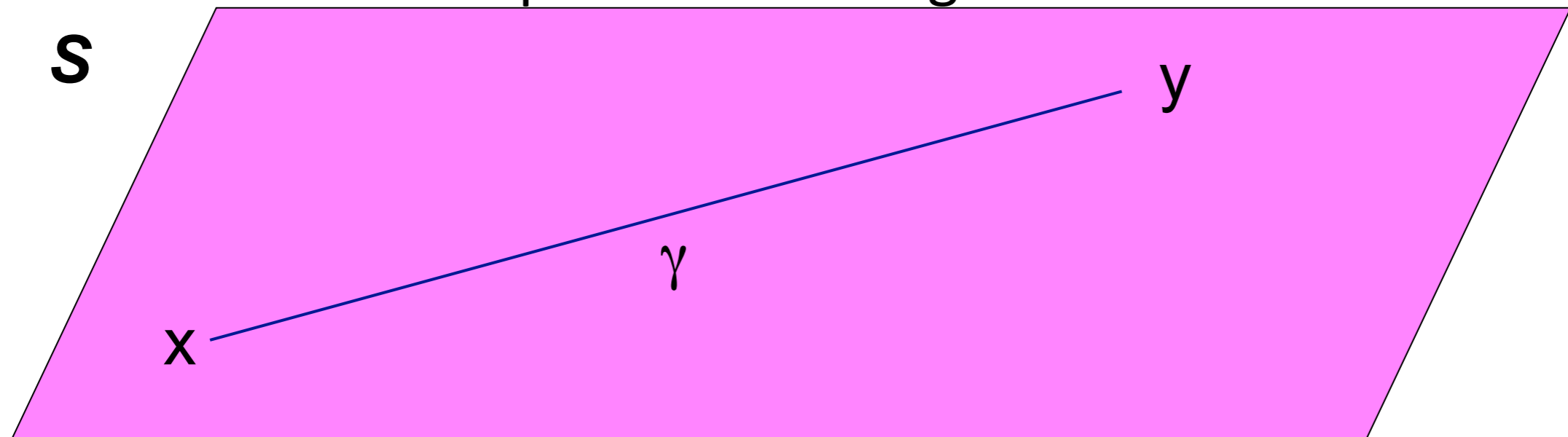
The Newtonian paradigm:

- A state space, \mathcal{S} , is constructed, It is assumed invariant under time. In classical mechanics this is the phase space of configuration, momentum pairs. In quantum mechanics it is the Hilbert space.



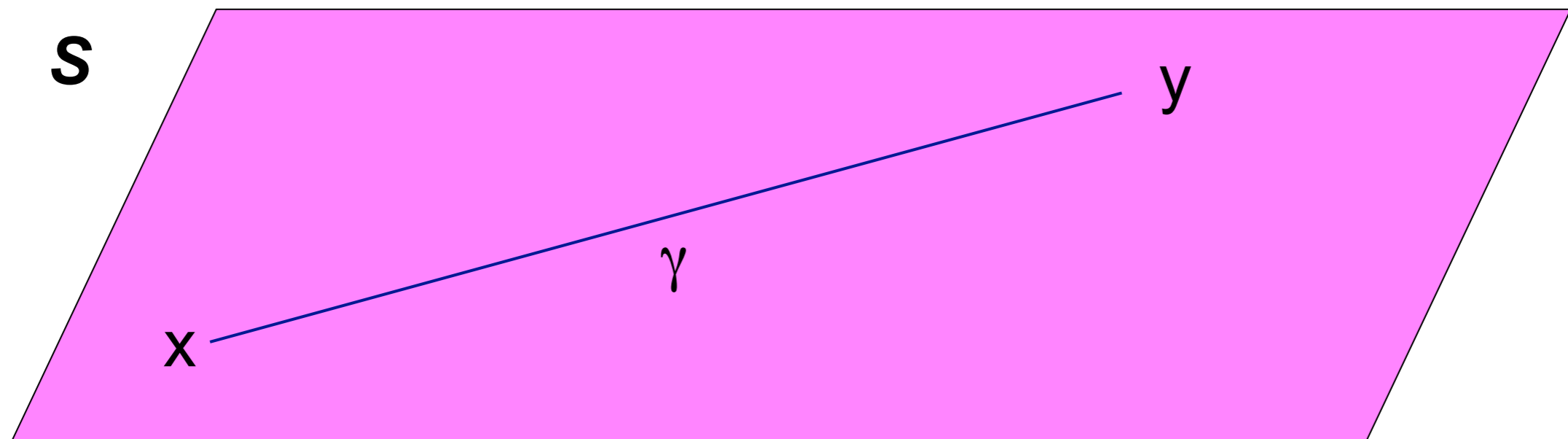
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- The dynamics is specified by giving a rule to evolve the state on \mathbf{S} . If the dynamics is continuous it gives a set of curves, γ , on \mathbf{S} , which are allowed histories of the system. There is a unique curve through each \mathbf{x} of \mathbf{S} .



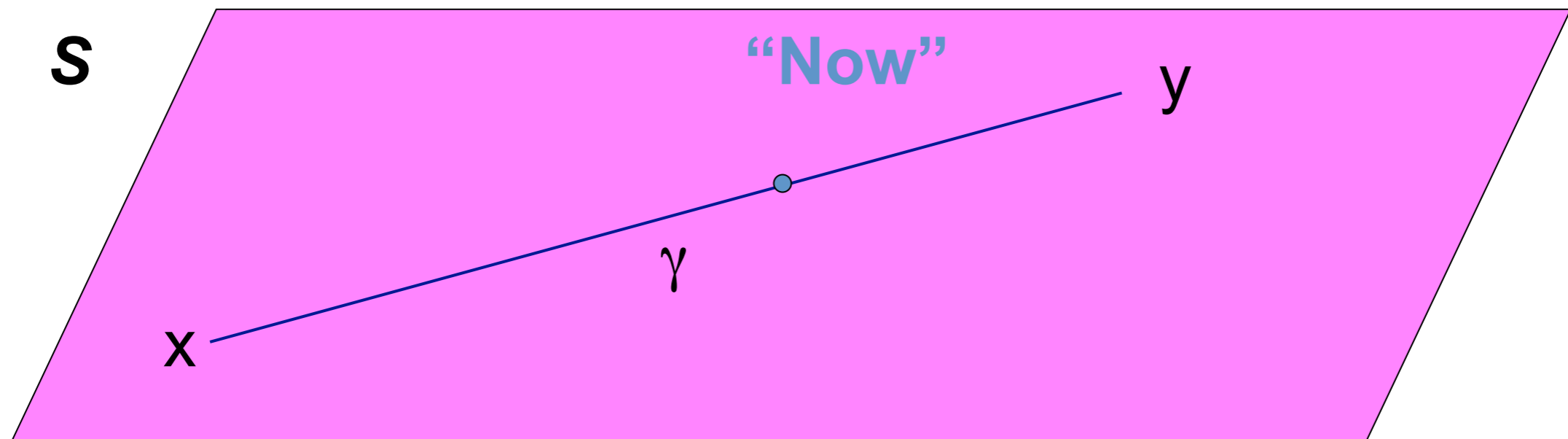
The Newtonian paradigm:

- To apply this schema to an experiment one prepares the system at an initial time, t_1 , in a state x of S . One then waits till a time t_2 and observes what state, y of S the system is in. The clock by which time is measured is assumed to be external to the isolated system.



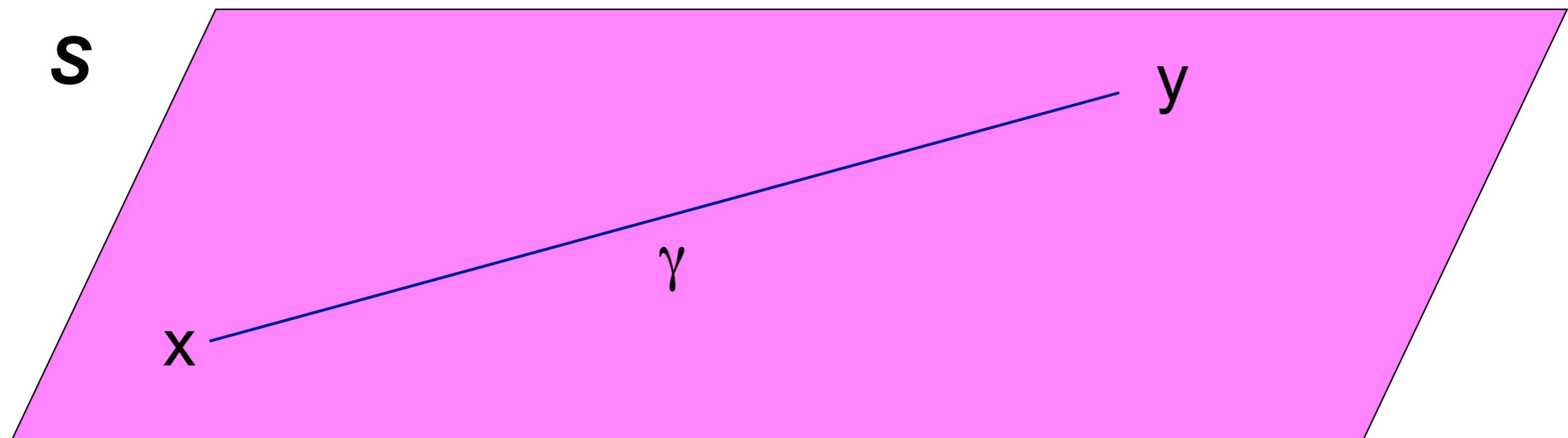
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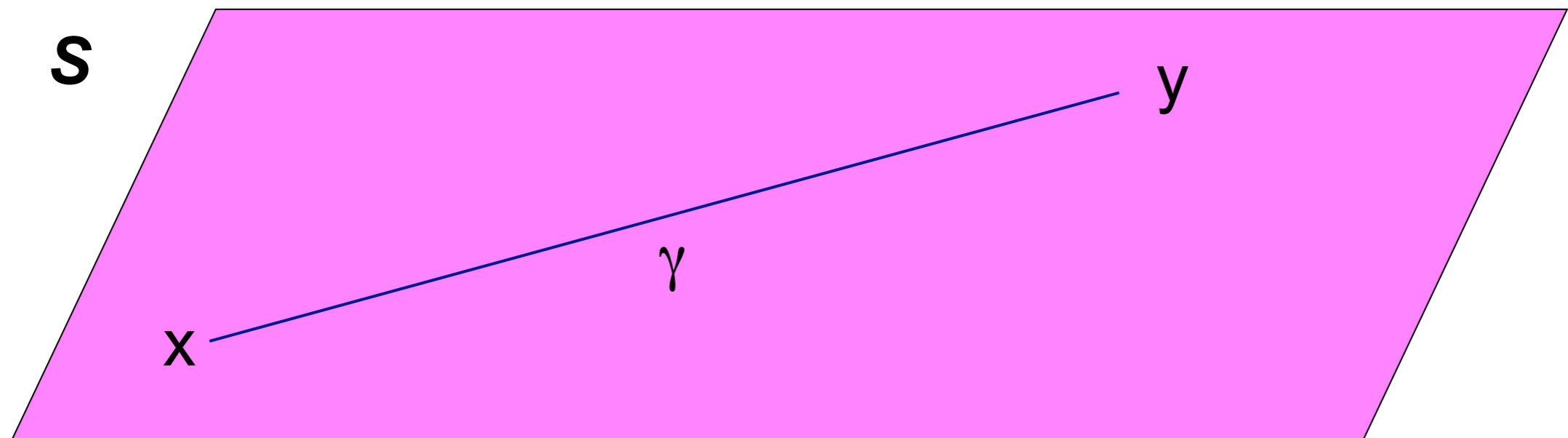
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The trajectory γ is a mathematical object (a curve in the space S) which represents the history of the system. The history in time is represented by a timeless mathematical object.



Timeless naturalism is the Newtonian paradigm extended to the universe as a whole.

Atoms,
moving
in the void

*All else is secondary, emergent,
not part of the fundamental description
of nature*

Atoms, eternal and unchanging
moving according to timeless laws
in the void that also never changes.

*All else is secondary, emergent,
not part of the fundamental description
of nature*

The proper use of the Newtonian paradigm, ie the use that matches up with experimental practice, is to describe records of past observations of isolated systems.

- States correspond to possible preparations or complete measurements, as done by an observer using instruments external to the system.
- Evolution is with respect to a clock external to the system.
- One made a series of measurements at times t_1, t_2, \dots to determine the state at each time.
- This resulted in a record, $\{x(t_1), x(t_2), \dots\}$. This record, once made, is static, it doesn't change in time.
- It is therefore entirely appropriate to represent the record by a mathematical object which is also unchanging in time.

It is fallacious to infer from this that nature is a mathematical object or is "really timeless."

The context of referring to an isolated system controlled or selected by an external observer is essential.

- There are many possible trajectories because there are many possible initial conditions that may be chosen by the experimentalist.
- Because the isolated system is a small subsystem of the universe it can be repeated many times with different initial conditions. The experimenter can use their freedom to do the experiment many times to vary the initial conditions and so test hypotheses as to the laws.
- So the absolute separation of laws and initial conditions, and thus of laws and states, is tied to the empirical context of studying small subsystems of the universe.

This empirical context falls apart if we try to apply this paradigm to the universe as a whole.

- There is only one unique history. How is that determined? No role for the others. Hence it explains at once too little and too much.
- No possibility of choosing or varying the initial conditions, hence of operationally separating the role of laws from that of initial conditions.
- Underdetermination from the impossibility of separating the role of laws from that of initial conditions arises in attempts to interpret cosmological data ie inflation.

To ignore this and attempt to scale up the Newtonian paradigm to the universe as a whole is to commit the ***cosmological fallacy***.

Classical and quantum models of cosmology appear timeless because they arise from applying to a system with no external clock a method and formalisms whose empirical context requires an external clock. ***To deduce from the formalism of classical or quantum general relativity that the universe is timeless is fallacious.***

The cosmological dilemma:

Any theory of a subsystem of the universe is necessarily an approximation because it leaves out interactions of the subsystem with degrees of freedom outside of it. At least there is no way to screen gravitational waves and interactions.

But if we attempt to remedy this by extending the subsystem to include the universe as a whole we are blocked by the issues just raised and the cosmological fallacy.

So any application of the Newtonian paradigm to nature, however exact its mathematical formulation, is approximate, effective and limited physically.

Timeless naturalism also fails because it renders key questions unanswerable. These are the cosmological questions:

- *Why these laws?*
- *Why these initial conditions*
- *Why irreversible processes dominate, why so long out of equilibrium?*

Question: Is the Newtonian paradigm to be applied to cosmological theories? The answer depends on the view of time:

Timeless naturalism and law:

- The Newtonian paradigm extends to the whole universe.
- Distinction between states and laws absolute.
- Laws are timeless and immutable,
- Reversible: no distinction between past and future.

The history of the universe is isomorphic to a mathematical object.

No answer to the three questions. Laws and initial conditions are input to the method, so cannot be output. Sufficient reason impossible.

Temporal naturalism and law

- Any true fact is a truth about the present: no timeless laws
- Distinction between laws and states breaks down
- Laws may evolve.
- The future is at least partly open.

The evolution of laws allows hypotheses with testible consequences to be put forward to answer the first two questions.

(examples follow)

Laws may be time asymmetric and irreversible so the third question is accessible as well.

So there is hope for sufficient reason.

Within temporal naturalism, the world and its history cannot be isomorphic to any mathematical object, MO:

1) Were it, every property of nature would have a corresponding property of MO.

Here is one property of the world that has no correspondent in any property of any mathematical object: that it is always some moment which is one of a succession of moments.

Properties of mathematical objects are true timelessly, ie if true they are always true.

2) In any case, for a naturalist all that exists is part of nature as perceived by the senses; mathematical objects are not part of nature, hence they can have no independent existence.

Nature cannot be isomorphic to anything outside of nature as nature is all that exists.

**How the why these laws question can be addressed
in temporal naturalism:**

If time is real we can use it to try to explain the why these laws question:

- The present laws must have evolved in time, so that they can be explained by the mechanism of evolution.
- This requires that the initial singularity be a bounce from a previous area, ie a deep history of the universe going back through a succession of eons.
- This means that time is prior to law.



*“To suppose universal laws of nature capable of being apprehended by the mind and yet having no reason for their special forms, but standing inexplicable and irrational, is hardly a justifiable position. Uniformities are precisely the sort of facts that need to be accounted for. Law is par excellence the thing that wants a reason. **Now the only possible way of accounting for the laws of nature, and for uniformity in general, is to suppose them results of evolution.**”*

Charles Sanders Peirce (1893):

At the beginning of time the laws of Nature were probably very different from what they are now. Thus, we should consider the laws of Nature as continually changing with the epoch, instead of as holding uniformly throughout space-time.

-Paul Dirac

The only field which has not admitted any evolutionary question is physics. Here are the laws, we say,...but how did they get that way, in time?...So, it might turn out that they are not the same [laws] all the time and that there is a historical, evolutionary, question.

-Richard Feynman

<http://www.youtube.com/watch?v=uNOghidK2TY>

Reprocessing the universe...

-John Archibald Wheeler

There are specific hypotheses for the evolution of laws of physics on a cosmological scale:

- cosmological natural selection

- the principle of precedence in quantum theory

The Principle of Precedence:

[arXiv:1205.3707](https://arxiv.org/abs/1205.3707)

If we prepare and measure a quantum system we have studied many times in the past, the response will be as if the outcome were randomly chosen from the ensemble of past instances of that preparation and measurement.

Usually we think that that is because a timeless law will act in the future as it has in the past.

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But this is a wild idea!!

What kind of thing is a law that lives outside of time but can act in time on every material process?

How does an electron know it is supposed to follow the electron law rather than the quark law?

There is a radical metaphysical idea at work, making the crazy seem obvious.

The Principle of Precedence:

There is a less radical assumption: What was just stated is the only law of nature needed.

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Testable because novel quantum systems shouldn't obey quantum mechanics.

[A]ll things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise. This tendency itself constitutes a regularity, and is continually on the increase. In looking back into the past we are looking toward periods when it was a less and less decided tendency.

Charles Sanders Peirce, "A Guess at the Riddle,"

Cosmological natural selection:

- Universes reproduce by black hole singularities “bouncing”, giving rise to new regions of spacetime.
- At each bounce the parameters of the laws of physics mutate slightly.

Consequently:

- A typical universe is most likely to come from a parent that had many progeny than few.
- If our universe is typical then it is likely to be tuned to maximize the production of black holes.

Cosmological natural selection:

If our universe is typical then it is likely to be tuned to maximize the production of black holes.

This explains many features of our laws:

- Star formation requires plentiful carbon and oxygen.
- Supernovas require tuning of weak interactions.
- Gravity must be very weak.

This makes several falsifiable predictions

- The heaviest stable neutron star must be less than twice the sun's mass.
- Inflation, if true, must be single field, single parameter.

Both have so far survived non-trivial experimental tests.

Objections to temporal naturalism:

Inconsistent with the relativity of simultaneity:

Temporal naturalism assumes an object observer independent distinction between present, past and future. This violates the relativity of simultaneity, which is supported by ultra-precise tests of special relativity (up to Energies/Planck energy).

Furthermore there is the Putnam argument that presentism + the relativity of simultaneity implies eternalism, i.e the block universe.

But there is a formulation of GR, empirically equivalent, shape dynamics, that has a preferred global simultaneity: (CMC slicings.)

There are two almost equivalent ways of defining general relativity by gauging away background structure:

The old way: gauge away space and time by imposing spacetime diffeomorphism invariance. This means there is no meaning to simultaneity.

BUT we must keep an absolute notion of size or scale.

The new way (shape dynamics): gauge away size but keep a preferred notion of simultaneity. Impose equivalence under diffeomorphisms of space and local rescalings of size.

Shape dynamics trades relativity of time for relativity of size. Has, in most cases, the same empirical content as general relativity, but with a preferred notion of simultaneity.

So we cannot deduce from the empirical success of GR the absence of a preferred global time.

(Barbour et al, Gomes, Gryb, Kowalski ,...)

A preferred global time is helpful for:

- Realistic completions of quantum mechanics, ie hidden variables theory. (This is necessary as QM must derive from another cosmological theory.)
- Resolves the problem of time in quantum cosmology.

Other empirical consequences of temporal naturalism:

- The most fundamental laws may be time irreversible, thus solving the problem of the origin of the arrows of time.
- Distinction between states and laws breaks down.
- “Laws must evolve to be explained.”

Hamiltonian general relativity and shape dynamics

The canonical formulation of general relativity sees spacetime as an evolving spatial geometry, evolving in an arbitrary coordinate time.

Spatial metric: q_{ab}

canonical momenta are extrinsic curvatures: p^{ab}

$$\{q_{ab}, p^{ab}\} = \delta$$

Spatial diffeomorphisms generated by constraints $D_a=0$.

Many fingered time gauge invariance generated by: $H=0$

Gauge fixing to constant mean curvature slices: $S=q_{ab}p^{ab}=0$

Time= gauge: Hamiltonian is a sum of constraints

This is the unique pair of first class systems that gauge fix each other.

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Spatial metric: q_{ab}

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Spatial diffeomorphisms generated by constraints $D_a=0$.

Local conformal gauge invariance generated by: $S=q_{ab}p^{ab}=0$

Gauge fixed by ADM Hamiltonian constraint: $H=0$

No many fingered time: Hamiltonian is non-zero and non-local.

This is the unique pair of first class systems that gauge fix each other.

The metalaw dilemma: If laws evolve, there either is a metalaw by which they evolve or the universe is lawless. Suppose there is a metalaw. We must ask why that metalaw, hence there is a regress. In either case a rational explanation of the world is stymied.

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The regress arises in a particular form of law, it can be avoided. Possible resolutions:

-Unify state and law, so that the distinction between them is emergent and approximate.

-Universality of metalaws, as in computer science.

-Laws evolve with the phenomena they describe, as in biology.

Internally inconsistent:

Temporal naturalism asserts that a moment has a special status. But it also admits that there were moments in the past and will be other moments in the future. **But all these other moments will have or have had that same special status with respect to observers at those times.** Hence any special status claimed for “now” must apply to all moments.

BUT this does not respect the assumptions of temporal naturalism, within which the blue sentence can have no truth value. With regard to the future it has no truth value because no statements about the future have truth values. With regard to the past it has no truth value because statements about the past only have truth value if they can be confirmed by present evidence. But present evidence only gives special status too the presently present moment. There may be evidence in records of past observers but this is not the same as the evidence that comes from the direct apprehension of “now”. Hence while we believe past moments may have existed, that belief is based on indirect evidence; we cannot assign that belief the same status as our direct knowledge of the present.

To put this in terms developed above, the blue sentence requires contingent, relational addressing too make sense of claims about the past, which is different from our knowledge of the present.

Can causality be prior to law?

There must be: causality is; the activity of time: it brings future events into being out of past events. Whereas any law is contingent and temporary, this activity of time can be posited to be the one aspect of nature that is inherent and immutable.

Another reason is that the identity of the indiscernible implies all events are unique, ie its properties, relational and intrinsic must be distinguishable from those of every other event. Thus the simple statement A and B are causes of C is incredibly complex because the full specification of A, B and C require vast amounts of information. But if each event and each causal influence are incredibly complex then there are no laws governing the microscopic scale that are both simple and general.

We see this already in GR in the incredible complexity of contingent observables needed to specify and describe local events,

What is the status of mathematics?

Temporal naturalism is incompatible with Platonic and Pythagorean views of mathematics and its relation to physics.

The effectiveness of mathematics in physics is limited to necessarily incomplete modeling of subsystems of the universe, hence is reasonable.

Can we speak preferentially about the present moment? Can we use the word “now” to refer to a fact about the world?

In **temporal naturalism** we can because, in fact, all facts are of this kind, ie are about now. In this version of naturalism it suffices to say, “now” means the moment which is now present, which we might call the presently present moment.

In **timeless naturalism** “now” is the same as “here”; it is always a stand in for a relational statement which refers to an observation in a way that indexes it to timeless observables. ie “by now I mean at the same spacetime event as a particular physicist named Lee Smolin, sitting at his dining room table at 6 am on August 12 2013.” We can call this *relational addressing*. It is the replacement of a use of “now” with a contingent and relational statement that refers only indirectly to a moment by a relational feature that distinguishes it from all other moments in the history of the universe. It is the replacement of a local statement in time by a complicated non-local observable.

Non-local because its implementation in general relativity would be a function of variables all over spacetime.

Any reference to a moment in general relativity is contingent.

In a **timeless natural** world there is no use of the presently present moment. Instead any statement about “now” or apparently local in time is to be replaced by a non-local observable that relationally and contingently addresses a moment.

Can we give truth values to facts apart from those that refer to now?

In **temporal naturalism**, hypotheses about the past can have truth values. These may be supported by evidence available in the present moment. No statement about the future has a present truth value.

In **timeless naturalism** statements with truth values do not distinguish past, present or future. For example, in a block universe interpretation of general relativity, all physical observables are non-local in time.

In **temporal naturalism**, “now” is an *intrinsic property*. It requires no further specification.

In **timeless naturalism**, “now” is not intrinsic, it is relational and can be defined only indirectly through the specification of a very complex, contingent and highly non-local observable. “Now” has no meaning. “Now in the SW corner of Trinity Bellwoods park at noon on the first Sunday in September, 2115” does.

Conclu

sions

The empirical agenda: discover testable consequences of hypotheses concerning:

- The evolution of laws.
- The resolution of cosmological and black hole singularities.
- Resolutions of the meta-laws dilemma.
- The irreversibility of the most fundamental laws.
- The existence of a preferred cosmological global time.
- The recovery of quantum mechanics from a non-quantum cosmological theory.

What is at stake:

Timeless naturalism is associated with the views that:

- The future is determined. The world is nothing but elementary particles with timeless properties moving and interacting according to timeless laws. Novelty, agency, purpose, intentionality, will are all illusions.
- The universe is or is equivalent to a computer, classical or quantum.
- Hence strong AI: persons are also perfectly emulate-able as computations.
- Laws and initial conditions are inexplicable except via the anthropic principle in a multiverse, ie modern science is at an end.

Temporal naturalism holds instead that:

- The future is partly open, in that laws evolve on cosmological and perhaps also quantum scales.
- The long term evolution of the universe is not computable
- Persons have properties that cannot be captured by any computation.
- Laws and their initial conditions may be explained by falsifiable hypotheses as to their mechanisms of evolution. ie there is much science still to do.

Relationalism and its limits: relational versus intrinsic properties

I am a Leibnizian, which I take to mean that I find his principles to be a very useful way to frame the search for a correct cosmological theory.

- Principle of (aspiration for) sufficient reason.
- Principle of the identity of the indiscernible.
- Principle of causal closure: the universe contains all its causes.

Relationalism is a methodological imperative: Progress in physics can often be made by identifying non-dynamical background structures in the description of a subsystem of the universe and replacing it with a real dynamical physical interaction with degrees of freedom outside of that subsystem.

The relationalist view of space and time leads to general relativity:

Eliminate fixed background geometry of space or spacetime (as in Newtonian physics and special relativity.) Replacing it with a dynamical spacetime geometry leads to general relativity.

But more than this: points of spacetime are to have no meaning unless they are distinguished by the values of fields there.

How to do this: Introduce a vast class of equivalences mapping points to points (the diffeomorphism group). Insist any two descriptions of the world are equivalent if they can be mapped into each other under such a transformation.

The result is that spacetime is NOT identified with metric and other fields on a manifold. It is identified with equivalence classes of such fields under diffeomorphisms.

The world is described in terms of diffeo invariant (ie physical, gauge invariant) observables.

This is called gauging away the background structure.

**Relationalism and its limits:
relational versus intrinsic properties**

Relational purism

A relational purist believes that once background structures are eliminated physics will be reduced to a description of nature purely in terms of relationships. An important example is the causal set program which aims to develop a complete theory of quantum gravity-and hence nature-on the basis of an ontology of discrete events, the only attributes of which are bare causal relations. These are bare in the sense that

event A is a cause of event B

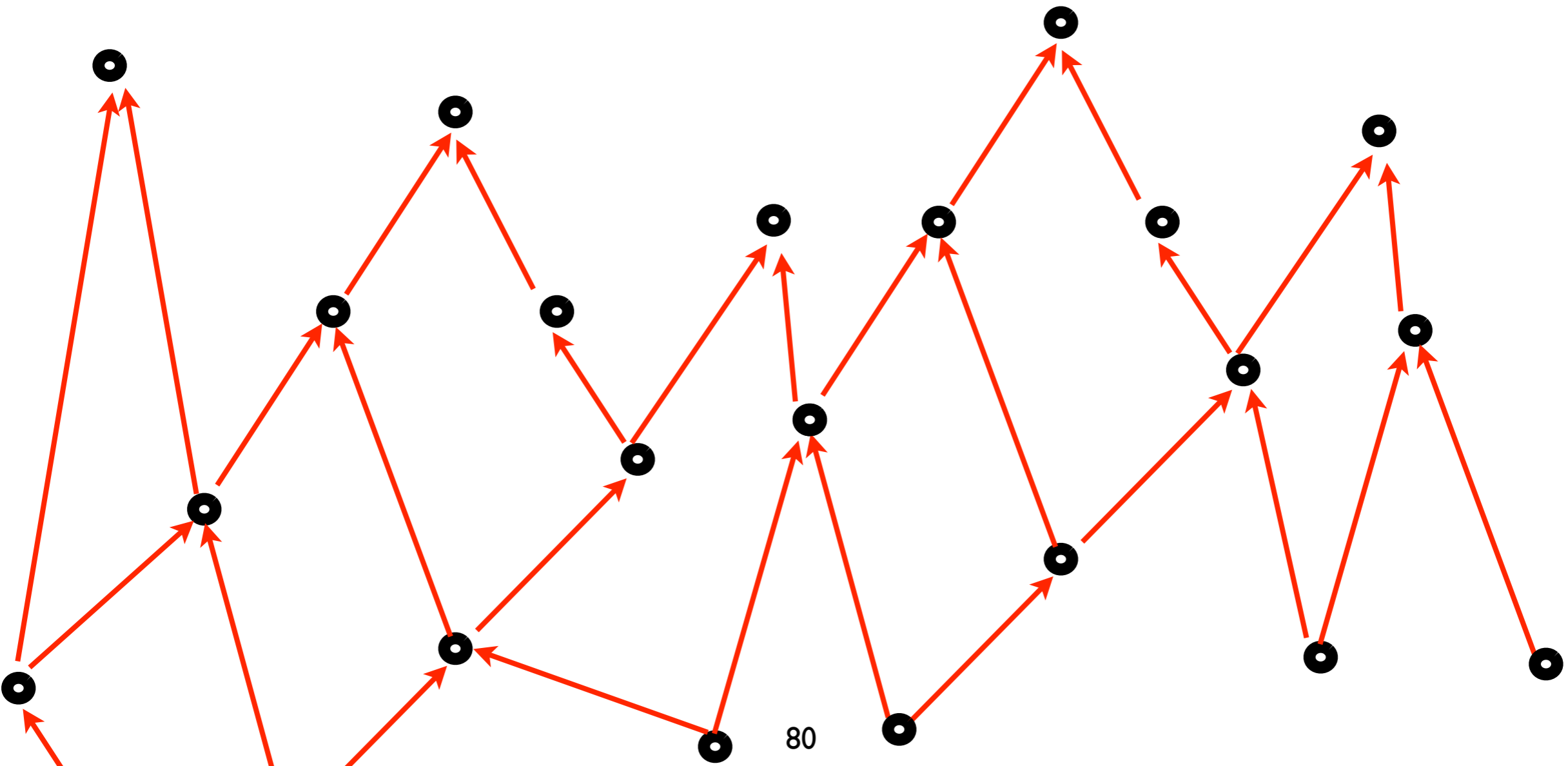
is a primitive. The causal set program denies there are any further properties, P of A and Q of B such that P of A causes Q of B.

The aspiration of the causal set program is to construct the geometry of a lorentzian spacetime approximately satisfying the Einstein equations as emergent only from a discrete set of events and their bare causal relations. To date this has not been realized.

Causal set program:

The history of the universe is completely described as a finite partially ordered set (partial order=causality):

Sorkin, Dowker et al



Impure relationalism: a role for intrinsic properties:

Completion of the program of eliminating background structures need not and does not imply that there can be no further properties of events except for their causal and other relations with other events. In an events ontology, you may eliminate all background structures-as the causal set program very nearly does-and still be left with an event having properties which are not specified when you know all the relations with other events. We can call such properties, intrinsic properties.

Intrinsic properties can be dynamical, in that they play a role in the laws of motion. For example, in an events ontology, energy and momentum can be intrinsic properties of events. They can play a role in dynamics and be transferred by causal links.

Dynamical pairings and relational versus intrinsic properties:

Physics has a particular structure in which spacetime variables are paired with dynamical variables: Poisson brackets: $\{x,p\}=1$

- Symmetry of translations in space IMPLIES conservation of momentum.
 - momentum generates translations in x .
- Symmetry of translations in time IMPLIES conservation of energy

If space is absolute, ie intrinsic, it can be perfectly homogeneous, so momentum conservation is exact.

Relational space has no exact symmetry (identity of the indiscernible) so momentum conservation is at best approximate. So where does momentum come from?

Proposal: momentum and energy are intrinsic-prior to spacetime.

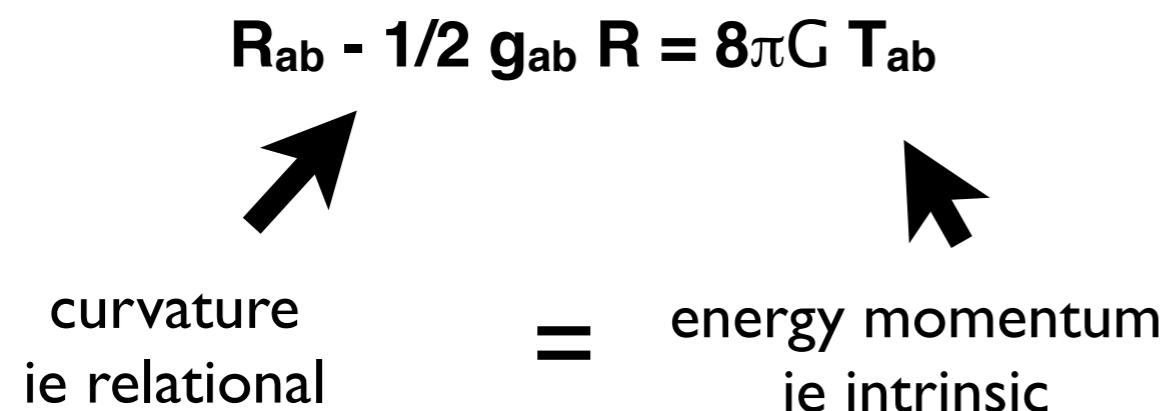
Support for this comes from the Einstein equations:

$$R_{ab} - \frac{1}{2} g_{ab} R = 8\pi G T_{ab}$$

curvature
ie relational

=

energy momentum
ie intrinsic



Thus, if space and time were absolute, fixed background structures, momentum and energy could be understood as derivative from their symmetries. But this will not work for a relationalist because by the identity of the indiscernible there are no exact symmetries.

For a relationalist energy and momentum can be intrinsic and prior to spacetime.

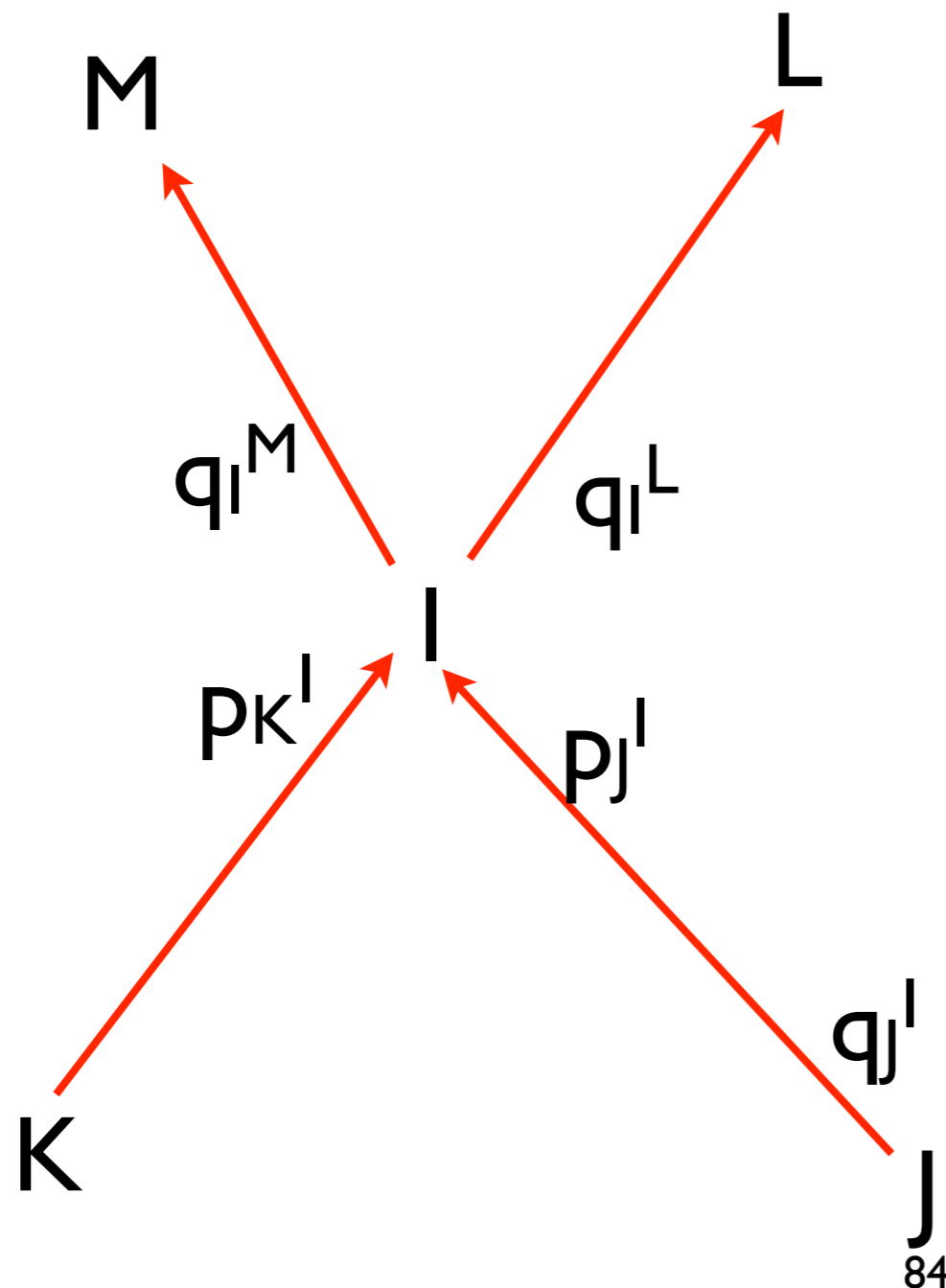
Energetic causal sets:

(Cortes, Is, arXiv:1307.6167, 1308.2206)

Each link, connecting E_I to one of its parents, E_J , has two momenta, an incoming momenta p_J^I and an outgoing momentum q_I^J .

The total momenta of an event

$$P_a^I = \sum_J p_{aI}^J$$



Resolves the problem of getting spacetime to emerge from a causal set. Emergence of spacetime from causal relations requires dual conjugate momentum and energy variables be present as intrinsic properties of events.

Two terminological confusions:

Intrinsic versus internal: If a property of an event is intrinsic it can be defined without regard to any relations to other events. That does not mean it plays no role in the dynamical equations of the theory. Let us reserve the term internal for a property of an event or a particle that plays no role in the laws of physics. Momenta can be intrinsic, but it is not internal. Qualia are intrinsic and appear to be internal.

Structural versus relational: By structural properties philosophers seem to mean the same thing that we physicists mean by relational properties. I prefer the term relational as structure seems to denote something static and hence timeless, a structural property seems to be one that transcends time or history, but temporal naturalism asserts there may be no such transcendent properties of nature.

Time and qualia

Qualia and time:

Basic observation: *Every instance of a qualia occurs at a unique moment of time.* Being conscious means being conscious of a moment. Being ordered and “drenched” in time is a fundamental attribute of conscious experience.

Facts about qualia being experienced now are not contingent.

There are no facts of the form, “If there is a chicken in the road then I am now experiencing a brilliant red.”

It follows that qualia cannot be real properties of a timelessly natural world, because all references to now in such a world are contingent and relational.

Qualia can be real properties of a temporal natural world.

Here is one version of the argument:

We have direct experience of the world in the present moment. Just as the fact that we experience is an undeniable feature of the natural world, it is also an undeniable feature of the natural world that qualia are experienced in moments which are experienced one at a time. This gives a privileged status to each moment of time, associated to each experience: this is the moment that is being experienced now. This means that we have direct access to a feature of the presently present moment that does not require relational and contingent addressing to define it. We can define and give truth values to statements about “now” which are not contingent on any further knowledge of the world.

How can these facts about nature: that each qualia is an aspect of a presently privileged present moment, that does not require contingent relational addressing to define or evaluate, be incorporated into our conception of the natural world?

This fact fits comfortably in a temporal naturalist viewpoint, because in that viewpoint all facts about nature are situated in presently privileged present moments and no relational and contingent addressing is required to define them.

This fact cannot fit into a timeless version of naturalism according to which there are no facts situated in presently privileged present moments, except when that can be defined timelessly through relational addressing.

We can draw a stronger conclusion from this. There is no physical observable in a block universe interpretation of general relativity that corresponds to my ability to evaluate truth values of statements about “now”, without any need for further contingent and relational facts. The block universe cannot represent “now” because “now” is an intrinsic property and the block universe can only speak of relational properties. Hence the block universe is an incomplete description of the natural world.

That is, because qualia are undeniably real aspects of the natural world, and because an essential feature of them is their existing only in the present moment, qualia allow the presently present moment to be distinguished intrinsically without regard to relational addressing. Any description of nature that does not allow “Now” to be intrinsically defined is an incomplete description of nature because it leaves out some undeniable facts about nature. Hence the block universe and timeless naturalism are incomplete, and hence they are wrong.

Two questions and speculative answers:

Q2?: Panpsychism asserts that some physical events have qualia as intrinsic properties, some of which are neural correlates of human consciousness. But it does not need to assert that all physical events have qualia. Might there be a physical characteristic which distinguishes those physical events that have qualia?

Speculative proposal: Qualia are associated with events or states that are novel, in that they have no precedent in the past. This can be made sense of in a temporal formulation of quantum theory to be discussed below. (Related to Peirce's view of laws as habits.)

Two questions and speculative answers:

Q3?: If brains have states which are neural correlates of consciousness, but consciousness is a general intrinsic property of matter, then what physical properties correlate to qualia? Or, to put it differentially, in what way do the physical attributes of correlates of consciousness vary when the qualities of qualia vary?

Speculative proposal 3: *differences of qualia are correlated with differences in energy.*

ie the experiences of different colors are correlated with differences in energy. Similarly for sounds. Both are intrinsic, non-relational properties, as will be discussed below.

Question:

Is there a form of naturalism which admits qualia as part of the natural world? Let us call this a qualia-friendly naturalism.

Proposal: This must be a form of naturalism which is temporal, ie where the present is objectively distinguished from the past and future in such a way that the laws of nature can refer to these distinctions.

Query:

Can pan-psychism discover what features of physical events correlate with features of experience or qualia?

Speculative proposals which emerge below:

Differences of qualia (color, tone) reflect differences of energy.

Maybe qualia are associated with novel quantum states.

Intrinsic properties and qualia: a proposal

Panpsychists argue that the elements of the physical world have structural properties and intrinsic and eternal properties.

By arguing that matter may have internal properties not accounted for in the description in terms needed to express the laws of physics, panpsychists reserve a place for qualia as intrinsic, non-dynamical properties of matter.

I would propose to cut the pie up differently. I would hold that events have relational and intrinsic properties, but relational properties include only causal relations and spacetime intervals which are derivative from them. Under intrinsic properties I would include the dynamical quantities: energy and momenta, and qualia.

I would go further and relate energy and qualia. I would point out that the experienced qualities of qualia correlate with changes of energy. Colors are a measure of energy, as are tones.

The Principle of Precedence and qualia:

There are then two kinds of events or states in nature:

- Those for which there is precedence, which hence follow laws.
- Those without precedence, which evoke genuinely novel events.

Speculative proposal: this novelty is the correlate of qualia.

Habitual actions are unconscious in people. Maybe the same thing is true in nature. Maybe brains are systems where a lot of novel events take place?

The bottom line:

Belief that qualia are real and are a part of nature is closely related to the belief that the present moment is real.

Both are direct apprehensions.

Both are internal and intrinsic non-relational aspects of nature.

HENCE temporal naturalism is qualia friendly.

Timeless naturalism is at a dead end, because the why these laws and why these initial conditions questions are unanswerable within it.

Temporal naturalism offers avenues to resolve these questions and hence is the way to continued progress of science.

The Principle of Precedence

There are then two kinds of events or states in nature:

- Those for which there is precedence, which hence follow laws.
- Those without precedence, which evoke genuinely novel events.



Roberto Mangabeira Unger

You can trace properties of the present universe back to the properties it must have had at the beginning. But you cannot show that these are the only properties that the universe might have had...Earlier or later universe might have had entirely different laws...To state the laws of nature is not to describe or explain all possible histories of all possible universes. Only a relative distinction exists between law like explanation and narration of a one time historical sequence.

If you are asked what you mean by the necessity of the laws of nature (that is to say by the necessity of the most necessary relations), you can legitimately respond only by laying out the substance of your cosmological and other scientific ideas. People who appeal to fixed conceptions of necessity, contingency and possibility are simply confused.

The Newtonian paradigm from the viewpoint of temporal naturalism

On cosmological scales the universe is unique and laws evolve: so the Newtonian paradigm breaks down.

On fundamental scales events are unique (principle of the identity of the indiscernible) so the Newtonian paradigm breaks down also.

Events are distinguished by their relational properties thus must be fundamentally unique: no general, repeatable laws on the fundamental scale.

Repeatable laws arise on intermediate scales by coarse graining which forgets information that makes events unique and allows them to be modeled as simple classes with vast numbers of instantiations.

Hence the Newtonian paradigm works only on intermediate scales.

Hence intermediate scale physics is statistical because similarity arises from neglect of information.

Uniqueness can sometimes not wash out on intermediate scales, leading to a breakdown of lawfulness. See principle of precedence below.