

Title: What can we know of the world?

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Abstract:

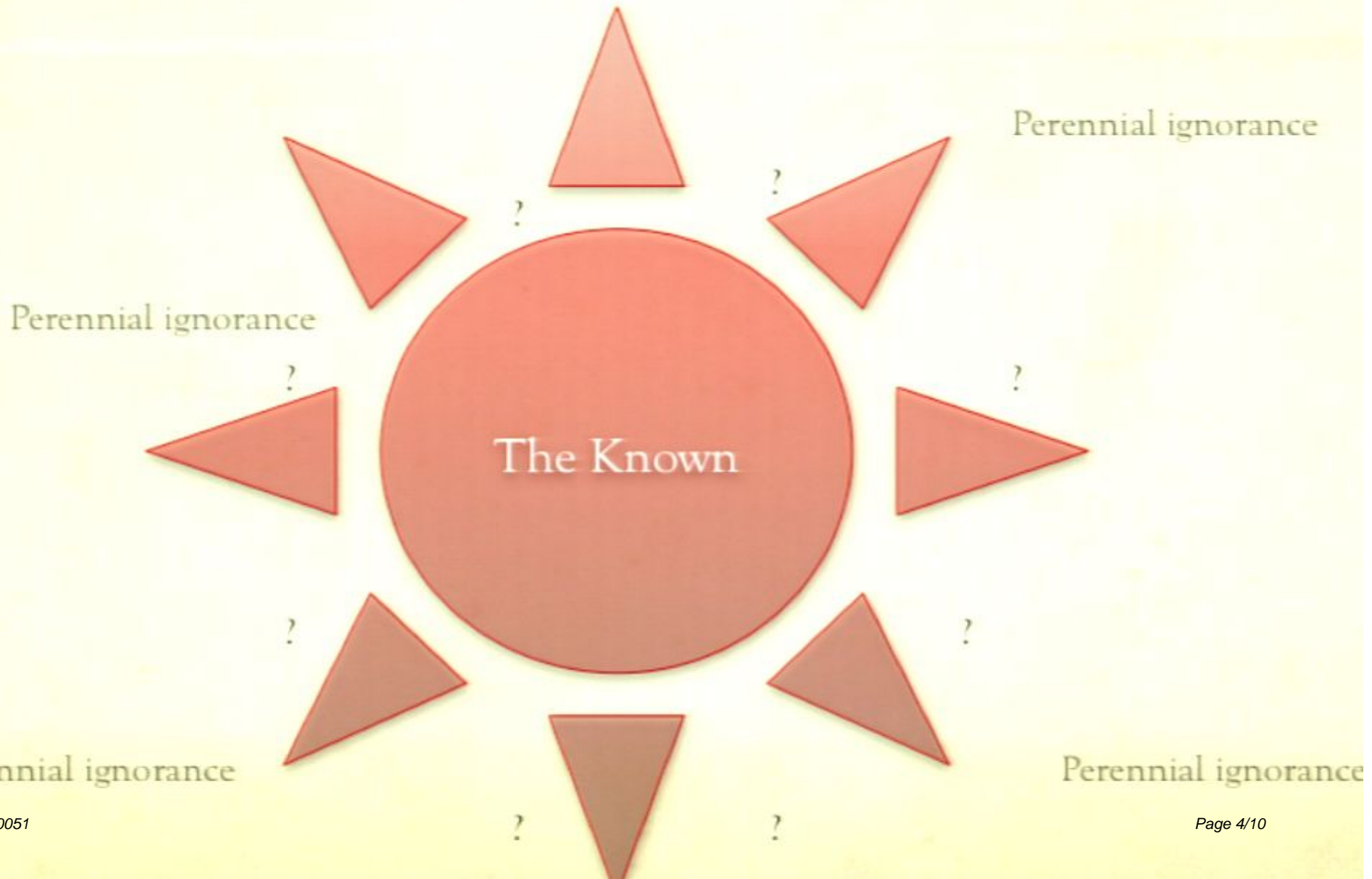
# HOW MUCH CAN WE KNOW OF THE WORLD?

- TOOLS AND WORLDVIEWS
- THE PROBLEM OF THE FIRST CAUSE
- KNOWLEDGE AND ULTIMATE REALITY

# 1. TOOLS AND WORLDVIEWS

- Empiricism vs. rationalism: an old battle  
[becoming vs. being] Outside in or inside out or...?  
[science is a mode of interaction between humans and the world]
- We only “see” what our tools allow us to see  
Galileo (1609)/Hubble (1924/1929)/HST/JWST
- Tools have precision limits:  
We only “know” what we can measure  
“Energy is conserved” – How well is it conserved?
- There is much of the world we can’t measure and thus don’t “see” (e.g. particle decays too fast to be detected or low mass)
- And even what we can “see” we don’t always measure (e.g. data filtering and triggering at the LHC)

Knowledge grows but is always limited:



## CONSTANTS OF NATURE:

$c$  (1676) – Ole Rømer

$G$  (1798) – Henry Cavendish

$e/m$  (1897) – J J Thomson

$k_B$  (1900) – Max Planck (!)

$h$  (1900) – Max Planck

20+ parameters in SM + Cosmology

NEW: Neutrino masses (?)

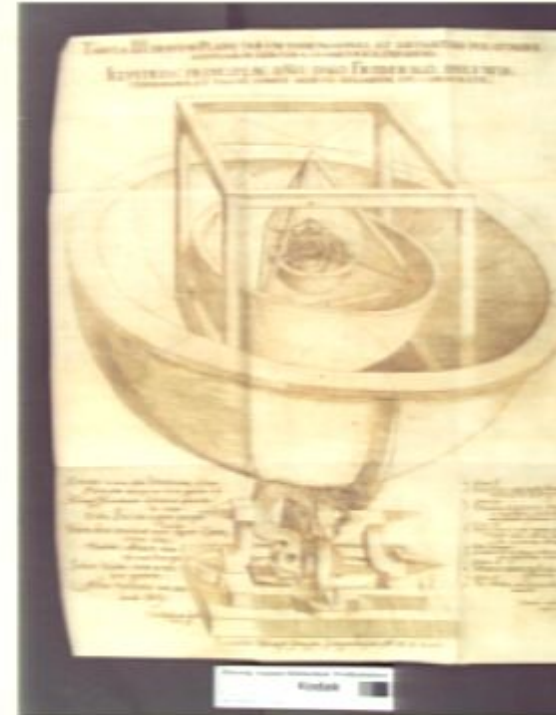
Cosmological Constant

**WILL/CAN THE LIST END?**



## 2. THE PROBLEM OF THE FIRST CAUSE: Can we get around it?

- Creation Myths: Absolute Reality
- Aristotle: Unmoved Mover
- Kepler's dream: A priori knowledge
- Kepler's mistake & Final Theory
  
- Big Bang singularity & Quantum Cosmology
  - \* extrapolation of laws to Planck scale
  - \* minisuperspace and modeling the unknown  
(is consistency enough?)
- Multiverse: where does it come from?
- Science as a construction
  - What are the laws of Nature? Who decides? (Complexity)
  - Is there a finite number of principles and laws needed to describe the world? If we can't answer  
can we ever know the world **IN ITS TOTALITY?**



### 3. KNOWLEDGE AND ULTIMATE REALITY:

- The world is and the world is what (how) we perceive (it)

“It [is] hopelessly narrow-minded...to imagine that all significant laws of physics had been discovered at the moment our generation began contemplating the problem. There would be a twenty-first-century physics and a twenty-second-century physics, and even a Fourth-Millennium physics.”

Contact, by Carl Sagan

“Pure thought didn't supersede creative engagement with phenomena as a way of understanding the world twenty years ago, hasn't in the meantime, and won't anytime soon”  
Frank Wilczek,

Summary Talk at “Expectations of a Final Theory”  
Cambridge University, September 2005

“I don't want to discourage string theorists, but maybe the world is what we've always know the Standard Model [of particle physics] and general relativity.”

Steven Weinberg,

CERN Courier, September 2009, pg. 23



## • ON THE IMPOSSIBILITY OF KNOWING ABSOLUTE TRUTH:

HEISENBERG: Any concepts or words which have been formed in the past through the interplay between the world and ourselves are not really sharply defined with respect to their meaning: that is to say, we do not know exactly how far they will help us in finding our way in the world. We often know that they can be applied to a wide range of inner or outer experience, but we practically never know precisely the limits of their applicability. This is true even of the simplest and most general concepts like "existence" and "space and time". Therefore, it will never be possible by pure reason to arrive at some absolute truth."

ISAIAH BERLIN: On the "Ionian fallacy": "A sentence of the form 'Everything consists of...' or 'Everything is...' or 'Nothing is...' unless it is empirical...states nothing, since a proposition which cannot be significantly denied or doubted can offer us no information."



EUGENE WIGNER: "The question which presents itself is whether the different regularities, that is, the various laws of nature which will be discovered, will fuse into a single consistent unit, or at least asymptotically approach such a fusion. Alternatively, it is possible that there always will be some laws of nature which have nothing in common with each other. At present, this is true, for instance, of the laws of heredity and of physics. It is even possible that some of the laws of nature will be in conflict with each other in their implications, but each convincing enough in its own domain so that we may not be willing to abandon any of them. We may resign ourselves to such a state of affairs or our interest in clearing up the conflict between the various theories may fade out. We may lose interest in the "ultimate truth," that is, in a picture which is a consistent fusion into a single unit of the little pictures, formed on the various aspects of nature."

EINSTEIN: "What I see in Nature is a magnificent structure that we can comprehend only very imperfectly, and that must fill a thinking person with a feeling of humility."

FEYNMAN: "Every scientific law, every scientific principle, every statement of the results of an observation is some kind of summary which leaves out details, because nothing can be stated precisely."

- We cannot turn the statement “energy is conserved” into an absolute statement. From this pragmatic perspective, there are no absolute statements at all in the context of the physical sciences.
- We construct models to describe, as best as we can, the reality we are able to measure. We can't even say that this measured reality is the “ultimate” reality, even if you believe such a thing exists. No “Final Theory” is possible.
- As humans, we are bound to see the world forever out of focus. The glasses we invent along the way may sharpen the image somewhat, but we will always be missing details here and there.

Cf., MG “A Tear at the Edge of Creation” (Free Press, 2010)

- **Every potential mind out there in the cosmos  
is bound to its own perspective of things**