

Physics 102 - April 27, 2011

Final Exam

- May 3, 4pm, Hoyt Aud.
- Cumulative
- 8.5 x 11 inch formula/note sheet okay

Will try to set up a Q+A session
on May 2 - will email

The Mathematical Universe Hypothesis



Max Tegmark
ArXiv: 0704.0646
gr-qc

External Reality Hypothesis:

There exists an external reality completely independent of us humans.

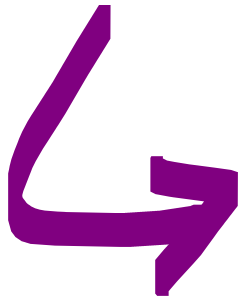
EIRH reasonable to most folks but NOT universally accepted — even among Scientists ... extreme Copenhagenists for example.

Ultimate goal of theoretical physics



Develop/Discover Theory that completely describes this External Reality
Theory of Everything \equiv TOE

TOE MUST NOT have Ambiguities
or human-related "baggage"



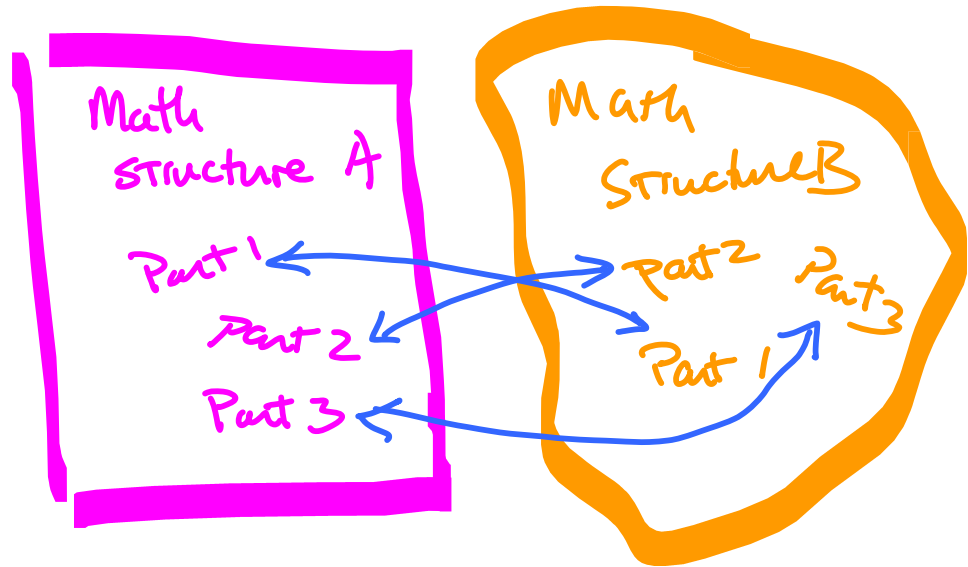
Mathematical Structure

In Mathematics

If $\left\{ \begin{array}{l} \text{Part 1 same as Part 1} \\ \text{Part 2 same as Part 2} \\ \text{Part 3 same as Part 3} \end{array} \right\}$

Then

Math Structure A and Math Structure B
are one and the same



Mathematical
Structure that is
The TOE



External
Reality

The External Reality is a Mathematical Structure

Mathematical Universe Hypothesis

Could Have Many
Different complete and
Self-consistent and independent
irreducible Mathematical
Structures

Does each correspond
to a different universe?
→ Multiverse

Not quite the same as "Anything goes".

If discover TOE

Why these equations

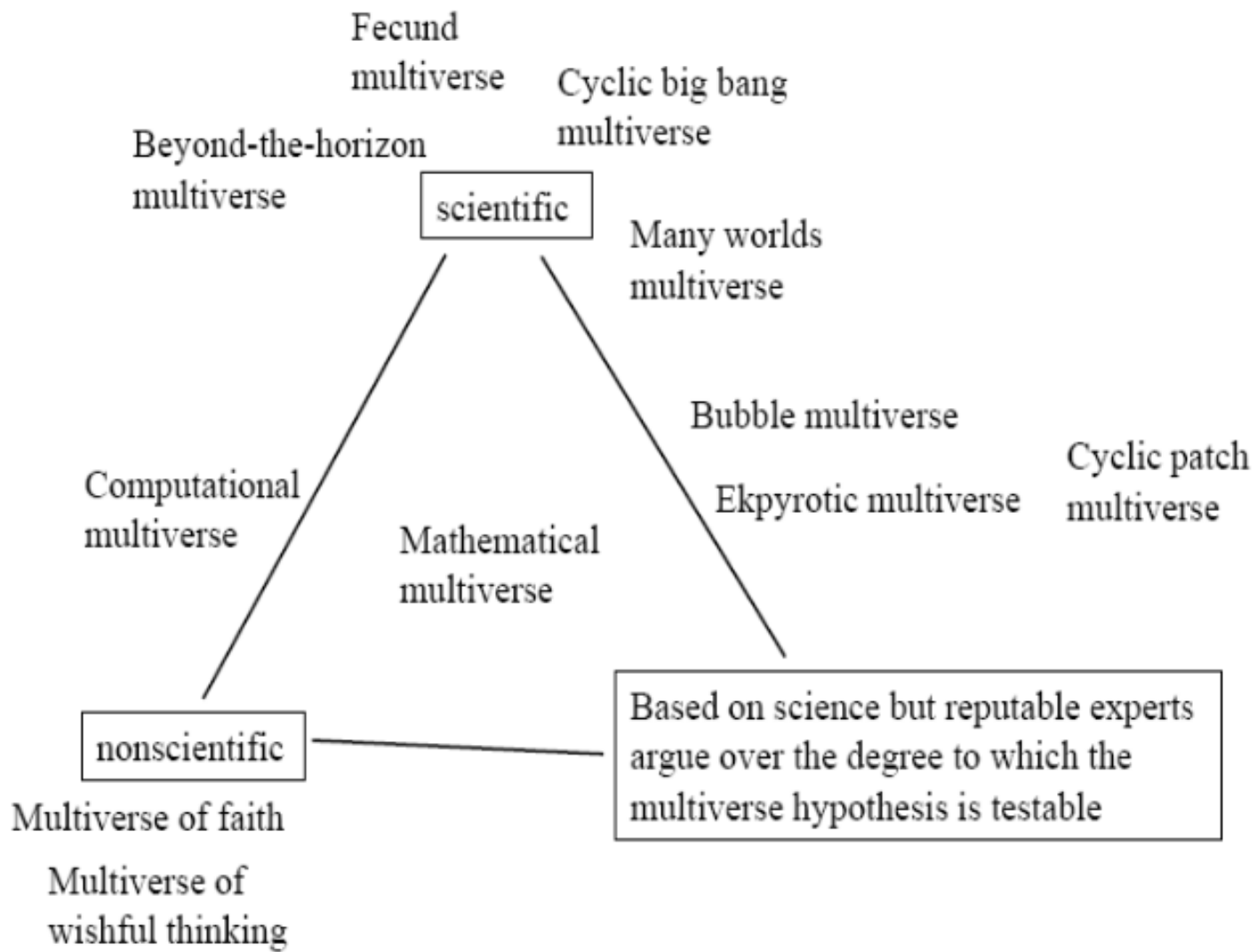
and NOT others?

(Wheeler / Hawking)

MUH → why NOT others?
Multiverse

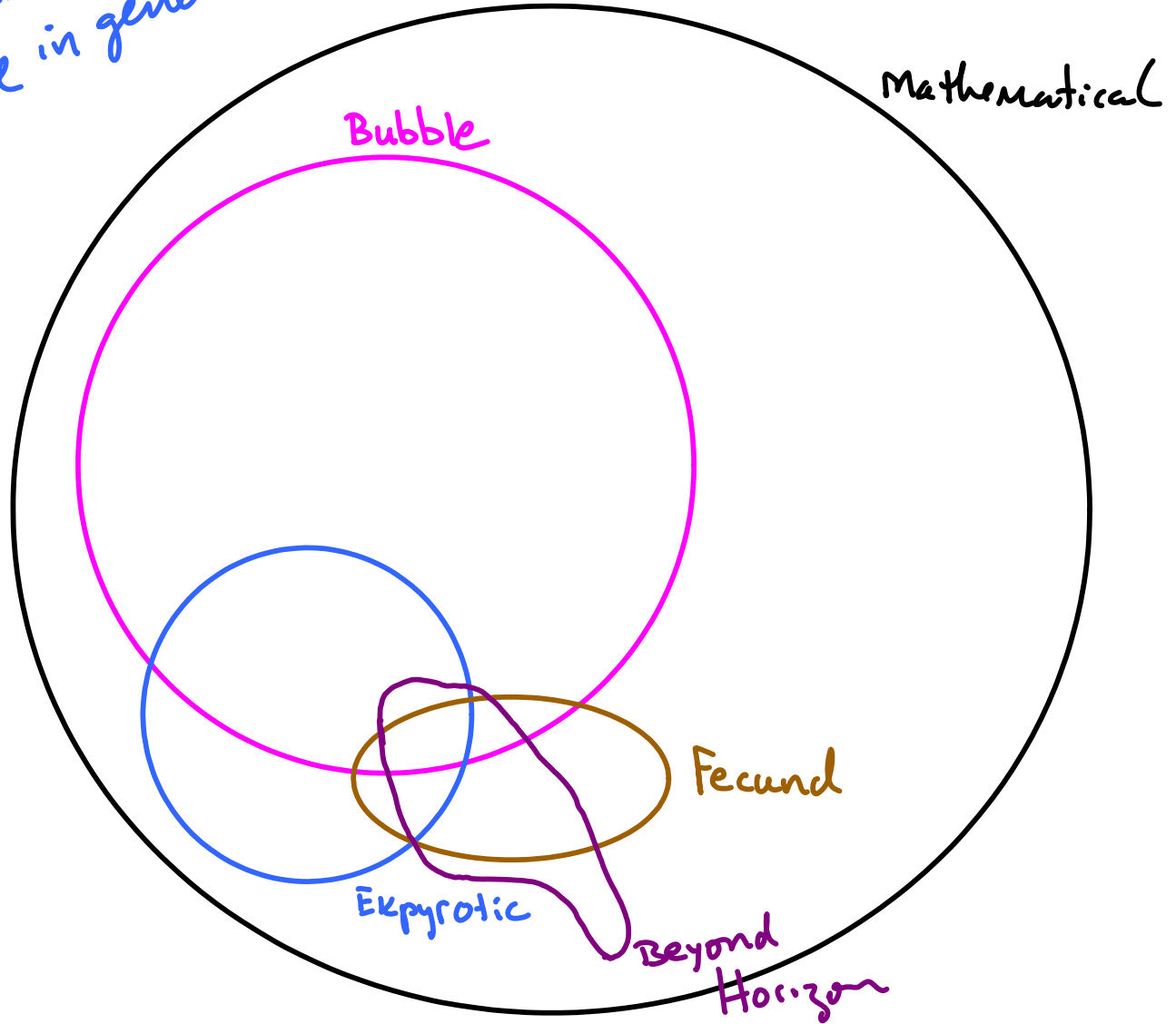
Extreme Copernican Revolution ...

This Multiverse concept includes all others ...



A multitude of Multiverses

These multiverses
are NOT mutually
exclusive in general



Perhaps the question is Not so much

Do we live in a multiverse?

But rather

In how many different
types of Multiverses
do we live?

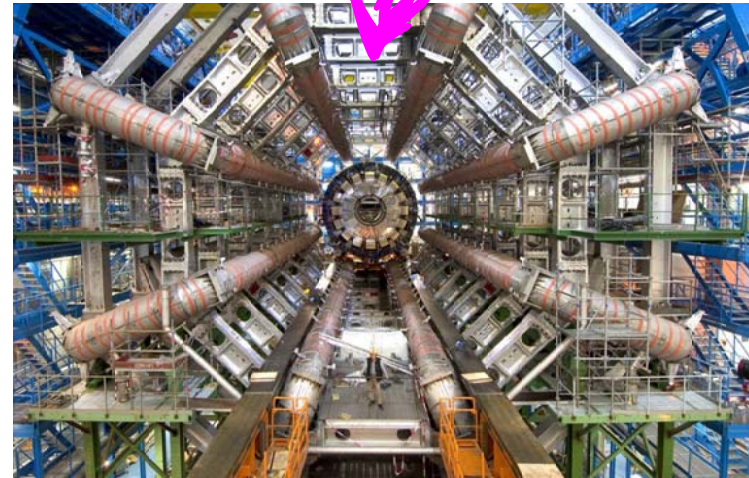
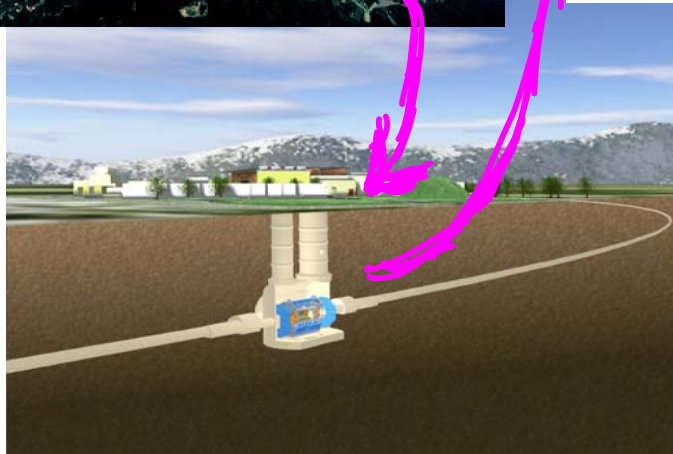
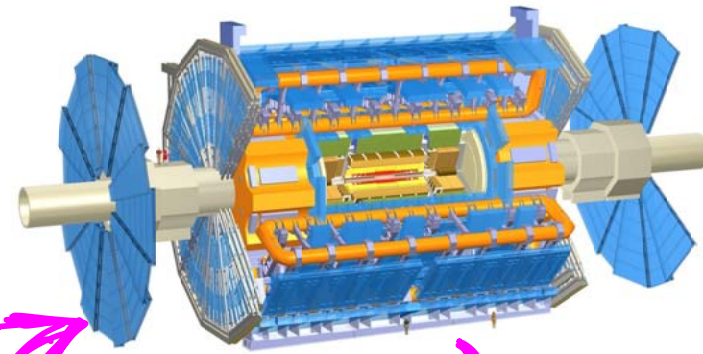
CAN we
Learn More?

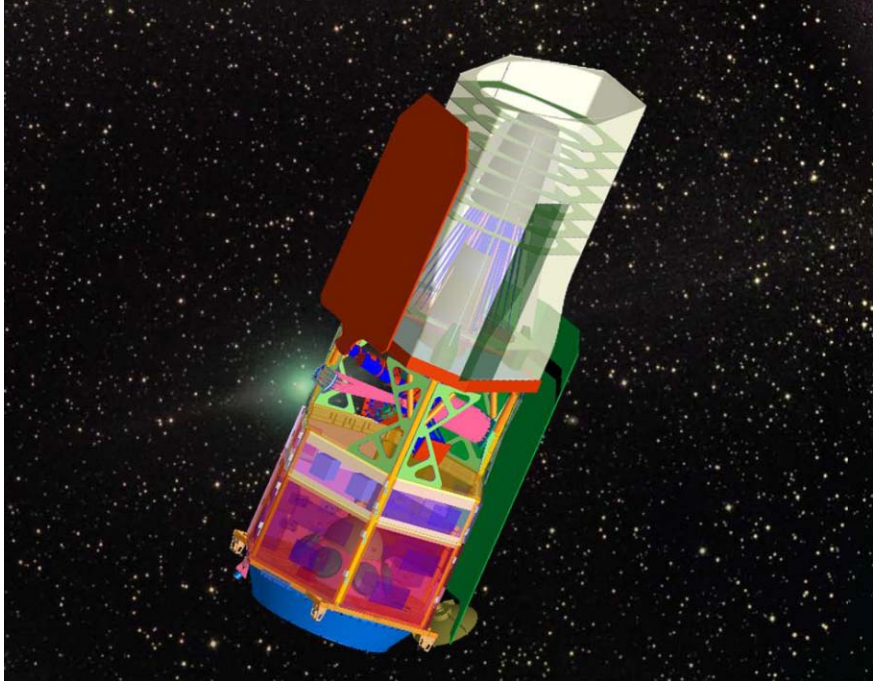


Large Hadron Collider

Explore inner space

↳ extra dimensions, supersymmetry,
Dark matter, what does what the Higgs
does





WFIRST
Mission

Dark energy



Planck Satellite

launched May 2009

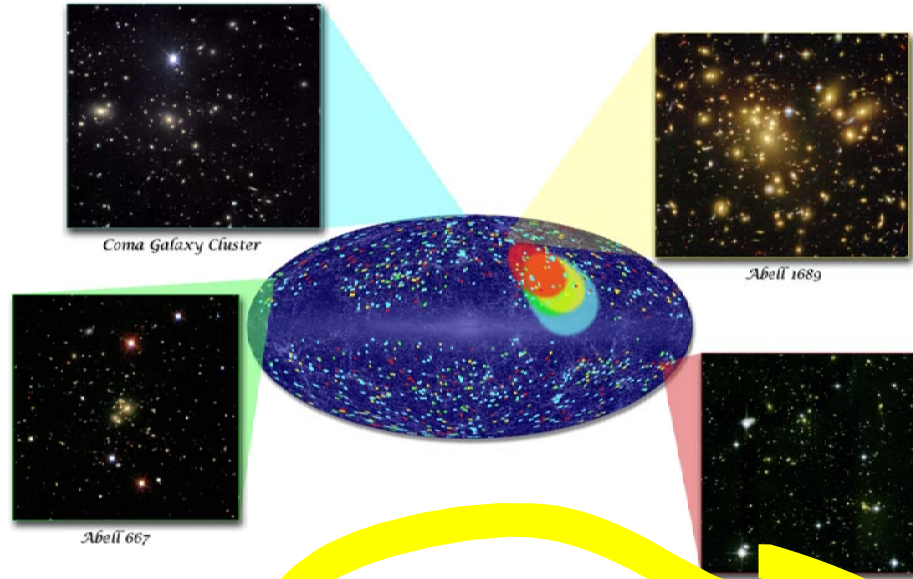
Making more precise
Map of CMB

might uncover
evidence of inflation
and help probe
Dark matter +
Dark energy
content of universe



Brilliant
Theorist discovers
There is a natural
"best" solution in the
String theory landscape
and it is the TOE
or something entirely new!

Surprises!



Sasha Kashlinsky
NASA Goddard
Detailed study of WMAP data

Dark Flow (2008)

Able to see motion of galactic clusters thru small effects in the CMB Temp near the cluster. See clusters all moving toward one part of sky — due to effect of things beyond the observational horizon ??

