

**RICARDO ABDOEL'S HAND WRITTEN NOTES OF**

# **COSMOLOGICAL KOANS**

*A journey to the heart of physical reality*



**WRITTEN BY ANTHONY AGUIRRE**

*“A breath taking piece. An experience you can feel, visulize and almost can touch.” - Ricardo Abdoel*






UNDERSTOOD BY  
THE SPIRIT AND BY  
INTUITION

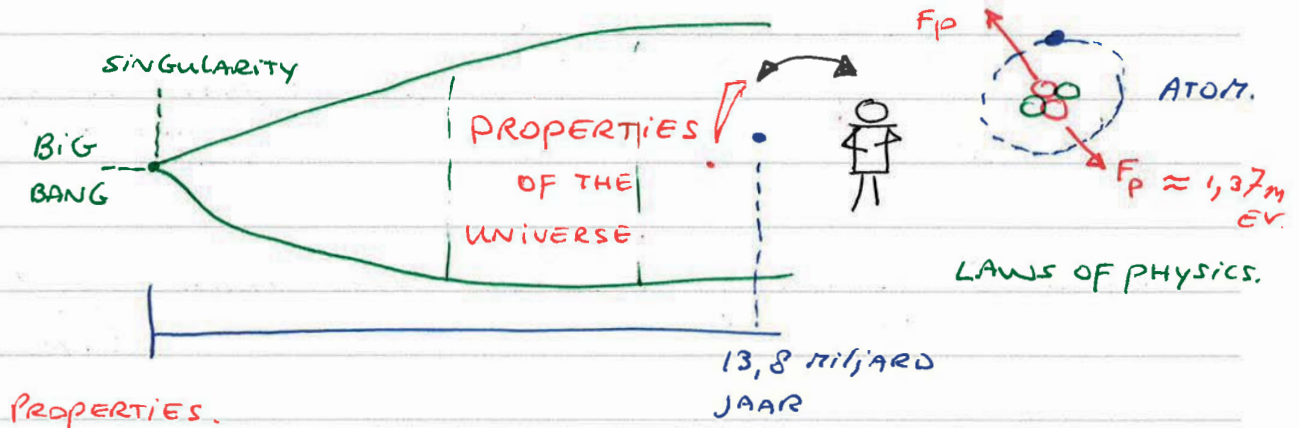
→ Riddle/puzzle (PARADOXES)

7

= COSMOLOGICAL KOANS = INTRODUCTION

4 POSSIBLE EXPLANATIONS

- ① DESIGNED FOR US (INTENTIONALLY)
- ② COINCIDENCE "ROLE OF DICE"  LUCKY
- ③ MANY UNIVERSES
- ④ COINCIDENCES ARE ILLUSORY → LIFE WOULD ARISE ANYWAY.



PROPERTIES.



→ DIRECT INSIGHT INTO THE RELATION BETWEEN THE SELF-INNER  
SUBJECTIVE WORLD AND REALITY

ZEN KOAN PRACTICE. = ENGAGEMENT WITH A KOAN  
IS FULLY PERSONAL AND  
PARTICIPATORY EXPERIENCE



→ DEEP UNDERSTANDING IS ACHIEVED BY BREAKING  
THROUGH THE PREVIOUS PATTERNS OF THOUGHT  
AND LOOKING AT AN ISSUE IN A GENUINELY  
NEW WAY.

GALILEO

NEWTON TRUE TENDENCY OF OBJECTS IS TO STAY IN MOTION !

EINSTEIN

HEISENBERG

SCHOPENHAUER.

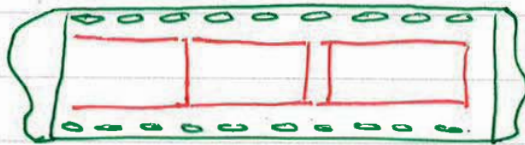
THE QUESTIONS ARE THE IMPORTANT THINGS.

# = PART 1 CH 1 THE ARROW =

INSTANT OF  
TIME  
DOES NOT MOVE



DIVIDE  $\rightarrow \infty$ ? ATOM. (88)



MOVIE : FRAMES STICKED  
TOGETHER IN OUR  
BRAIN.

By using

$$\Delta x / \Delta t$$

$\rightarrow$  SPEED NEVER REACHES ZERO.!

NO MOVEMENT



EXPERIENCE  
THE PAST

PAST



NOW!

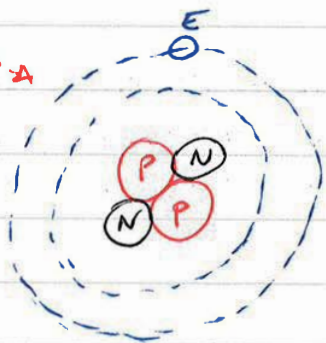
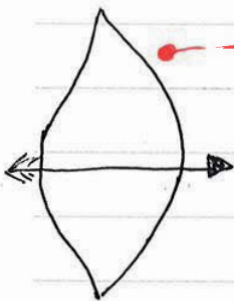
EXPERIENCE  
THE

FUTURE



WE SENSE NOW INSTANTLY  
BUT IT HAS NO PLACE AT  
ALL IN PHYSICS.

ATOM NUCLEUS.



QUARKS  
ELECTRONS  
SUPERSTRINGS.

MADE OF  
INFORMATION

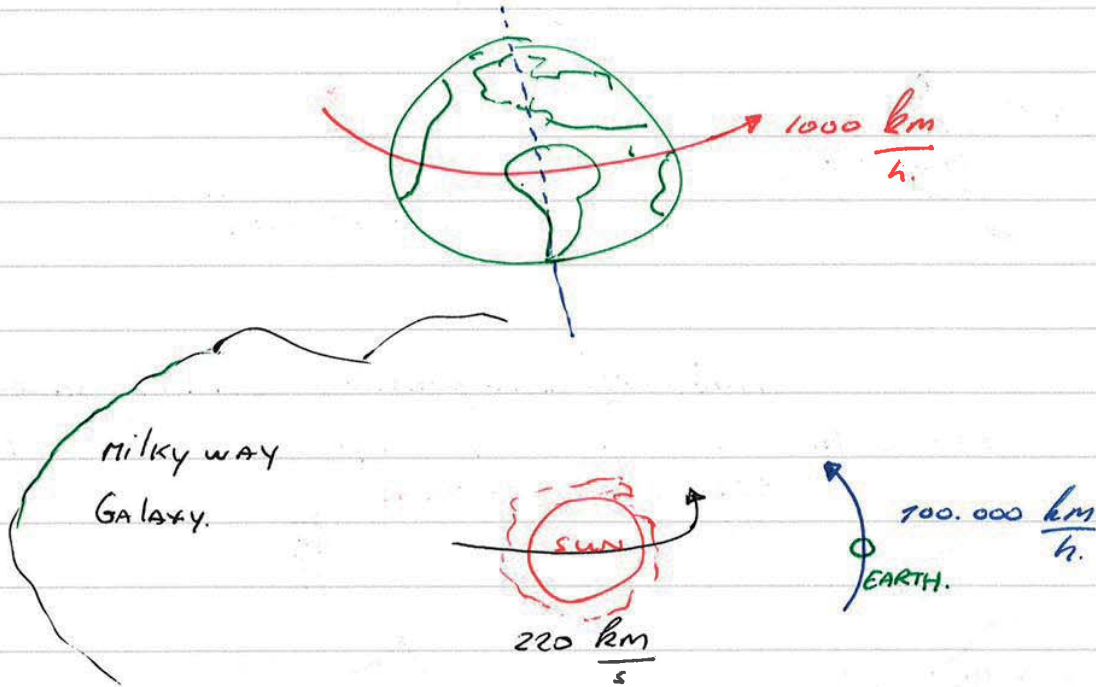
WHAT?

WHEN?

WHOM?

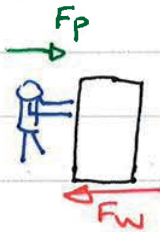
How long?

## = CH. 2 SETTING SAIL =



ABSOLUTE MOTION → NOT DETECTABLE (B)

↳ RELATIVE TO SOMETHING ELSE (C)

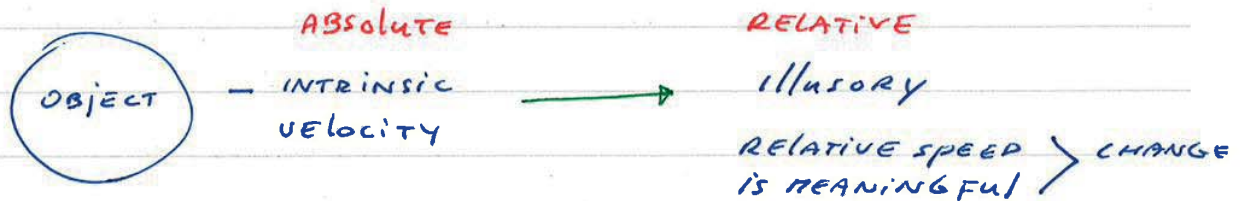


RESISTS CHANGE

[INERTIA]

↳ OBJECTS ABILITY TO RESIST CHANGE IN THEIR VELOCITY

Galileo: IF THERE IS NO SUCH THING AS ABSOLUTE MOTION, THEN THERE IS NOTHING PARTICULARLY NATURAL, EASY OR SPECIAL ABOUT BEING AT REST. IT IS JUST AS NATURAL TO MOVE AT CONSTANT VELOCITY !

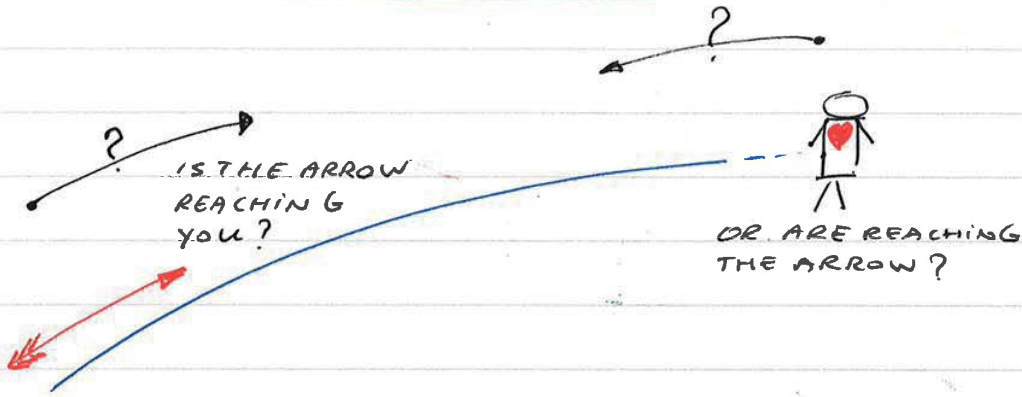


MEASURE THE VELOCITY RELATIVE TO ANOTHER. (UNIFORM)

NONUNIFORM → ACCELERATED - MOTION WITHOUT APPARENT REFERENCE



# = CH 3 BEING TIME =



TIME FEELS LIKE PASSING. (HUMAN EXPERIENCE)

13:00 h.

14:00 h.

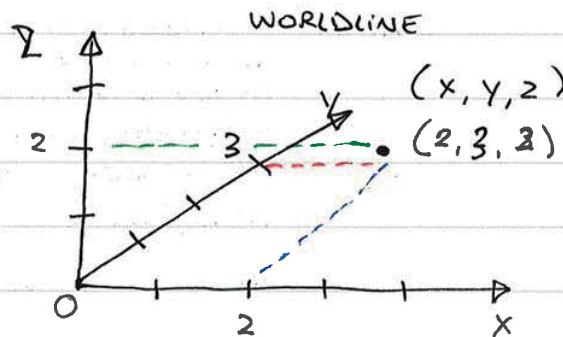
TIME

TIME MOVES THROUGH US.



SPACE!

WE ARE MOVING THROUGH TIME



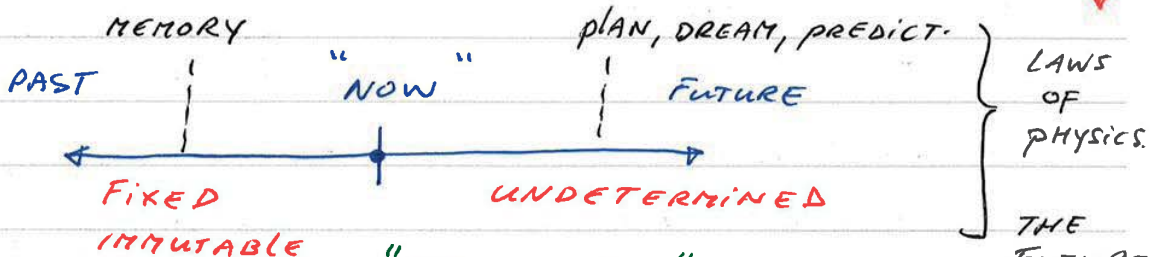
3D + TIME

SPACE + TIME

TIME IS LAID OUT, LIKE SPACE, NOTHING IS CREATED

WE MOVE THROUGH TIME IN ONE DIRECTION.

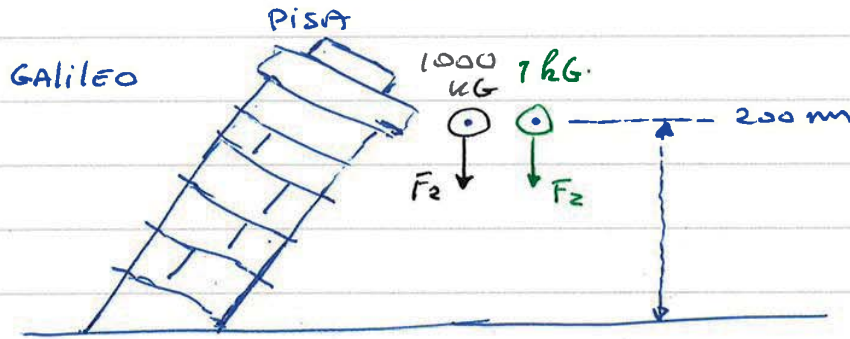
FORWARD.



"ARROW OF TIME" THAT POINTS TOWARDS THE FUTURE.

ETERNALIST VIEW

= CH 4 THE TOWER =



PRECISE  
REGULARITIES  
BEHIND THE  
BEHAVIOR OF OBJECTS.

STATEMENTS ABSOLUTE UNIFORM MOTION  $\Rightarrow$  EMPTY

RELATIVE MOTION / CHANGES IN MOTION  $\Rightarrow$  QUITE REAL.

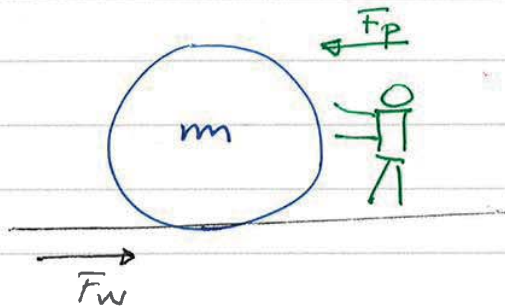
$\downarrow$  BUILDING BLOCKS OF OUR PHYSICAL  
WORLD'S BEHAVIOUR.

$\downarrow$  UNIVERSAL LAWS } ISAAC NEWTON  
MATHEMATICAL }  
MECHANICS  
(physics)

acceleration  $a = \frac{F}{m}$

FORCE INERTIA

$F = m \cdot a.$



THE MOTIONS OF OBJECTS  
CAN BE CALCULATED PRECISELY  
IF ONE KNOWS 3 THINGS:

- ① INITIAL position + STATE OF MOTION
- ② INERTIA OF EACH OBJECT
- ③ FORCE THAT EACH OBJECT EXERTS ON EACH OF THE OTHERS.

$F = g_1 \times g_2$

$g_1$  = GRAVITATIONAL CHARGE

$g_2$  = GRAVITATIONAL FIELD.

$a \times m = F = g_1 \times g_2$

$a = \frac{g_1 \times g_2}{m}$

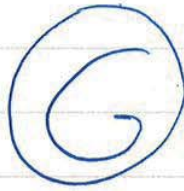
ALL OBJECTS ACCELERATE

$F = m \cdot g = F = m \cdot a.$

AT PRECISELY THE SAME RATE  
IN A GIVEN GRAVITATIONAL



NO FORCE?



GRAVITY

WAIT WHAT?

IT CHANGES THE PATHS OF OBJECTS IN A WAY THAT IS  
COMPLETELY INDEPENDENT OF THEIR MASS, WHAT THEY  
ARE MADE OF, OR ANY OTHER PROPERTY.

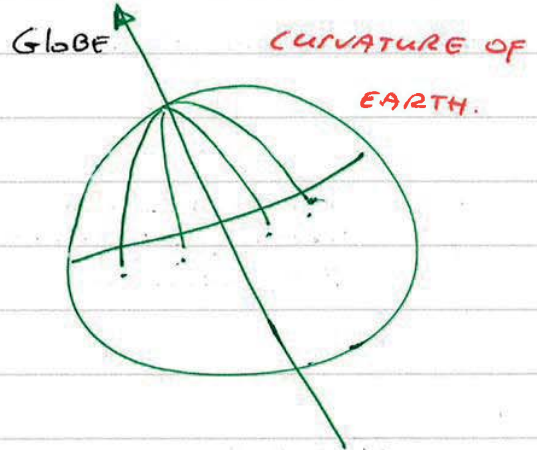
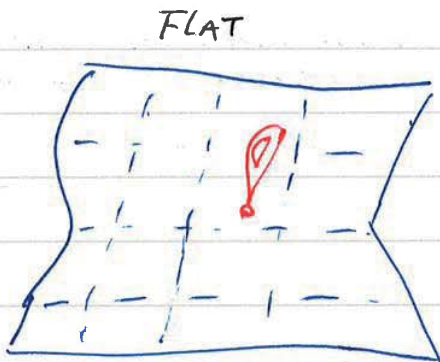
?

THE GRAVITATIONAL ACCELERATION OF AN OBJECT HAS  
NO CONNECTION WHATSOEVER TO WHAT THE OBJECT IS!  
IT DEPENDS ONLY ON THE OBJECTS ENVIRONMENT

WAIT WHAT?



# = CH. 5 A PERFECT MAP. =



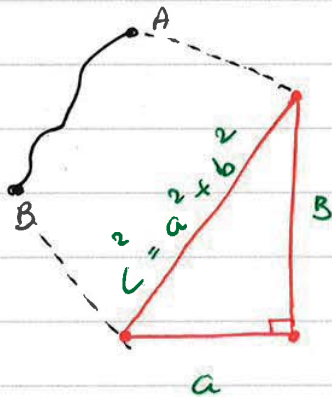
#

LONGITUDE } FIXED  
LATITUDE } SCALE I.E.  
1:10 (1cm = 10km)

MAPPING OF THE SURFACE CANNOT BE DONE PERFECTLY!

VARIATIONS IN SCALE BECOME MANIFEST ONLY WHEN WE COMPARE DISTANT PARTS OF THE MAP TO EACH OTHER.

YOU CAN'T HAVE EQUAL AREAS AND SIMILAR SHAPES.



HYPOTENUSE C IS RELATED TO A AND B.

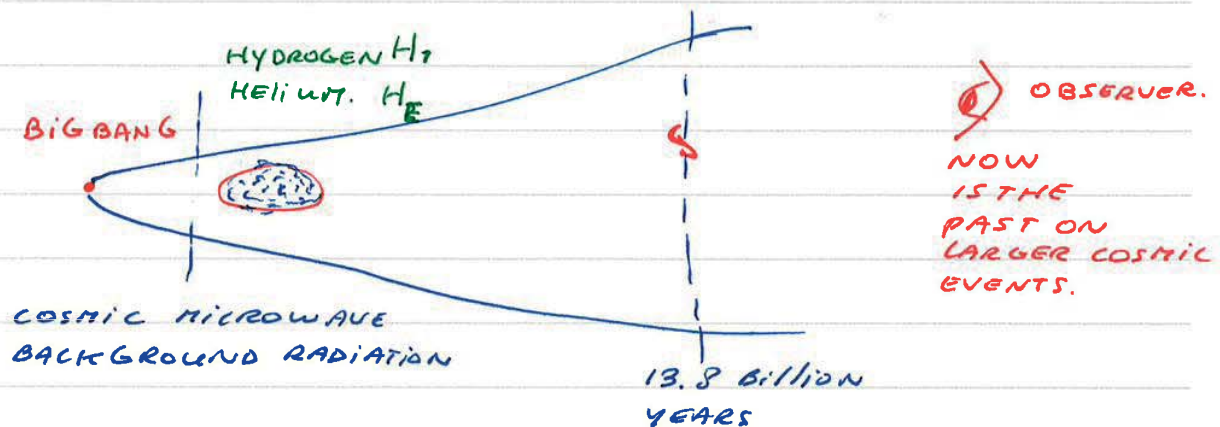
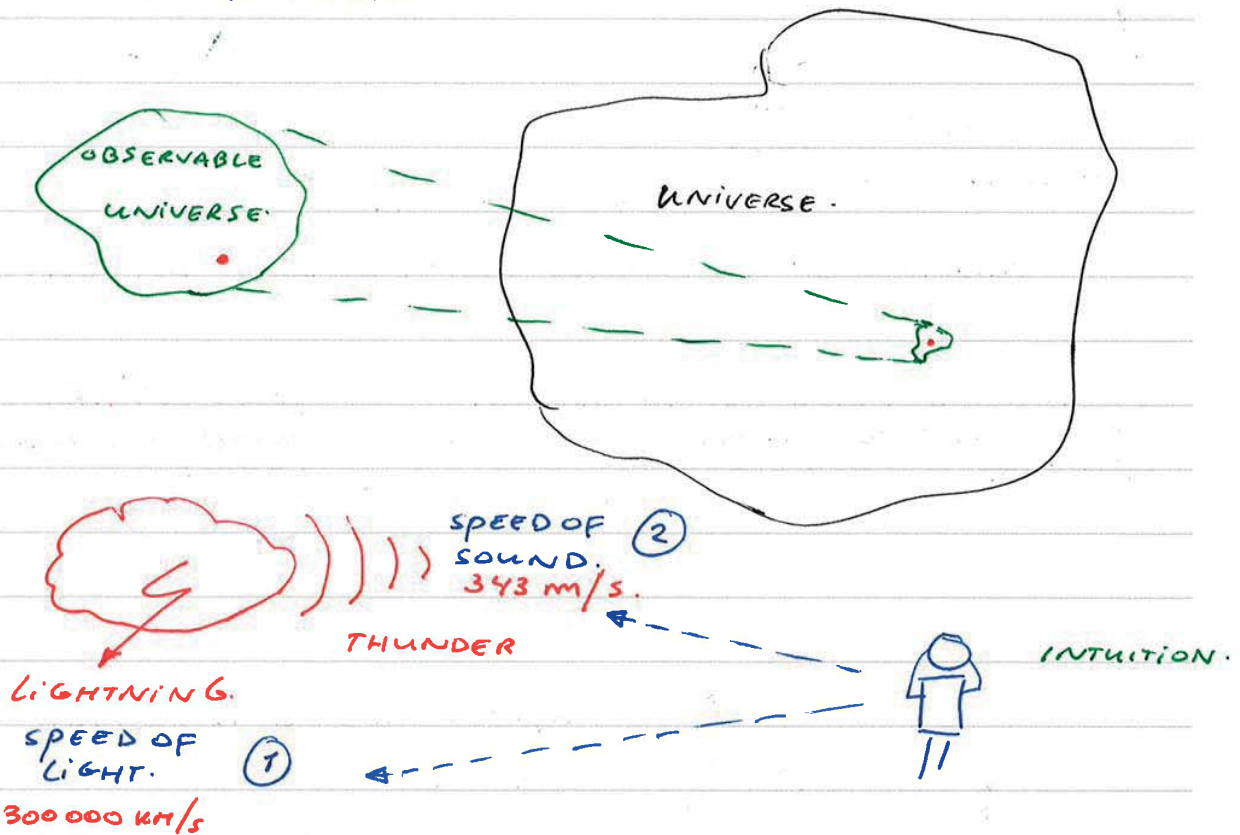


# = CH 6. THE COSMIC NOW =

ORDER OF MAGNITUDES ESTIMATES

→ CALCULATIONS THAT CAN BE DONE APPROXIMATELY

↓  
? UNDERSTAND THE ESSENTIAL INGREDIENTS OF A QUESTION.



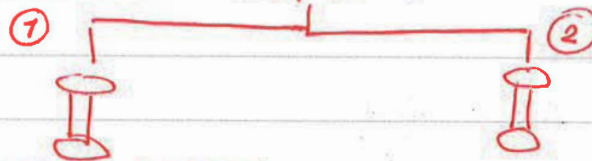
[STARS]

" ABSOLUTE, TRUE AND MATHEMATICAL TIME, OF ITSELF, AND FROM ITS OWN NATURE FLOWS EQUALLY WITHOUT REGARD TO ANYTHING EXTERNAL " - NEWTON

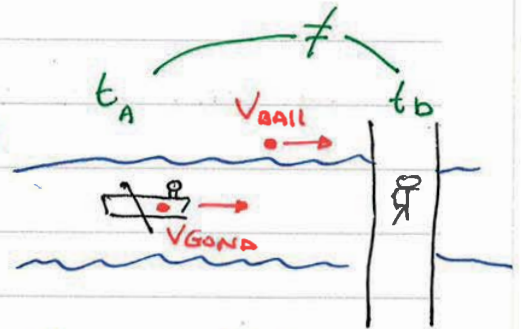
# = CH 7 DRIFTING DREAMS OF VENICE =

GALILEO.

PHYSICS.



EQUIVALENCE OF INERTIAL FRAMES.



$$V_{\text{BRIDGE}} = V_{\text{BALL}} + V_{\text{BOAT}}$$

- \* EQUIVALENCE → YOU CANNOT TELL ONE FRAME FROM ANOTHER
- \* INERTIAL → UNACCELERATED
- \* FRAMES → SYSTEM OF REFERENCE

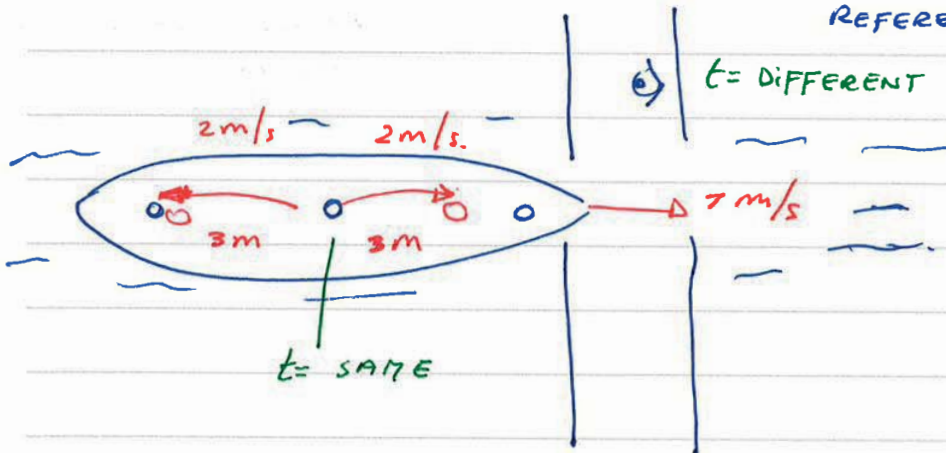
MAXWELL

ELECTROMAGNETIC FIELD = LIGHT !

$$C = 300.000 \text{ km/s}$$

EINSTEIN

ALL PHYSICAL LAWS, GOVERNING THE SPEED OF LIGHT, ARE THE SAME FOR EVERY INERTIAL REFERENCE FRAME.



[THE UNIVERSAL NOW IS A FICTION]



= CH. 8 CHOOSE YOUR PATH =

→ CHOOSE THE PATH OF HAPPINESS.



SHORTEST AND QUICKEST ARE NOT AT ALL THE SAME

$$\Delta t = \frac{\Delta d}{v}$$

EFFORT = AMOUNT OF DESCENT  $\times$  DIFFICULTY

PARTICLE.



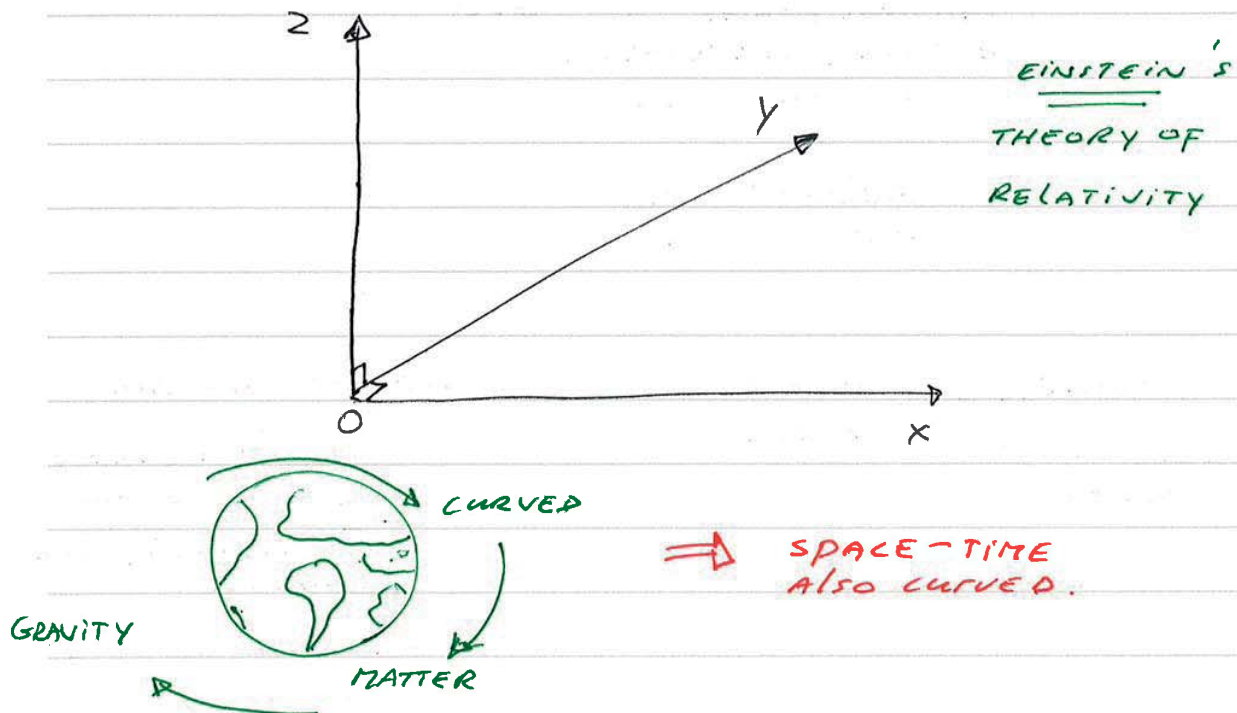
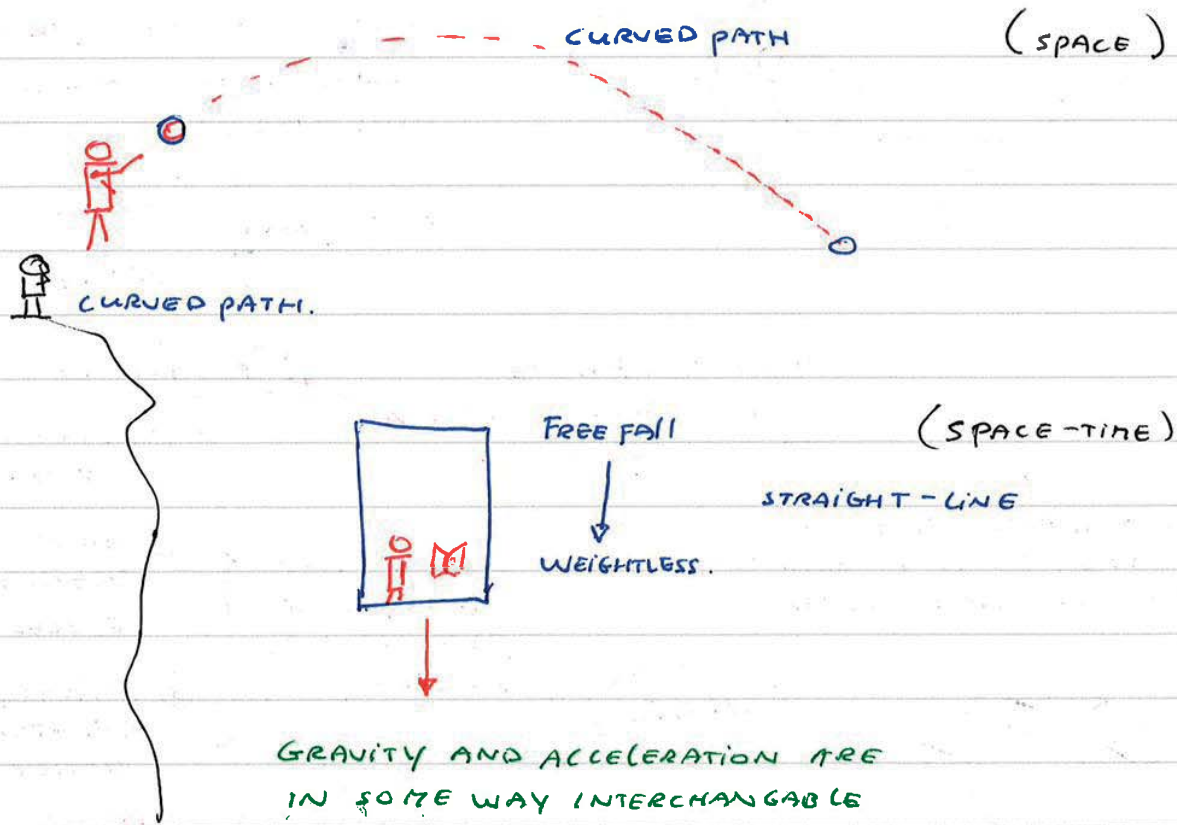
$\Delta t$



$\Delta d$

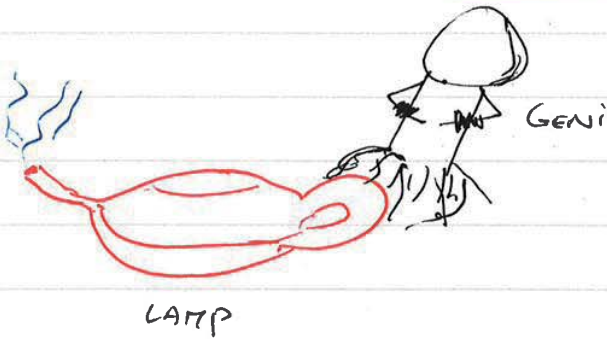
PARTICLES USE THE FORCES IT FEELS AND THE VELOCITY IT HAS TO MOVE RIGHT NOW WITH UTTER ASSURANCE THAT OVER TIME IT WILL TRACE OUT A PATH THAT TURNS OUT IN RETROSPECT TO BE THE PATH OF MAX. ACTION OUT OF ALL POSSIBLE PATHS IT COULD HAVE TAKEN.

# = CH 9 TAKING THE LEAP =





## PART 2 = CH 10 RELEASING THE DJINN =



BY LOOKING AT THE  
WHOLE UNIVERSE (ATOMS)  
I KNOW EVERYTHING THAT  
WILL EVER HAPPEN.

± 300 years  
↓  
GALILEO  
EINSTEIN

A PARTICLE MOVES  
UNDER THE INFLUENCE  
OF VARIOUS FORCES.

PARTICLE

THE LOCATIONS AND MASSES  
OF THE PARTICLES DETERMINE  
HOW SPACE-TIME CURVES.



illusion?

COMPUTE THE  
PATH OF THE  
PARTICLE VERY  
PRECISELY.

- ① STRUCTURE OF SPACE-TIME
- ② ALL NON-  
GRAVITATIONAL  
FORCES (WEAK)
- ③ INITIAL POSITION  
AND STATE OF  
MOTION

ESSENTIALLY ALL  
THE NON-GRAVI-  
TATIONAL FORCES  
ARE REALLY MANIFESTATIONS  
OF ELECTROMAGNETISM

ELECTRONIC FORCES  
BETWEEN ATOMS

- BRIGHTNESS OF THE SUN
- MAGNETIC FIELD
- DISTRIBUTION OF INTERPLANETARY  
GASES.

GRAVITY

ESSENTIAL  
FORCES

ELECTROMAGNETISM

DISTRIBUTION  
OF MATTER

- SMALL ATOMIC SCALE  
WEAK / STRONG
- FOR STABILITY AND  
BEHAVIOR.
- DISTRIBUTION OF  
CHARGE.

## Worldview:

- ① SPACE-TIME
  - ② PARTICLES
  - ③ FIELDS
- } CLOSED AND SELF-CONSISTENT LOOP  
= PREDICTIVE =

- ↓
- ⊗ - IN PRACTICE IMPOSSIBLE!
  - ⊙ - IN PRINCIPLE POSSIBLE  
WITH GREAT PRECISION

\* PIERRE-SIMON de LAPLACE (1821)

↳ PHILOSOPHY OF SCIENTIFIC DETERMINISM.

[LOGICAL CULMINATION]

↓

BEING TIME → "NOR IS YESTERDAY "GONE" IN ANYWAY."

\* EINSTEIN

"FOR US BELIEVING PHYSICISTS, THE DISTINCTION BETWEEN  
PAST, PRESENT AND FUTURE IS ONLY A STUBBORN ILLUSION"



- YOU CAN CHANGE THE FUTURE (DOES NOT EXIST YET)
- BUT NOT THE PAST (EXISTS BUT YOU CANNOT RETURN TO)
- AND THAT YOU REALLY ARE FREE TO MAKE  
? DECISIONS THAT AFFECT HOW THE FUTURE WILL TURN OUT.

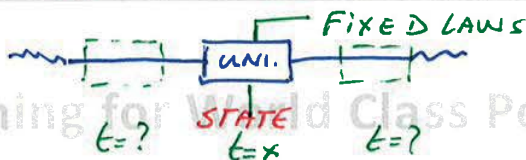
## THEOLOGICAL PARADOX

OMNISIENT → THE CHOICE IS ALREADY DETERMINED, IF  
(GOD/ALLAH) NOT ALREADY MADE.



↳ ANCIENT GREEKS → SOCRATES (TO WHICH WE SHALL RETURN)

↳ KARMA → CAUSE & EFFECT → BUDDHA'S THINKING





PAST  
(FIXED)

PRESENT  
(NOW)  
?

FUTURE  
(OPEN NOT DECIDED)

ACCORDING TO WHOM?

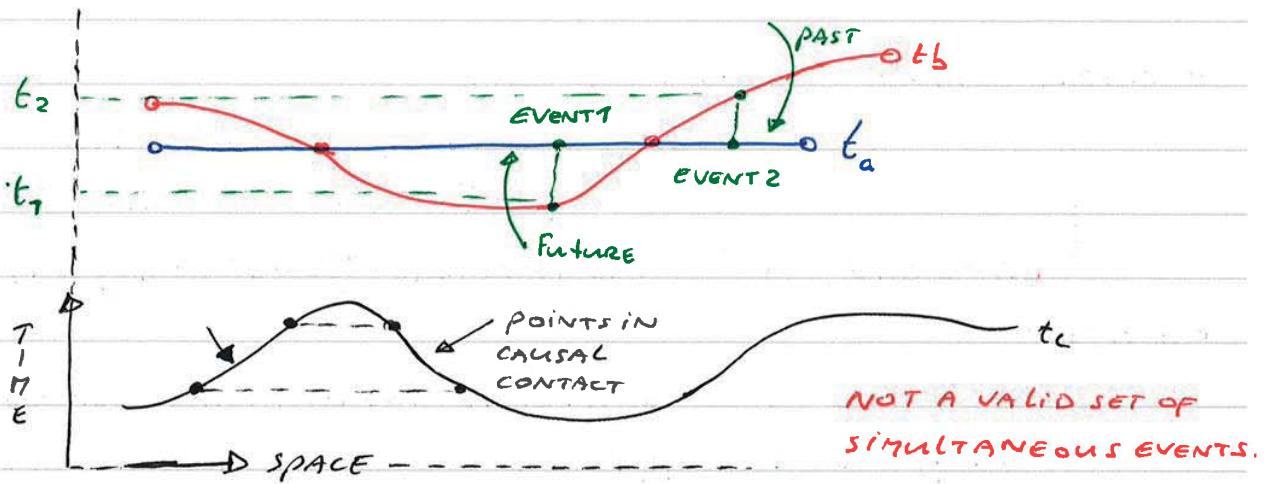
SPECIAL RELATIVITY  $\rightarrow$  DEPENDS ON THE OBSERVER.

①  FUTURE

A PLANET GORBBLED BY A BLACK HOLE ? NOW?

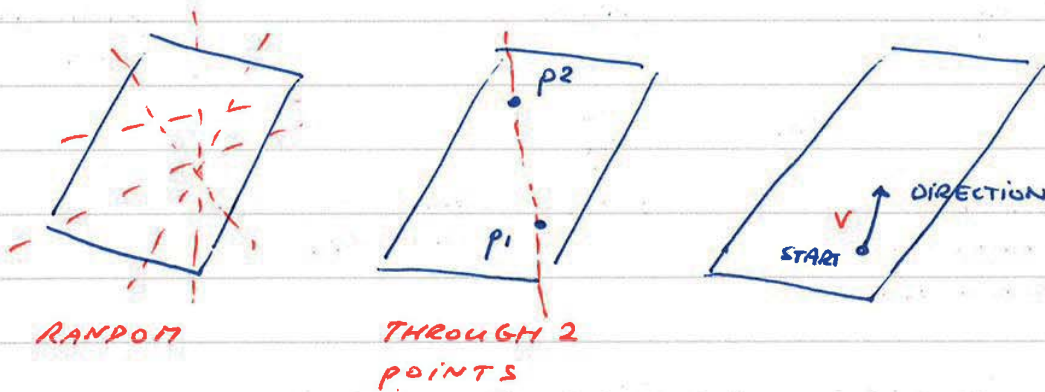
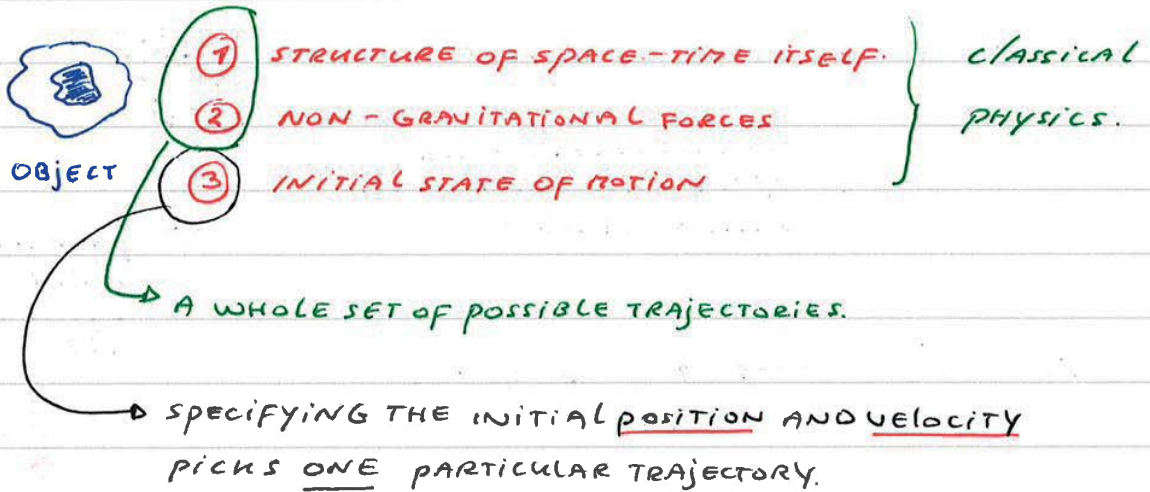
GENERAL RELATIVITY  $\rightarrow$

②  PAST



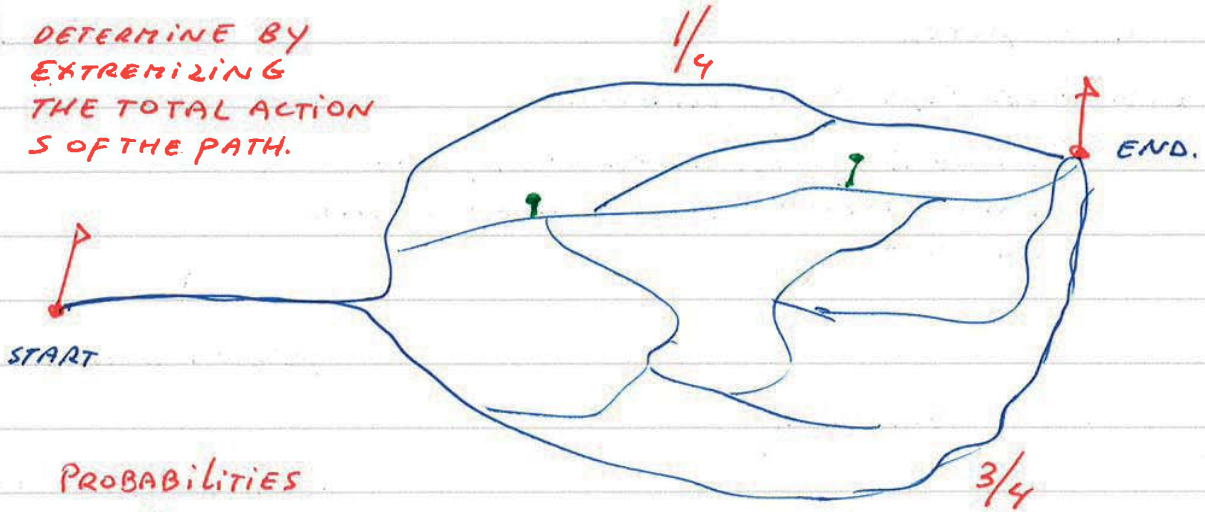
THE FUTURE IS PREDETERMINED ? OR NOT ?

## = CH 11. MANY PATHS MAKE THE ROAD =



[ FORCES REPRESENT CHANGES IN VELOCITY WITH TIME ]

① DETERMINE BY EXTREMIZING THE TOTAL ACTION S OF THE PATH.

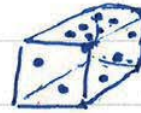


② PROBABILITIES SPLIT / RECOMBINE



# = CH12 SUFFICIENT REASON TO ROLL OF THE DICE =

WHAT DOES CAUSE THE ROLL OF A DIE?



→ COULD THERE BE A CHAIN OF CAUSATION THAT STARTS WITH NO CAUSE?



PROBABILITY ARISES FROM THE SYMMETRY OF THE DIE.

TWO 6'S →  $\frac{1}{36}$  → 2,78%

NO CORRELATION BETWEEN ANY PARTICULAR SIDE

SIMULATOR

HUMAN



V.S.



% (BASED ON PARAMETERS MEASURED)

1-6 (BASED ON SYMMETRY)

"IT SEEMS INTUITIVELY CLEAR THAT THE INFORMATION AND KNOW-HOW EXISTS."



PHILOSOPHERS.

\* DESCARTES / SPINOZA / LEIBNIZ

"THERE IS ALWAYS A REASON WHY ONE THING HAPPENS RATHER THAN ANOTHER THING"

UNIVERSE HAS THE INFORMATION.

(QUANTUM MECHANICS)

UNCERTAINTY

SUPERPOSITION

1  
2

MEASURE

7

MEASURE

2

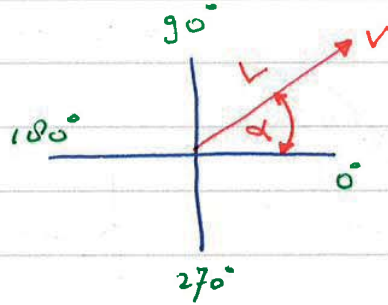
collapse

PERFECT PREDICTION

OR

PERFECT EXPLANATION SHOULD ALWAYS BE POSSIBLE

# = CH 13 THROUGH THE GATES =



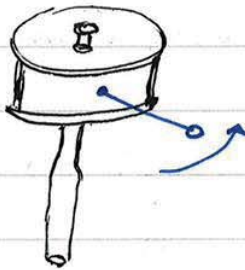
$L$  = LENGTH (MAGNITUDE)

$V$  = ARROW (VECTOR)

$\alpha$  = DIRECTION (PHASE)



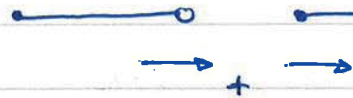
ADD ARROWS



PRAYER WHEELS.



CANCEL OUT

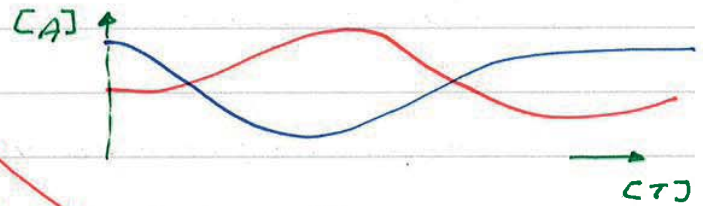


AMPLIFY OR  
REINFORCE

{ INTERFERENCE } PROPERTY OF  
WAVES.

MAGNITUDE

PHASE



LIGHT

(EINSTEIN) PARTICLE

WAVE (THOMAS YOUNG)

DISCRETE PARTS

PHOTONS

[ THE TWO SLIT EXPERIMENT ]

QUANTUM  
STATES

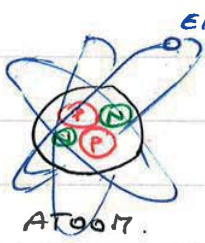
SUPER POSITION

WAVEFUNCTION

WAVE  
PHOTON PHOTON



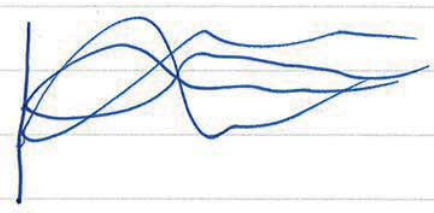
# Feynman's Statement!



ELECTRONS GO IN ANY DIRECTION  
AT ANY SPEED.

## CLASSICAL PHYSICS

✓ ONE PATH AS THE  
RIGHT ONE.



ADD ALL AMPLITUDES.



[WAVEFUNCTION]

## QUANTUM PHYSICS (MECHANICS)



DUE TO INTERFERENCE

✓ PARTICLES TAKE MORE THAN  
ONE PATH.



SCHRÖDINGER'S EQUATION



"PROBABILITY."

∞

∞

ADD MORE GATES, MORE BARRIERS



Q-MECHANICS.

CALCULATE PROBABILITY  
OF EACH POSSIBLE PATH  
THROUGH THE GATES.

① SUM OF ALL POSSIBLE PATHS  $\sum \text{PATH}^N$

② FREE MOVEMENT

WAVEFUNCTION DESCRIBES A SINGLE PARTICLE TRAVELING  
FROM ONE PLACE TO ANOTHER IS MATHEMATICALLY  
EQUIVALENT TO A PARTICLE FOLLOWING ALL POSSIBLE  
PATHS FROM ONE PLACE TO ANOTHER.



⚡ VERY PUZZLING ⚡



?

OBJECTS FOLLOW A STRAIGHT PATH BY LAW  
A PATH WE REMEMBER!

# = CH 14 SPLITTING THE WORLD =

## CLASSICAL PHYSICS

## QUANTUM MECHANICS

- SUPERPOSITION
- INTERFERENCE
- PROBABILITY
- POSSIBILITY
- STATES
- INTERACTIONS

### DECOHERENCE

↳ THE INTERFERENCE TERMS STILL EXIST,  
BUT THEY ARE NOT THERE.

↳ MAKES THE SPLIT A CLEAN CUT !

### QUANTUM MEASUREMENT PROBLEM

(MISMATCH)

↳ STATES MULTIPLE POSSIBILITIES. —  
ONE REALITY !



EPISTEMIC

ONTIC.

WAVE-FUNCTION { MATHEMATICAL DESCRIPTION  
OF EVERYTHING AN OBSERVER  
CAN KNOW ABOUT A SYSTEM

1 TO 1 CORRESPONDENCE  
WITH REALITY (RELATION)  
THE WORLD HAS  
DECOMPOSED INTO 2 WORLDS

→ BEFORE MEASUREMENT  
WAVEFUNCTION ATTRIBUTES  
SOME PROBABILITY TO VARIOUS  
OUTCOMES.

→ AFTER MEASUREMENT  
ALL THE PROBABILITY  
SHIFTS TO THE OUTCOME  
ACTUALLY OBSERVED BY  
THE OBSERVER.

{ COLLAPSE OF THE WAVEFUNCTION }

= CH 15 WHAT CANNOT BE KNOWN =

[CLASSICAL PHYSICS] <sup>EFFECTIVE</sup>

KNOWN  $\Downarrow$  BEHAVIOR

EXACT LAWS / THEORIES

[QUANTUM MECHANICS]

IMPOSSIBLE  $\Downarrow$  BEHAVIOR  
UNKNOWN

- EFFECTS
- VERY LOW PROBABILITY

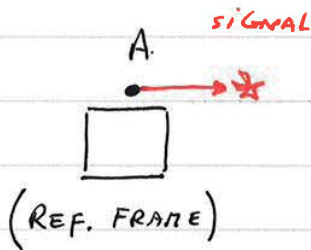
$\neq$



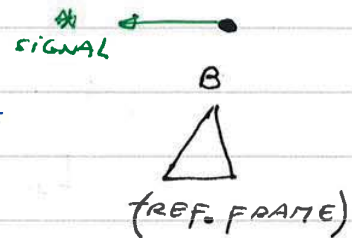
CANNOT BE DONE / CANNOT BE KNOWN

IMPOSSIBILITIES.

① PAST LIGHT CONE  $\rightarrow$  SIGNALS CANNOT BE TRANSMITTED  
(300.000 KM/S) FASTER THAN THE SPEED OF LIGHT.

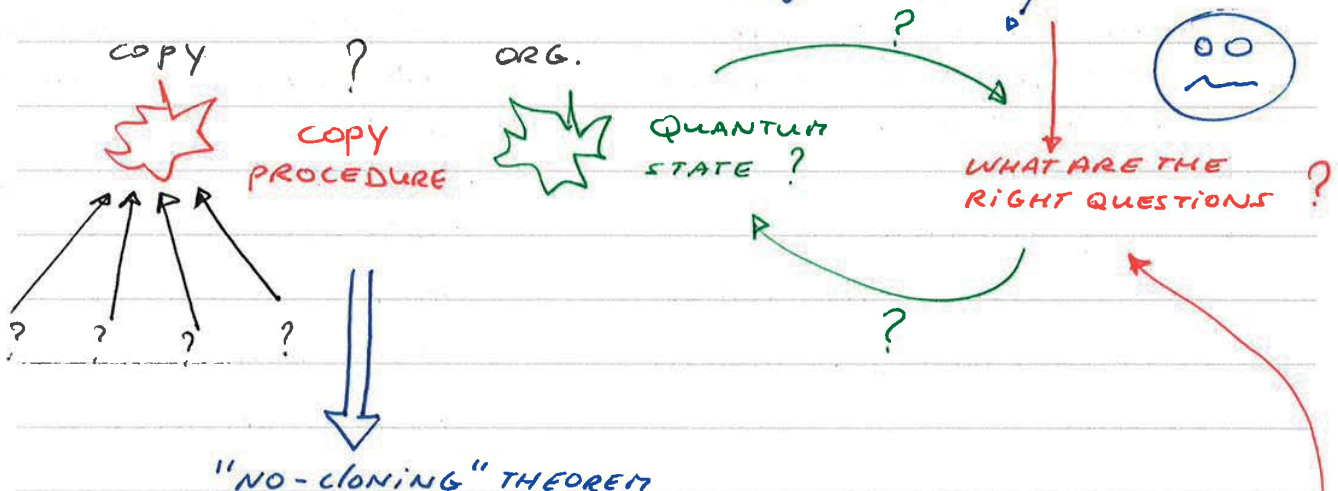


SPECIAL RELATIVITY  
LIMITS SPEED OF LIGHT.  
PARTICLES, FIELDS  
TELEPATHY



THE STRUCTURE OF REALITY  
THAT KNOWLEDGE IS LOCAL

CIRCUMVENT QUANTUM UNCERTAINTY: JUST ASK THE RIGHT QUESTIONS





THE SYSTEM HAS A QUANTUM STATE

↳ IN SOME WAY IT IS ! > INTERACTION

AT SOME LEVEL, ENTANGLEMENT HAPPENS WHENEVER ONE SYSTEM INTERACTS WITH ANOTHER ONE.

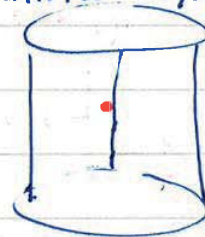
↓ "UNENTANGLE"

REVERSE THE INTERACTION

DECOHERENCE

VERY HARD  
TO MAINTAIN  
ISOLATED.  
SO IT DOES  
NOT BECOME  
ENTANGLED.

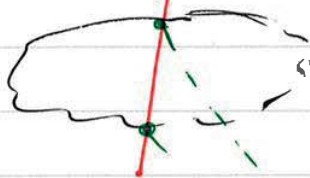
SINGLE ISOLATED  
QUANTUM SYSTEM



ELECTRON  
SPINNING  
AROUND A  
VERTICAL AXIS.

↓ QUANTUM  
COMPUTERS.

CUT THE STRING



EXCISE A SECTION OF  
THE WORLD TO FORM A  
SYSTEM OF OUR CHOICE

⚡ NOT IN A  
SUPERPOSITION

+ UNCERTAINTY  
STATE WITH SOME  
PROBABILITY. (50% → | 50% ←

[THE COST OF ISOLATION IS IGNORANCE]

△ DON'T YOU CHANGE THE END RESULT?  
YOU DO AFFECT THE STATE / REALITY.

## = CH. 16 WHAT / WHEN WE TALK ABOUT =

### FREE Will

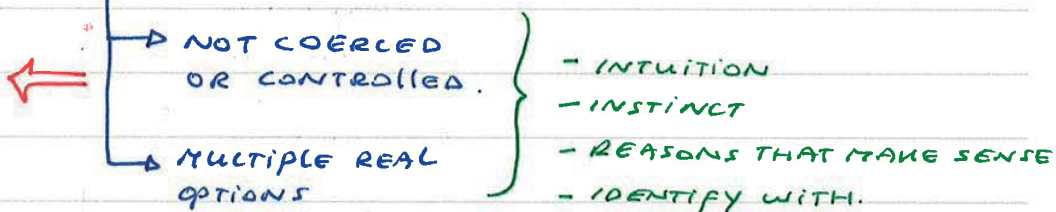


IF YOUR DECISION IS ALREADY KNOWN TO GOD  
AND THUS DETERMINED, HOW CAN YOU SAY IT IS  
YOUR DECISION?



EXPERIENCE  
OF FREE Will !

process

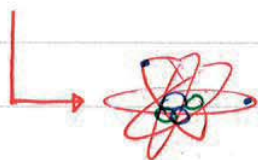


SARTRE : "ONCE FREEDOM LIGHTS ITS BEACON IN MAN'S HEART, THE  
GOD'S ARE POWERLESS AGAINST HIM".

### ④ DEFINITIONS OF FEELING FREE:

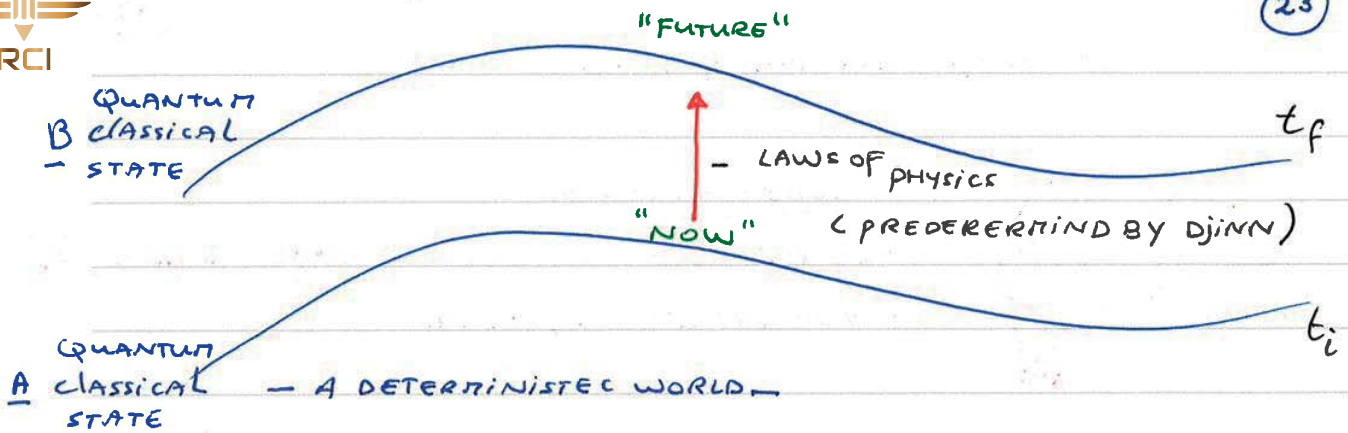
- ① ABSENCE OF EXTERNAL COERCION
- ② REASONS THAT YOU ENDORSE
- ③ YOUR DECISION COULD HAVE BEEN OTHERWISE
- ④ NOBODY CAN RELIABLY PREDICT WHAT THE  
DECISION WILL BE.

? AREN'T WE COERCED BY THE EQUATIONS OF MAXWELL?



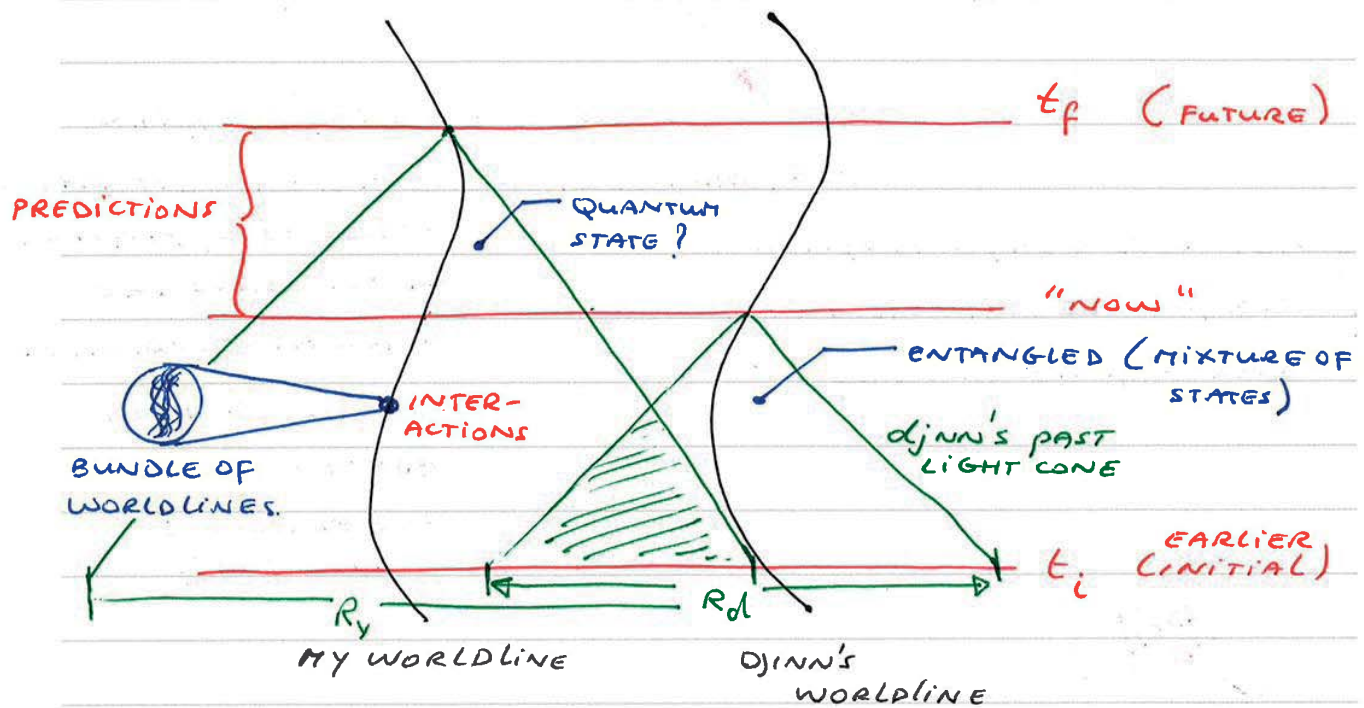
ATOMS. WITHIN SPACE-TIME METRIC.





LIGHT'S FINITE SPEED.  $\rightarrow$  CLASSIC PHYSICS.  
 (300,000 km/s)

SOME REGIONS OF SPACE TIME CAN AFFECT ONLY SOME OTHER REGIONS.



THE DJINN CANNOT PREDICT ANYTHING AT ALL !

LOCAL

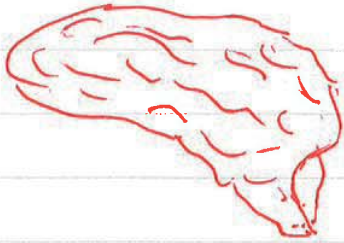
$\rightarrow$  SIMPLE PRACTICAL CAUSE & EFFECT

PREDICTION OF WHAT IS GOING TO HAPPEN  
 GENERALLY REQUIRES KNOWLEDGE OF MULTIPLE  
 QUANTITIES. (POSITION, VELOCITY), THAT CANNOT BE  
 SIMULTANEOUSLY KNOWN PRECISELY.



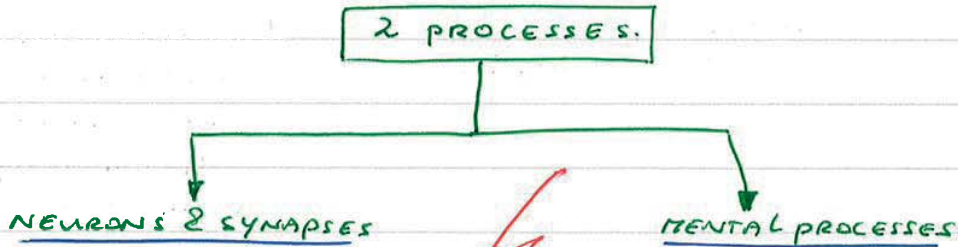


# = CH 17 THE MIND OF THE MIND =



## CEREBRAL CORTEX

- 20 billion NEURONS (1000 pulses/s)
- 100 trillion SYNAPSES

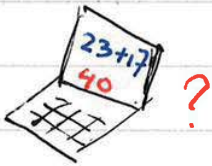


CONSCIOUSNESS  
(THE HARD PROBLEM)

WE TRY TO EXPLAIN  
CONSCIOUSNESS THROUGH  
MEASURABLE, PHYSICAL  
LAWS, WHILE THE  
COMPLEXITY INDICATES  
SOMETHING MORE  
ABOVE NATURAL.

FOR EXAMPLE:  
SPIRITUAL.

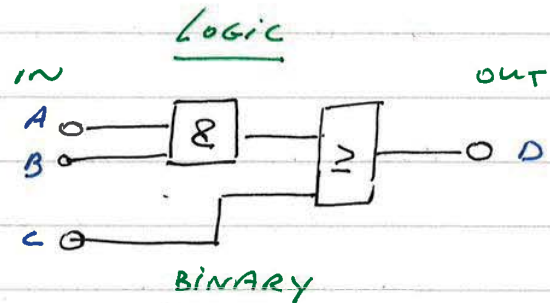
How does a physical system  
that follows inexorable laws  
ever compute or reason?



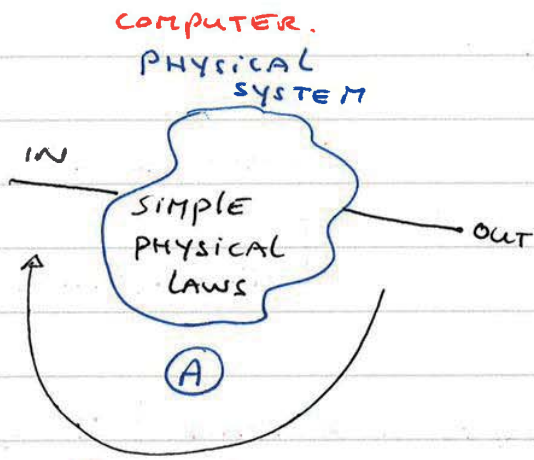
TO COMPUTE SOMETHING?

REASON AT AN  
ABSTRACT LEVEL

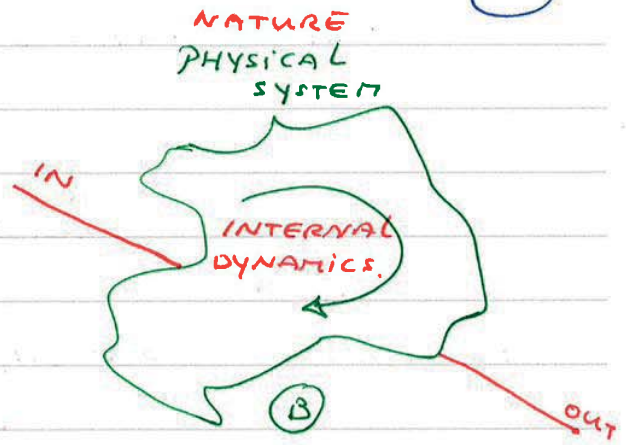
ALAN TURING → TURING  
MACHINE



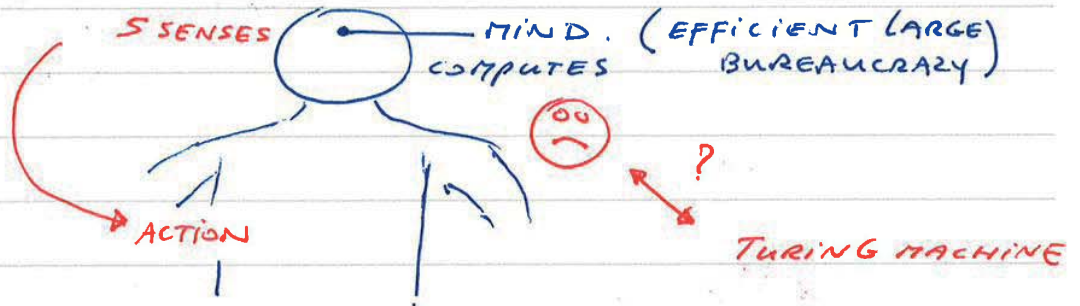
- SEMICONDUCTORS
- ORGANISM
- GOLF BALLS
- ANY SUBSTRATE



ALWAYS THE SAME  
RESULTS.

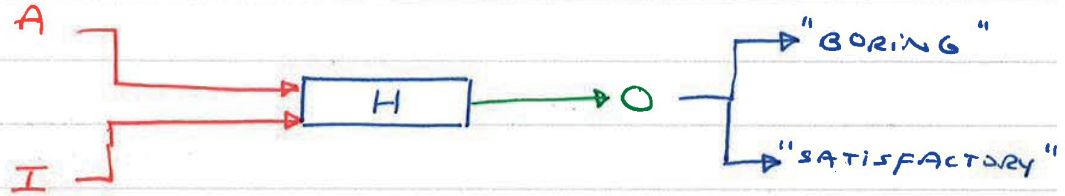


SUFFICIENTLY  
SELF CONTAINED.



HIGH LEVEL DECISIONS ARE STABLE IN MANY SENSES.

# = CH 18 A HALTING PROBLEM =

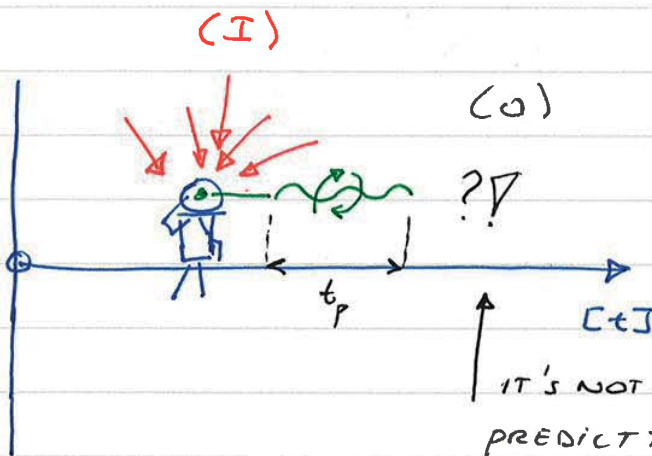


ALGORITHM  $\rightarrow H(A, I)$

$\rightarrow$  PERFECT ALGORITHM }  $H(M, M)$   
is impossible?

Loop?

USE M AS INPUT  
FOR ALGORITHM M



IT'S NOT POSSIBLE TO  
PREDICT THE OUTPUT  
WHILE YOUR BRAIN  
IS PROCESSING INFORMATION.

WHAT IS CONSCIOUSNESS?

WHAT MAKES YOU DECIDE?

IS THE BRAIN CONTINUOUSLY PROCESSING INFO?

$\rightarrow$  PATTERNS, MAPS, MEMORIES (AUTOMATIC)

$\rightarrow$  IS THE BRAIN SOMEHOW CONNECTED TO  
AN INTERNAL ENERGY SOURCE (UNIVERSE)

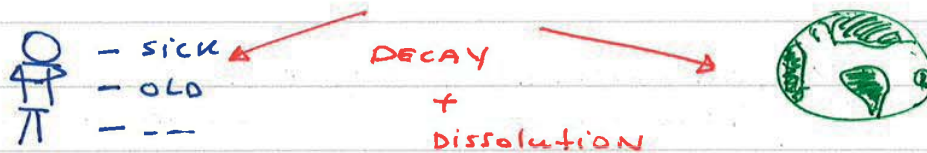


# = Part 3 =

= CH19 TORN APART AND REASSEMBLED =

INSTRUCTIONS FROM THE COOK.

{ FIREWOOD BECOMES ASH, AND IT DOES NOT  
BECOME FIREWOOD AGAIN. }



WHY ARE WE STILL  
HERE?

DISORDER NEVER DECREASES.

ENTROPY (2ND LAW OF THERMODYNAMICS)

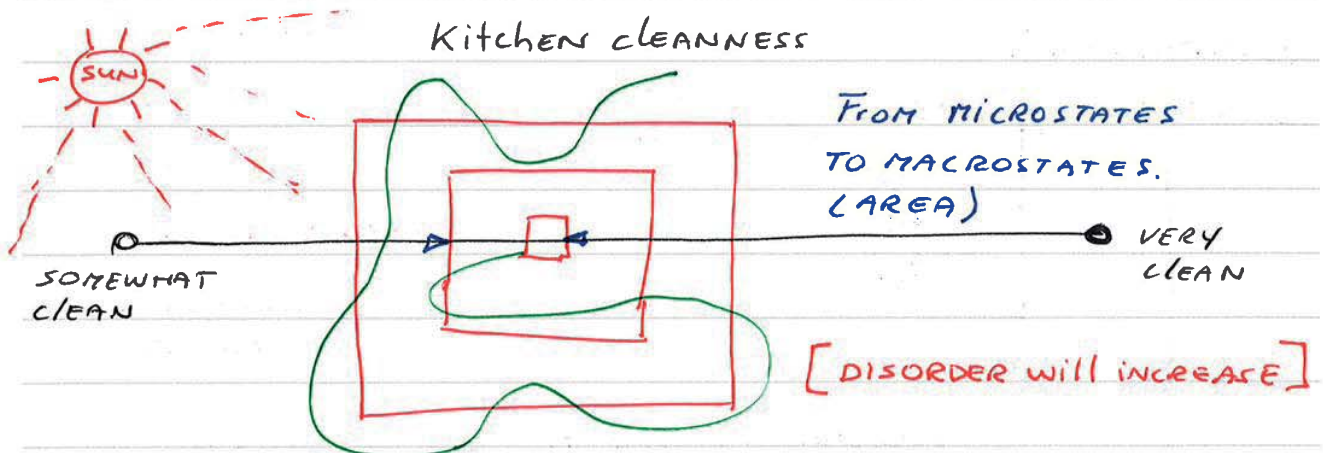
TENDENCY FOR A SYSTEM  
TO SPONTANEOUSLY BECOME  
"DISORDERED"

HEAT  
HIGHLY  
DISORDERED.

① DISORDER

② AS TIME PROGRESSES, THE SYSTEM EVOLVES

- ① Helium/HYDR. TO MACROSTATES OF EQUAL OR GREATER DISORDER.
- ② GRAVITY



QUANTUM MECHANICS → PHYSICAL SYSTEMS  
FINITE SET OF STATES.  
CLASSICAL PHYSICS → POSITION + VELOCITY

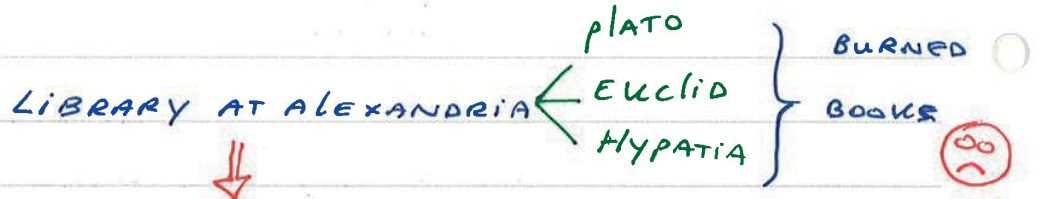
# = CH20 NOTHING IS LOST =

WHAT WILL YOU LEAVE, AND WHAT WILL REMAIN WHEN YOU ARE GONE?



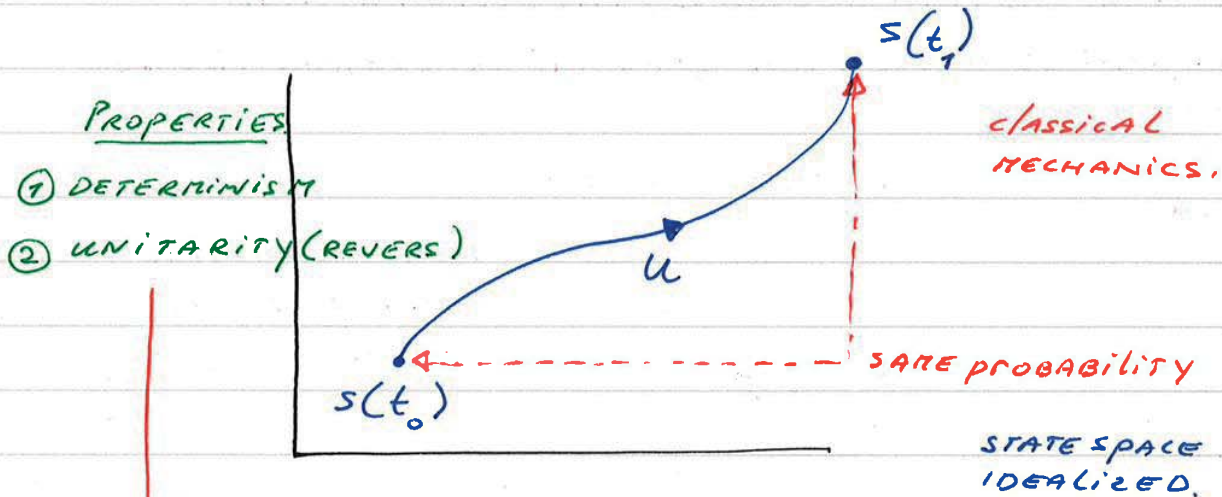
[EVERYTHING REMAINS FOREVER.]  $\Rightarrow$  ETCHED INTO THE MOTIONS OF THE ATOMS AND WAVES.

? ETERNALLY HIDDEN?



ENCODED IN THE COSMIC HISTORY?  $\Rightarrow$  BUT NOT REVERSIBLE IN PRACTICE.

⚡ THE FUNDAMENTAL PRESERVATION OF INFORMATION IS ONE OF THE CORE TENETS OF FUNDAMENTAL PHYSICS.



$U$  EVOLVES A STATE AT TIME  $t_0$  TO THE APPROPRIATE LATER STATE AT TIME  $t_1$

→ NOTHING WOULD BE LOST!

= CLASSICAL PHYSICS =

UNITARY  
DETERMINISTIC.

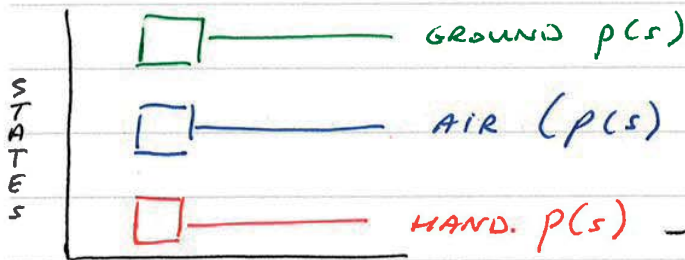
ASK A QUESTION



MEASURE IT

ONE UNIQUE SOLUTION

REVERSIBLE.



UNITARY + DETERMINISTIC.

INFO PRESERVED.

CLOSED SYSTEM → UNITARY + DETERMINISTIC BUT DON'T.



Aiming for World Class Performance

= QUANTUM MECHANICS =  
(UNCERTAINTY)

NONUNITARY  
NON DETERMINISTIC.

ASK A QUESTION

MEASURE IT



CHANGE THE STATE

⑦ INFORMATION IS LOST  
NO WAY TO TELL WHERE  
IT CAME FROM.

IN PRINCIPLE

EVOLUTION (INFO PRESERVED)  
(TAG THE TRAJECTORY)

AS LONG AS NO  
MEASUREMENT IS  
MADE.

OBSERVE OR  
MEASURE IT.

LSS



ENTROPY (DISORDER) (BOLTZMANN)

↳ MICRO STATES

↳ MACRO STATES.

ENTROPY (RANDOMNESS) (GIBBS/SHANNON)

↳ KNOWING THE EXACT STATE → ZERO RANDOMNESS.

↳ TOTAL IGNORANCE → MAXIMAL RANDOMNESS

MATHEMATICALLY PROVABLE: UNDER UNITARY EVOLUTION,  
RANDOMNESS IS CONSTANT.

preserves probabilities over  
micro states it generally lose  
track of information about  
macro states.

↓ PRESERVATION  
OF INFORMATION.

↳ LOSS OF ORDER (2<sup>ND</sup> LAW OF THERMODYNAMICS)

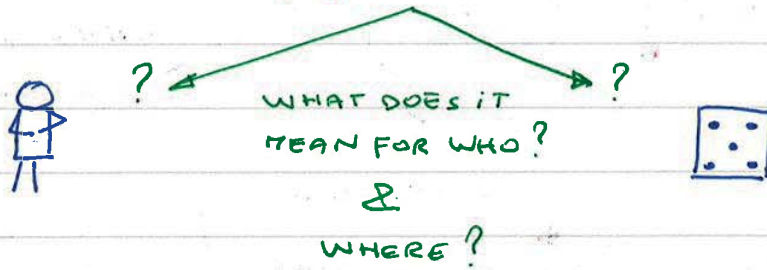
{ PERHAPS NOTHING IS LOST, BUT EVERYTHING IS  
HIDDEN? }



LAW OF ATTRACTION.

# = CH 27 BEING AND KNOWINGNESS =

## CALCULUS OF PROBABILITIES.



- ① PROBABILITIES AS FAIRLY OBJECTIVE → REALLY CORRESPOND TO RELATIVE FREQUENCIES OF INSTANCES IN AN ENSEMBLE OF SIMILAR SYSTEMS.
- FREQUENTIST

- ② PROBABILITIES ARE ALWAYS DEGREES OF BELIEF IN FACTS

↓  
OBSERVER  
AGENT.

BAYESIAN (SUBJECTIVIST) VIEW OF PROBABILITIES.

↳ TENDS TO COMPARE BELIEFS IN ALTERNATIVE POSSIBILITIES, AND TO UPDATE THOSE BELIEFS ON THE BASIS OF NEW DATA.

OBJECTIVITY? → PROBABILISTIC REASONING CAN BE QUITE TRICKY.

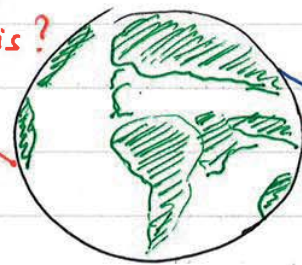
↳ HOW TO TRANSLATE A REAL-WORLD PROBLEM INTO PROBABILITIES

↓  
INVOLVING DIFFICULT CHOICES.

TO WHAT DEGREE  
IS THE WORLD  
WHAT IT IS?

INDEPENDENT  
OF US.

$P(s)$

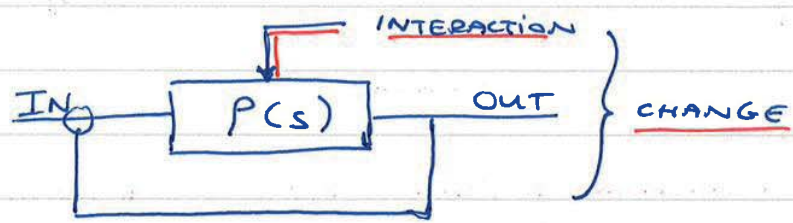


TO WHAT DEGREE IS THE WORLD  
CREATED BY THE OBSERVER  
ACTING UPON THAT  
WORLD?



CONSCIOUSNESS.

SYSTEM:



UNITARY EVOLUTION

KNOWLEDGE

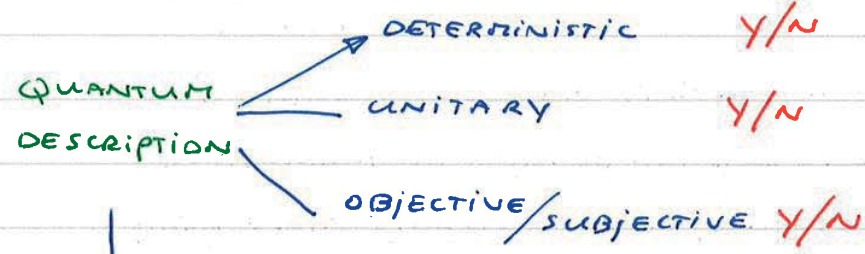
QUANTUM  
MECHANICS

EPISTEMIC  $\rightarrow$  TO THE DEGREE OF ITS VALIDATION  
WHEN WE ACQUIRE  
INFORMATION, WE CHANGE THE STATE  $\rightarrow$  STATE  
OF MIND.

ONTOIC  $\rightarrow$  REAL

OR

$\rightarrow$  OBJECTIVE  
FEATURE OF THE  
WORLD.



oo  
~  
Huh?

$\downarrow$  2 LEVELS OF PROBABILITY, HOW TO INTERPRET REALITY!

$\downarrow$  ASSIGN PROBABILITIES TO STATES.

?

- WHAT DO THEY MEAN
- WHAT DOES THE Q STATE ITSELF MEANS.

\* "OUT THERE" IS FAR LESS CERTAIN

\* THE WORLD IS CERTAINLY FAR LESS "OUT THERE"

♡  
Soul



= CH 22 EACH MORNING IS THE UNIVERSE =

RANDOMNESS  
DISORDER  
DESTRUCTION } EASY. !

INFORMATION  
ORDER  
STRUCTURE } ?



2<sup>ND</sup> LAW OF THERMODYNAMICS

SYSTEM  
Physical

→ RELIABLE

- GALAXIES
- STARS
- PLANETS
- MOUNTAINS
- OCEANS

- INVENT
- SOCIAL STRUCTURES
- TECHN.
- LANGUAGE

DELAY ?

→ PHYSICAL MICROSTATE

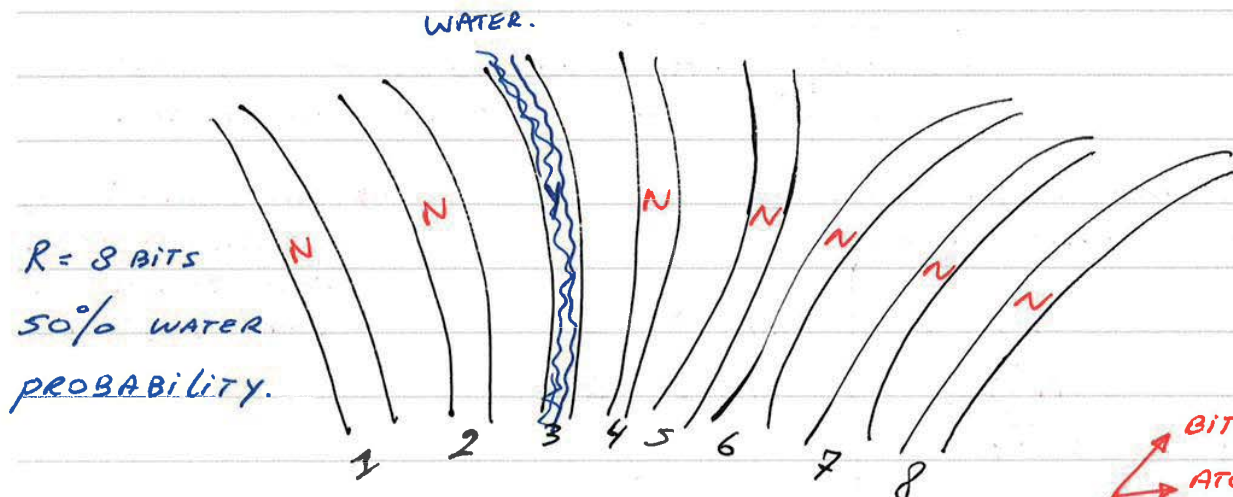
→ INFO PRESERVED BY  
UNITARY PHYSICAL  
EVOLUTION

→ QUANTIFIED BY  
RANDOMNESS.

$$I = R_{\text{MAX}} - R$$

DIGITAL  
ANALOG

↓ SHANNON / GIBBS  
BITS / BYTES.



THIS METHOD APPLIES TO ALL OTHER SYSTEMS.

- BITS
- ATOMS
- MOLECULES
- ETC.

Aiming for World Class Performance

LSS

subjectivity (observer)

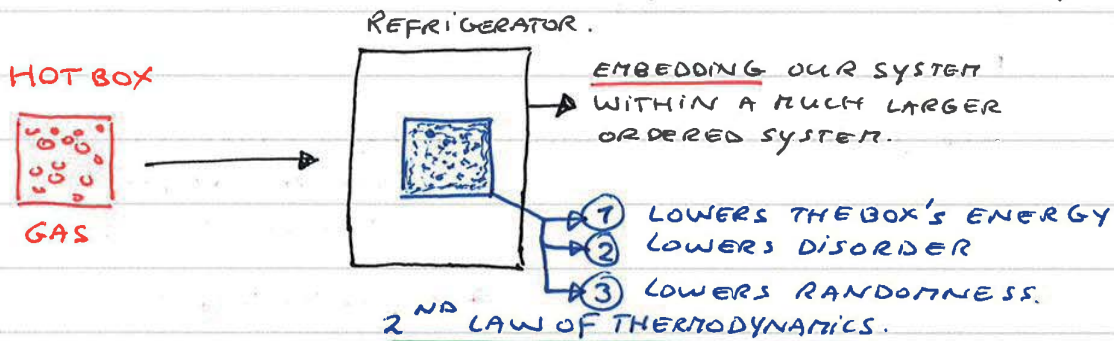
$P(s) \rightarrow$  MICROSTATES (ORDER) INFORMATION

$P(M) \rightarrow$  MACROSTATES (DISORDER) ORDER.

$\rightarrow$  RELATED TO THE DISORDER NUMBER OF MICROSTATES.

$$O = D_{MAX} - D$$

ORDER GOES AWAY AS HIGHLY DISORDERED MACROSTATES TEND TO GROW MORE AND MORE PROBABLE  $\rightarrow$  THINGS GET MESSY.



SATISFYING ENERGY CONSERVATION { SYSTEMS WITH MORE UNIFORM TEMPERATURE ARE MORE DISORDERED THAN THOSE WITH A MIX OF TEMPERATURES.

$$I = R_{MAX} - R.$$

$\Rightarrow$  WE GET A LOT OF INFO. BY COOLING MATTER DOWN.

ANOTHER WAY TO CREATE INFORMATION AND ORDER.



$$R_{MAX} > I >$$

$$D_{MAX} > O >$$

$\rightarrow$  THIS DOESN'T SAY ANYTHING ABOUT THE AMOUNT OR QUALITY OF THE INFO.

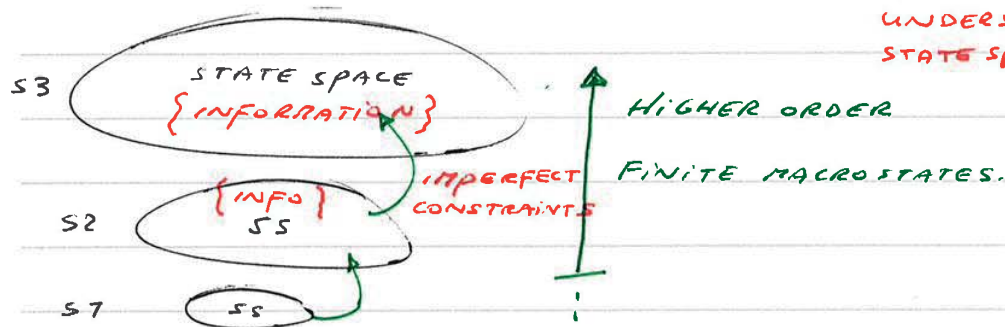
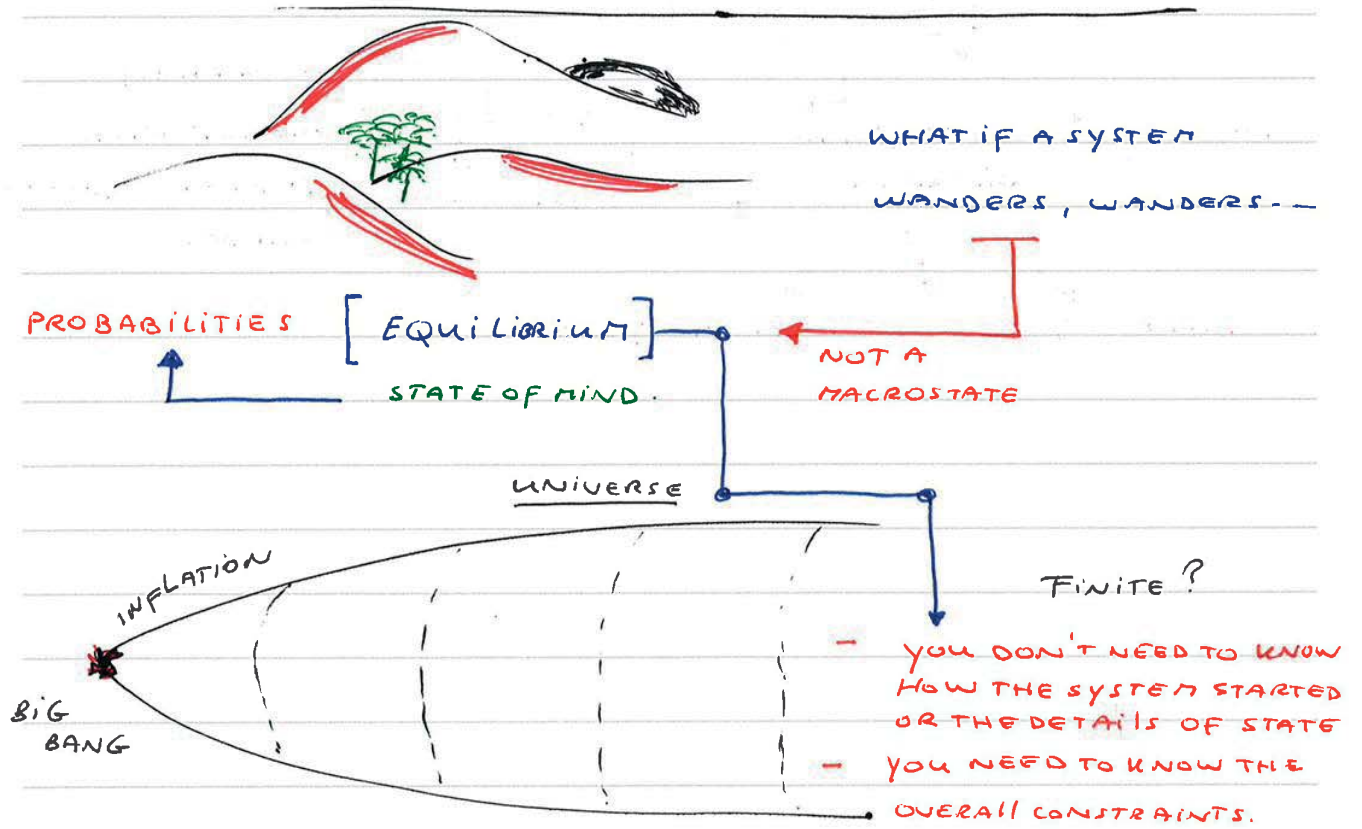
$\rightarrow$  LAW OF EVOLUTION.

ENLARGE STATESPACE OF A SYSTEM.

- MEASURE PROPERTIES.

$$\begin{matrix} O > < R \\ I > < D \end{matrix}$$

# = CH 23 WANDERING IN THE DESERT =



{NO INFORMATION} MIX ALL POSSIBLE STATES!

TOO MANY FOOTPRINTS TOGETHER LOOK LIKE NONE AT ALL.

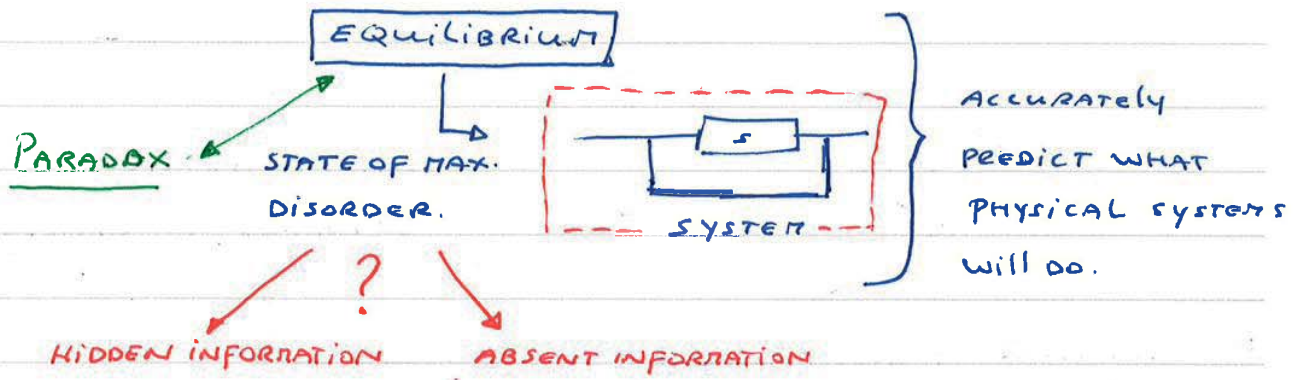
EARTH'S 2D SURFACE WITH CONSTRAINT

Mix all colours AND you GET "BROWN" ALWAYS.

{ INCREASE RANDOMNESS }  
{ DECREASE INFORMATION. }

- FIXED VOLUME
- NUMBER OF PARTICLES
- TOTAL ENERGY / ELECTRIC CHARGE



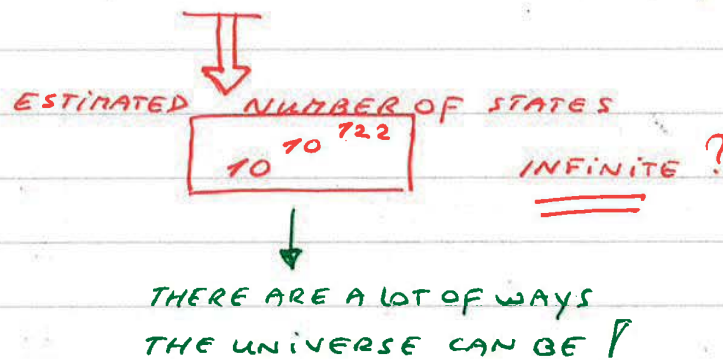


= CH24 A HUNDRED THOUSAND MILLION KALPAS =

KALPA  $\Rightarrow$   IT TAKES TO REALIZE THAT ARE PLAYING THE GAME YOU HAVE PLAYED BEFORE!  
 $10^{(22 \dots)}$  YEARS



THE AGE OF THE OBSERVABLE UNIVERSE  $\rightarrow 10^{10}$  YEARS.!



METAKALPA  $\Rightarrow 10^{10^{(23 \dots)}}$  YEARS.

POINCARÉ'S RECURRENCE THEOREM.

- ① YOU CAN'T ACTUALLY LEAVE THE "DESERT" (FINITE BUT LARGE)
- ② YOU CAN'T EVER CROSS YOUR OWN PATH. (UNITARITY FORBIDS THIS)

$\rightarrow$  A FIXED CLOSED SYSTEM IS GUARANTEED TO EVENTUALLY COME ARBITRARILY CLOSE TO ITS INITIAL STATE

# = CH25 MOUNTAINS AND MIST =

VIEWPOINTS



0

- PATTERNS
- RULES
- OBJECTS
- PATHS
- BEINGS

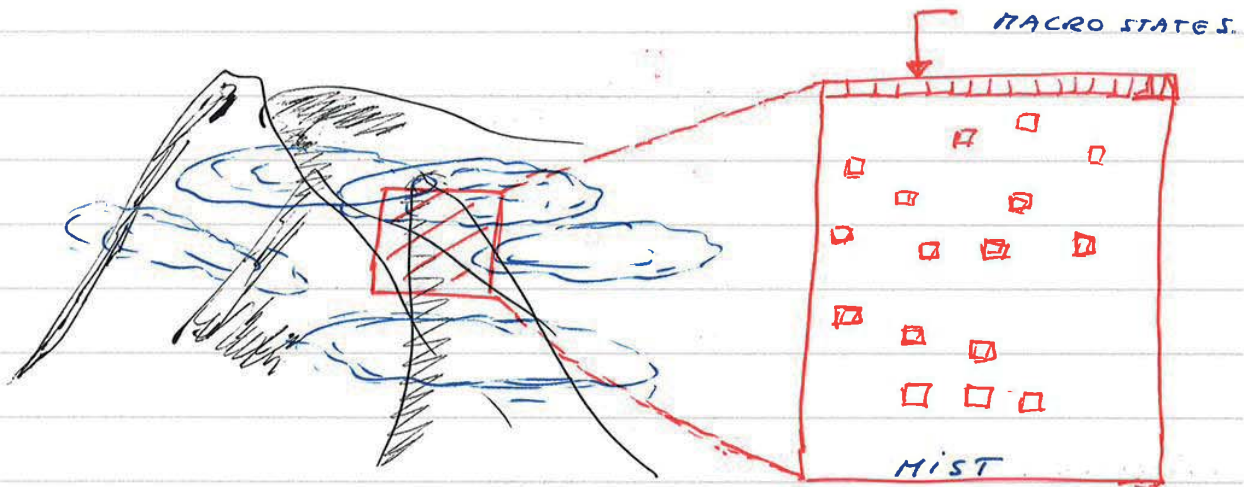
0

PHYSICISTS

- PARTICLES
- SUPERPOSITIONS
- INTERACTIONS
- STATE SPACES
- WAVEFUNCTIONS
- PHYSICAL LAWS
- UNITARY DYNAMICS

EVOLUTION OF  
CLASSICAL SYSTEM

- ① TRACKING A PARTICULAR STATE
- ② TRACKING THE PROBABILITIES  $P(s)$  FOR STATES.
- ③ TRACKING THE PROBABILITIES FOR



Fluid  
MECHANICS

- MEASURE :- DENSITY
- MOMENTUM
  - TEMPERATURE

## PHYSICAL REALITY

- STRONG, SOLID OBJECTIVE
- FEELING
- NEWTONIAN MECHANICS
- CONTINUOUS
- DEFINITE

MACRO

## QUANTUM REALITY

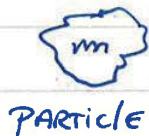
- AMBIGUOUS
- QUASI SUBJECTIVE
- DISCRETE
- STATES
- SUPERPOSITIONS

MICRO/NANO

V. S.

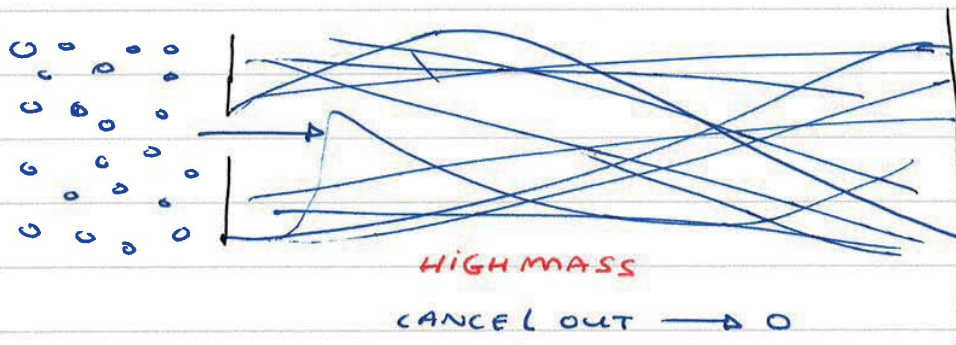


FEYNMANN  $\rightarrow$  ALL POSSIBLE PATHS



THE RATE AT WHICH THEIR  
PHASE CHANGES DEPENDS  
 ON THE PARTICLES MASS.

$\rightarrow$  PHASE EVOLUTION NOT GIVEN BY  
 THE LENGTH OF THE PATH THROUGH  
 SPACE OR SPACE-TIME, BUT BY THE  
ACTION S THAT IS ACCUMULATED ALONG  
 THE PATH.



CLASSICAL PATHS CAN EMERGE FROM A COMBINATION  
 OF MANY POSSIBLE PATHS.

= CH26 HAZY BIFURCATIONS IN DECOHERED HISTORIES =

SELF REFERENTIAL PARADOXES



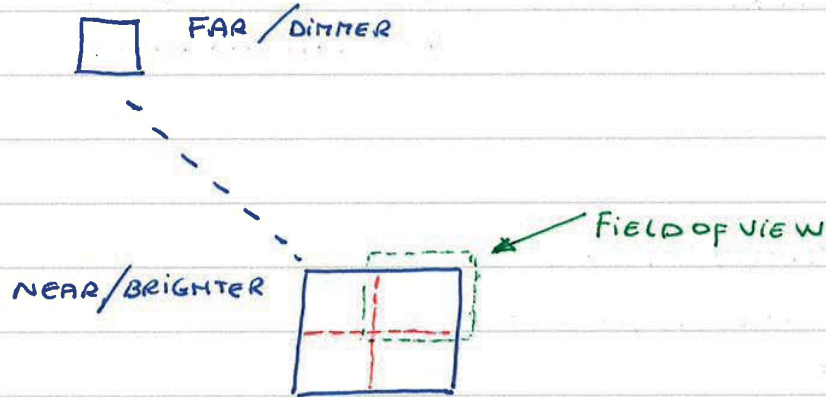
- QUASI-LOCAL QUANTUM HAMILTONIAN

- HILBERT SPACES

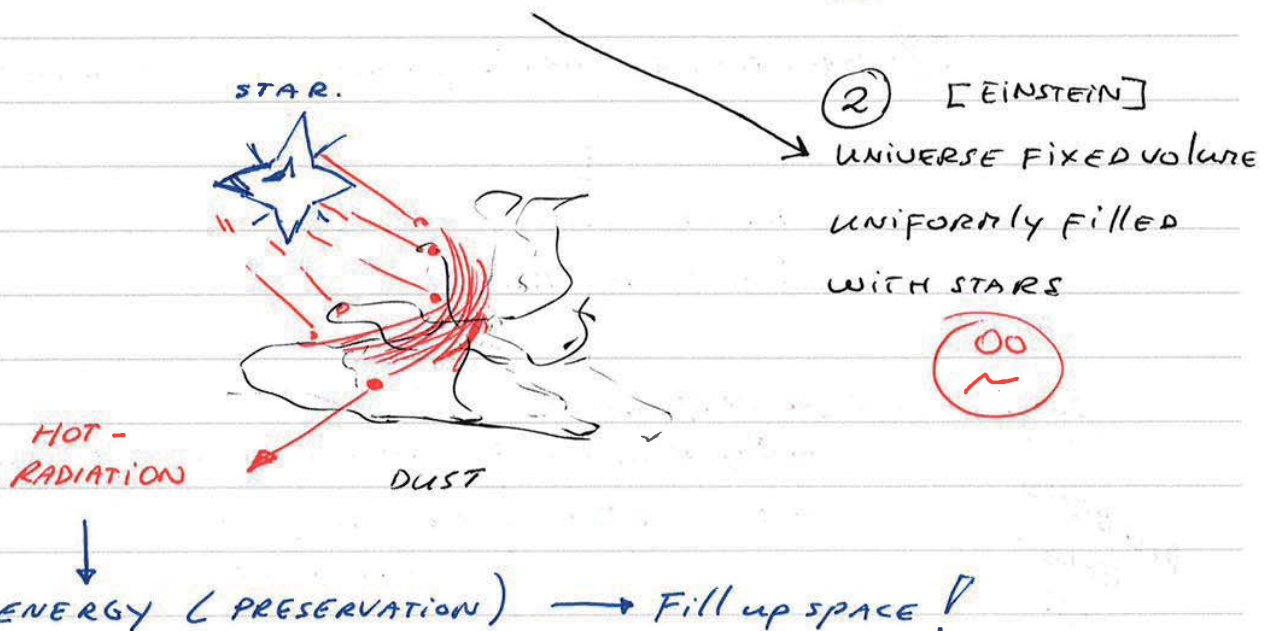
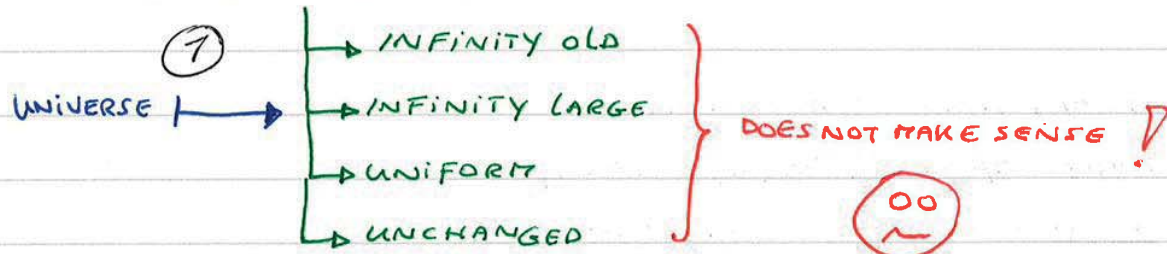


# Lofty Peaks with Endless Views.

= CH27 BENEATH THE FIRMAENT =



PARADOX : HEINRICH WILHELM OLBERS.





- ③ UNCHANGING FINITE } - WE LOOK BACK IN TIME  
 AGED UNIVERSE ? } - COSMIC TIME WITH NO STARS.

How did it start?



NO INFINITE TIME FOR  
 ENERGY TO BUILD UP  
 AND FILL THE SPACE.

- ④ UNIVERSE INFINITE IN TIME  
 EXPANDING (V.S. STAYING STILL)

→ ADDING NEW VOLUME.  
 → CREATING NEW MATTER. } AVERAGE DENSITY  
 CONSTANT BY BALANCING

- ⑤ STEADY STATE COSMOLOGICAL  
 MODEL OF AN INFINITE, ETERNAL  
UNCHANGING AND EXPANDING UNIVERSE.



☺ → RESOLVES OLBER'S PARADOX / SELF CONSISTENT

↓  
 ⚡ ACTUAL OBSERVED UNIVERSE  
 IS NOT LIKE THIS. !

COSMIC NOW :- UNIFORM

BIG BANG  
MODEL

- EXPANDING → MEASURE GALAXIES / SUPER NOVA'S  
 - EVOLVING → DENSITY DECREASING WITH TIME

DOPPLER EFFECT (ELECTRO MAGNETIC)



AWAY



TOWARDS

## EXPANDING

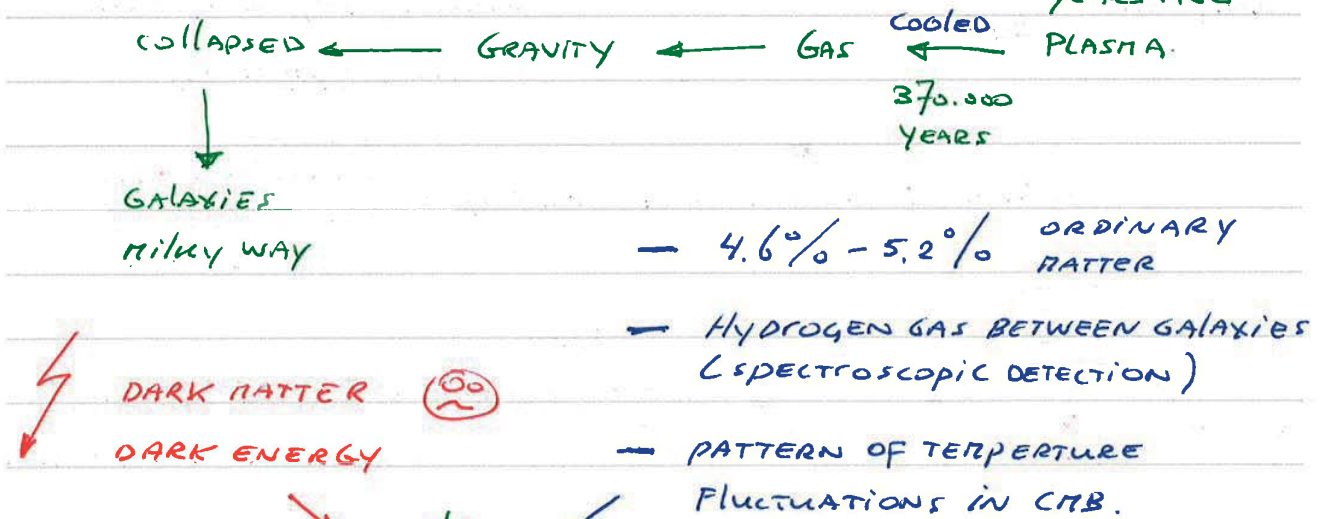
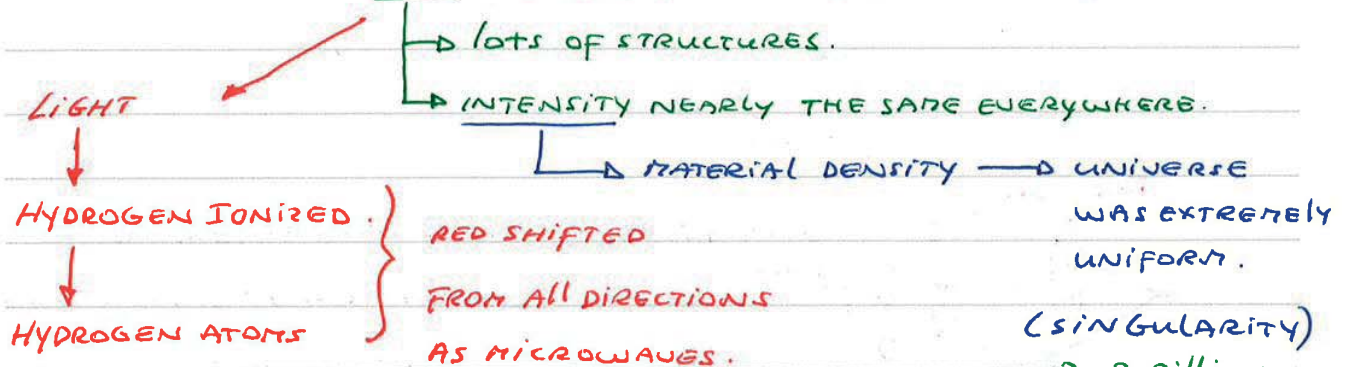
- ① GALAXIES ARE MOVING AWAY FROM US. (RED SHIFTING)
- ② HOW FAST A GALAXY MOVES AWAY INCREASES WITH HOW FAR AWAY THE GALAXY IS. (HUBBLE'S LAW)

EVOLVING: - DISTANT OBJECTS NOT EXPANDING AT THE SAME RATE.

- ABUNDANCE HYDROGEN, HELIUM. (LIGHT ELEMENTS)
- LEFTOVERS FROM A MUCH HOTTER AND DENSER UNIVERSE.

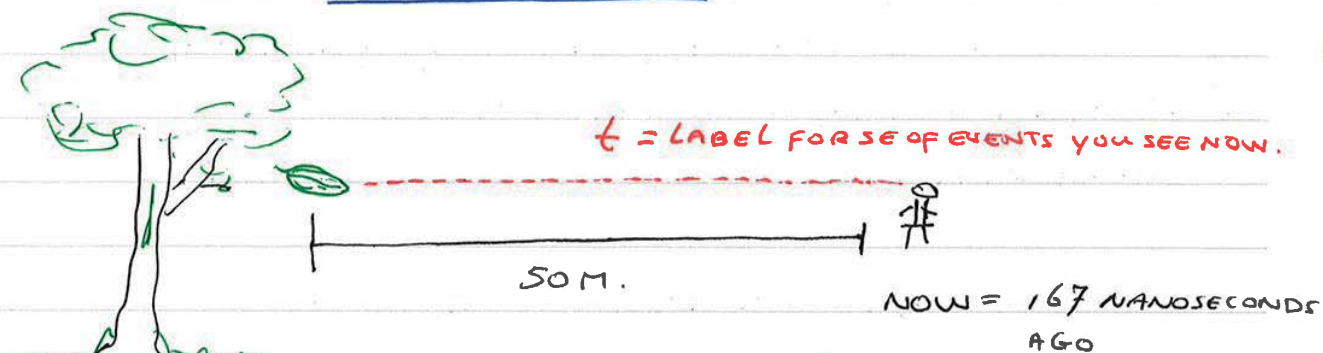
UNIFORM: - LARGE SCALE DISTRIBUTION OF GALAXIES.

- CMB (COSMIC MICROWAVE BACKGROUND)

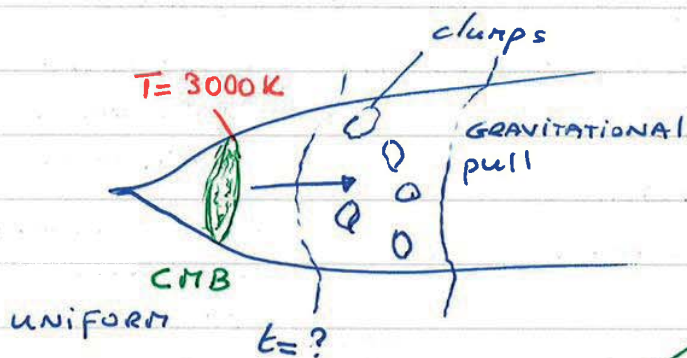
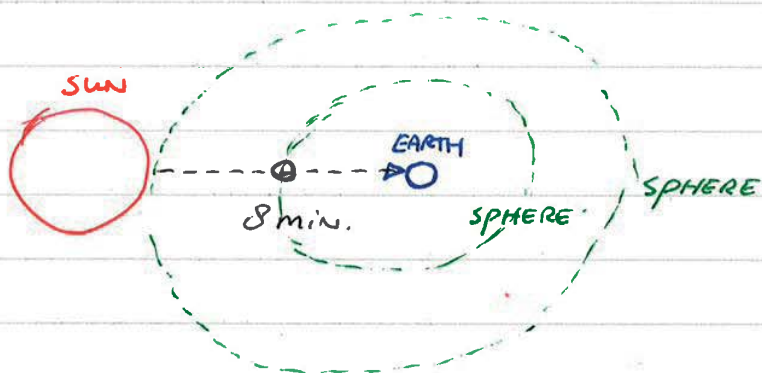


= **BIG BANG MODEL** =

# = CH28 CELESTIAL SPHERES =



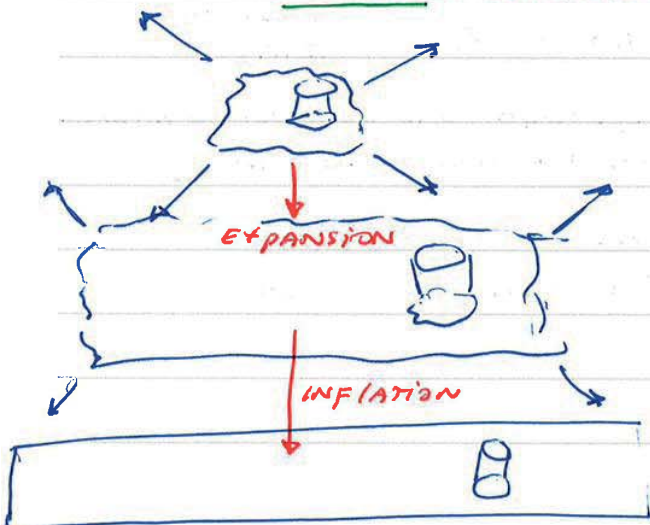
WE SEE THE WORLD AS IT WAS IN THE PAST. !



BIGBANG MODEL TELLS US  
 THAT AT A GIVEN COSMIC AGE  
 ( $t$ ) THE UNIVERSE IS  
 STATISTICALLY UNIFORM  
 IN ITS PROPERTIES.

EINSTEIN: COSMOLOGICAL PRINCIPLE

- AGE
- BRIGHTNESS
- DIMENSIONS
- ABUNDANCE



1980  
ALAN GUTH: UNIVERSE UNDERWENT  
 RAPID AND ACCELERATED  
 EXPANSION

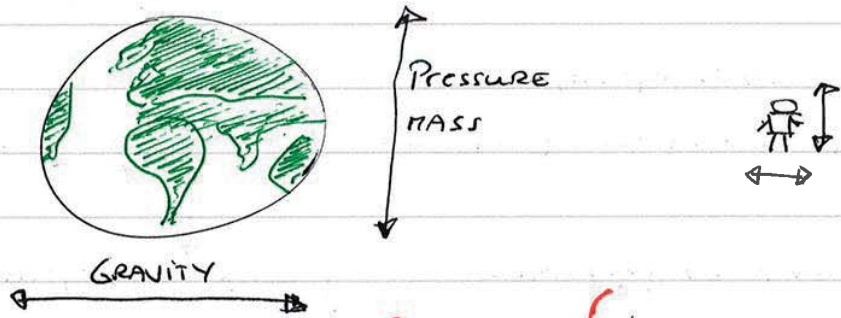


= CH 29 THROUGH THE LOOKING GLASS =

ZENJO'S QUESTION: WHO CLEANS THE UNIVERSE? EXPANSION

WHY ARE PEOPLE OR WORLDS ABOUT THE SIZE THEY ARE?

⚡ SWEET SPOT! BECAUSE OF THE BASIC NUMBERS THAT UNDERLIE THE UNIVERSE!



SPACE IS STRUCTURED.  
(BEND, ---)

PRECISE & PREDICTIVE { LAWS OF PHYSICS DETERMINE THE CHARACTERISTICS.  
NEWTON:  $F = m \times a$ .

OTHER CONSTANTS OF NATURE:

☺

$3 \times 10^8$  m/s  
 $186,000 \frac{\text{miles}}{\text{s}}$

USE VERSIONS THAT ARE UNITLESS.

$c$  = LIGHT OF SPEED  
 $e$  = STRENGTH OF THE ELECTROMAGNETIC FIELD IS (FORCE)  
 $k$  = Boltzmann CONSTANT → ENERGIES TO TEMPERATURES  
 $h$  = PLANCK'S CONSTANT

$$\alpha = \frac{2\pi e^2}{hc} = \dots [-]$$

FINE STRUCTURE CONSTANT

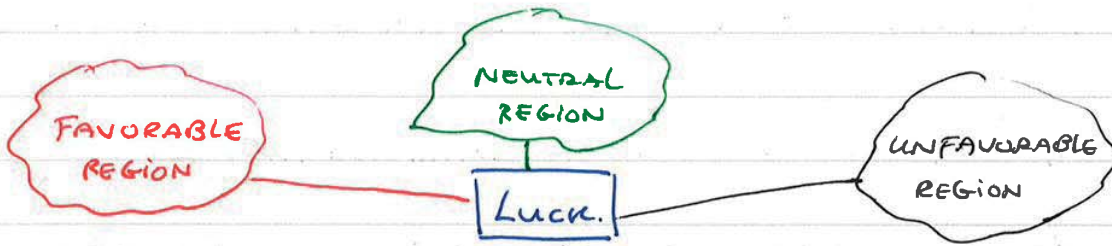
$$\beta = \frac{m_p}{m_e} \approx \frac{\text{PROTON}}{\text{electron}} \approx 1,836$$

26 UNITLESS CONSTANTS

MASS AND LENGTH OF OBJECTS:  
 $\alpha, \alpha_G, \beta$

$$\alpha_G = \frac{G \cdot m_p^2}{hc} = 6 \cdot 10^{-39}$$

# = CH30 THEODICY =



- LAWS OF PHYSICS.

- CONSTANTS OF NATURE ( $\epsilon, G, \beta, \dots$ )

FOR THE UNIVERSE TO BE HOSPITABLE  
TO COMPLEX THINKING BEINGS LIKE  
US, IT SEEMS THAT MANY DIFFERENT  
CONSTANTS OF NATURE MUST HAVE  
MORE OR LESS JUST THE RIGHT VALUES.

↓  
COMPLEXITY OF THE  
WORLD ON THE TINY  
VALUE OF G.



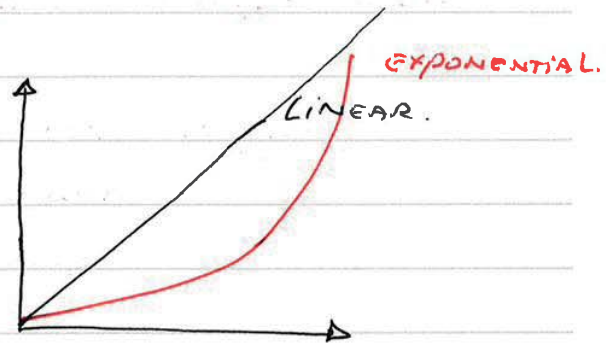
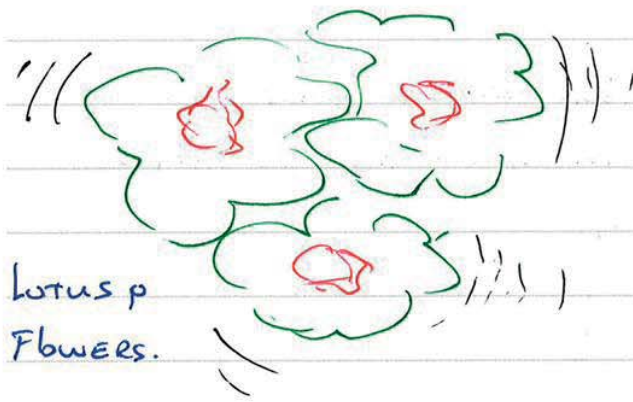
FINE-TUNING OF NATURE

- ① WE ARE REALLY, REALLY LUCKY. ✓
- ② OUR UNIVERSE WAS DELIBERATELY DESIGNED FOR INHABITATION?
  - ↳ GOD?
- ③ LIFE WOULD FIND A WAY.
- ④ UNIVERSE STARTED MANY, MANY TIMES BEFORE?

LEIBNIZ: "BEST OF ALL POSSIBLE WORLDS"

↓  
SIMPLEST IN HYPOTHESES  
↓  
RICHEST IN PHENOMENA

# = CH31 THE FLOATING GARDENS =



= VACUUM ENERGY =

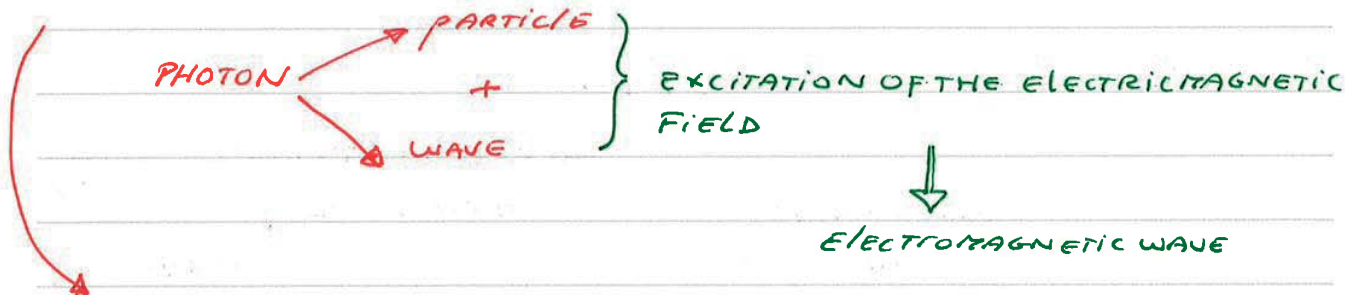
↳ ENERGY CARRIED  
BY SPACE IN THE  
ABSENCE OF ANY  
PARTICLES OR WAVES.  
HUH

EXPANSION/INFLATION

SPACE DOUBLES IN SCALE

ABOUT 85 SUCCESSIVE TIMES.

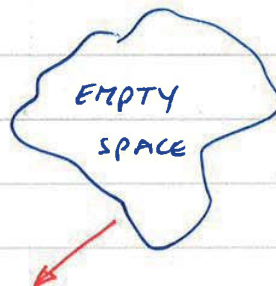
DURING A BRIEF 10<sup>-36</sup> SECOND



ELECTRON

⇒ EXCITATION OF THE ELECTRON FIELD

- NO PHOTONS
- NO PROTONS
- NO ELECTRONS



⇒ ABSENCE OF EXCITATION  
OF FIELDS (NOT WAVING AT ALL)

THE FIELDS ARE STILL THERE

SO A FIELD IN ITS UNEXCITED  
STATE CAN CARRY ENERGY.

(VERY SMALL)

VACUUM ENERGY

DOES NOT DILUTE

NOT EVEN WHEN  
YOU STRETCH IT



THE MORE SPACE  $\rightarrow$  THE MORE VACUUM ENERGY

EINSTEIN: IT FORCES OBJECTS APART IN SPACE-TIME  
AND CAUSES THE SPACE-TIME TO EXPAND  
EXPONENTIALLY.



NEW FIELD "INFLATON"  $\rightarrow$  FORMING A NEARLY

BUT NOT QUITE

UNIFORM

POSTINFLATIONARY  
UNIVERSE.

VACUUM ENERGY:

① CAN EVOLVE  $\rightarrow$  APPROACHING ZERO

② TRANSFORM  $\rightarrow$  PHOTONS AND OTHER  
PARTICLES.

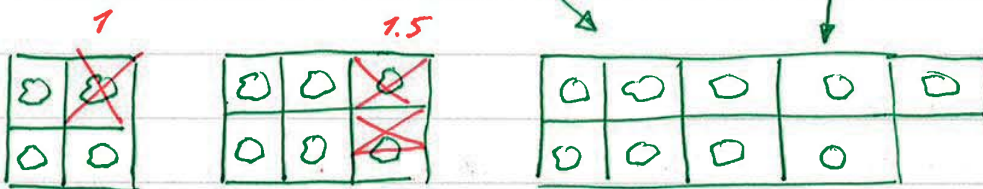
THE BIG BANG IS THE END OF INFLATION

$\rightarrow$  OVERALL INFLATION

CAN NOT END! 

HUH.

EXPONENTIAL  
GROWTH.  
(LOTUS GARDEN)

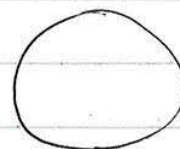


DOUBLES

DOUBLES.

How CAN INFLATION STOP?

$\rightarrow$  BY FORMING A  
BUBBLE



ENDLESS  
NUMBERS  
OF REGIONS

INFLATION NEVER RUNS

OUT OF SPACE TO INFLATE

INTO BECAUSE IT CREATES SPACE

AT A SLOW RATE

ETERNAL INFLATION / EVERLASTING

# = CH 32 THE PAINTING IN THE CAVE =

SOUL

MIND (CREATES)

HEAVEN

HELL

↓  
AWARENESS

SUBCONSCIOUSNESS  
(AUTOPILOT)

CONSCIOUSNESS

OBSERVABLE UNIVERSE (ACCESSIBLE) TO TELESCOPES, IS ABOUT  
90 BILLION LIGHT-YEARS ACROSS.

↳ INFINITESIMAL SUBSET OF THE MULTIVERSE

ETERNAL INFLATION (MULTIVERSE) → THE UNIVERSE MAY BE DIZZYLINGLY  
LARGER AND MORE COMPLEX THAN

THE UNIVERSE WE CAN OBSERVE.

SIZE

DIVERSE  
IN PROPERTY

↓ = FINE-STRUCTURE CONSTANT → STRENGTH OF THE ELECTRO-  
MAGNETIC FORCE

↳ HARD-CODED INTO THE UNIVERSE

THEODORE KALUZA

+

OSCAR KLEIN



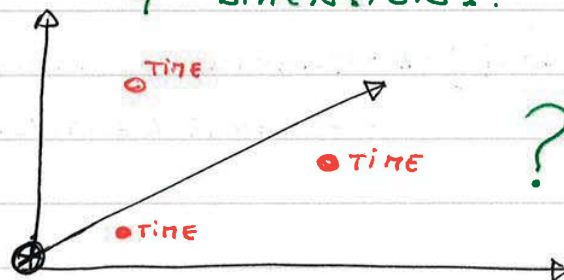
STRING THEORY  
( '90, '80 )

EINSTEIN  
(GRAVITY)

+

MAXWELL  
(ELECTROMAGNETISM)

4-DIMENSIONS.



⊗ = RADIUS OF THE TINY "TIME" CIRCLE

FROM CONSTANT → DYNAMICS → FIELD  
VARY ACROSS SPACE-TIME

Kaluza - Klein THEORY  $\Rightarrow$  STRING THEORY

↓  
3 SPATIAL DIMENSIONS.

+

6 OR 7 SMALL DIMENSIONS / CIRCLES



HUNDREDS  
OF  
FIELDS.

HUNDREDS  
OF  
PARAMETERS

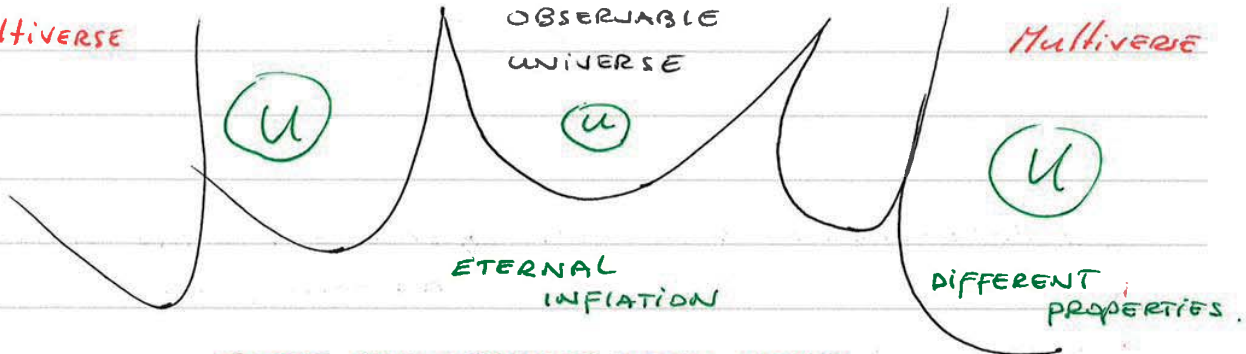
VERY COMPLEX GEOMETRIC  
STRUCTURE.

DESCRIBE



α + MANY MORE CONSTANTS FROM THE  
STANDARD MODEL OF PARTICLE PHYSICS.

Multiverse



SOME, AND PERHAPS VERY, VERY  
VERY FEW OF THE UNIVERSES  
CONTAIN SENTIENT LIFE / INHABITANTS.

STRING THEORY

$\Rightarrow$  • QUANTUM MECHANICS

• GENERAL RELATIVITY

UNIVERSAL

FUNCTIONING IN THE  
SAME WAY ACROSS ALL  
SPACE AND TIME.

CAN GIVE RISE  
TO A MULTIVERSE



DHARMA

OVERARCHING SET  
OF PHYSICAL LAWS  
HOLDS AT VERY HIGH  
ENERGY SCALES.





- ② MEASURE THE RELATIVE FREQUENCIES OF DIFFERENT TYPES OF ELEMENTS IN A SET.  $\rightarrow$  SET MUST BE ARRANGED IN SOME PRESCRIBED MANNER.

THE RATIO OF SQUARED INTEGERS TO INTEGERS } "NATURAL"  
APPROACHES ZERO. ORDERING

IF ETERNAL INFLATION = TRUE  $\rightarrow$



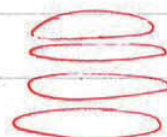
ADDITIONAL  
AMBIGUITY

INFINITE NUMBERS OF  
POSTINFLATIONARY REGIONS.

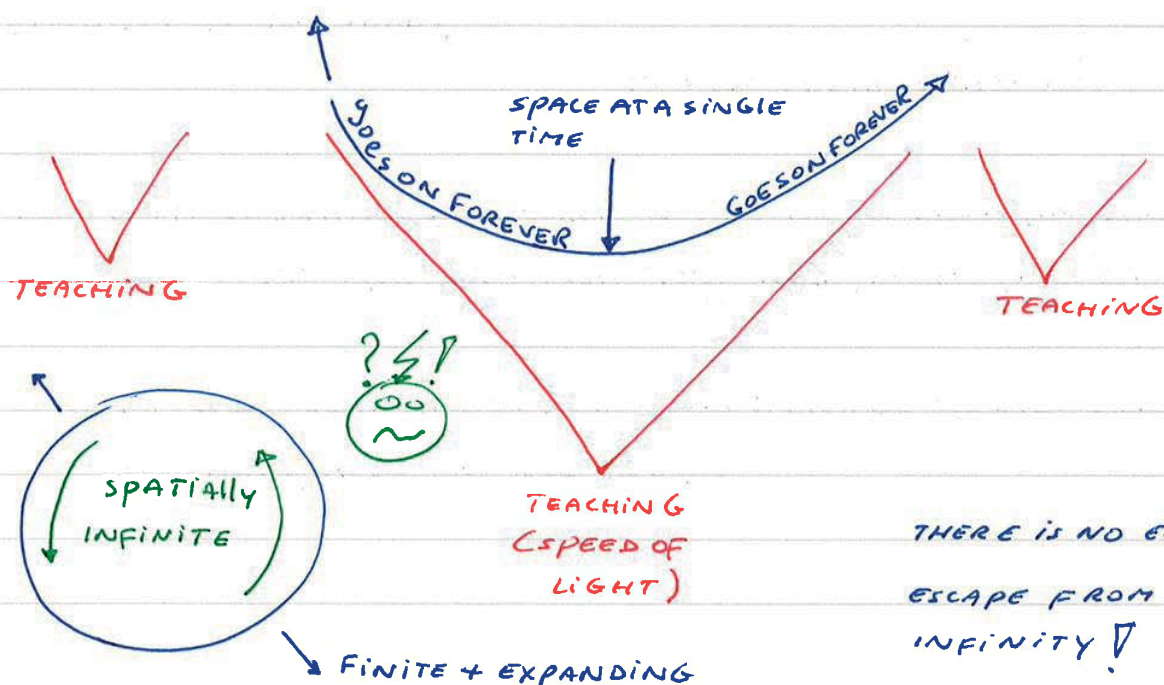
MEASURE  
RELATIVE  
FREQUENCIES  
(PROPERTIES)

TIME AMBIGUITY OF GENERAL RELATIVITY.

SPACE-TIME SLICED UP INTO SURFACES  
OF SIMULTANEITY.



How DO WE DEFINE NOW !

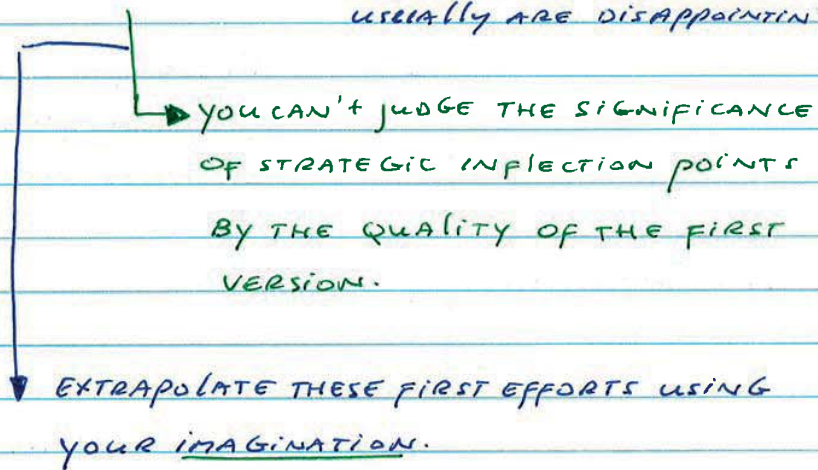




## PETER DRUCKER : DEF. OF AN ENTREPRENEUR.

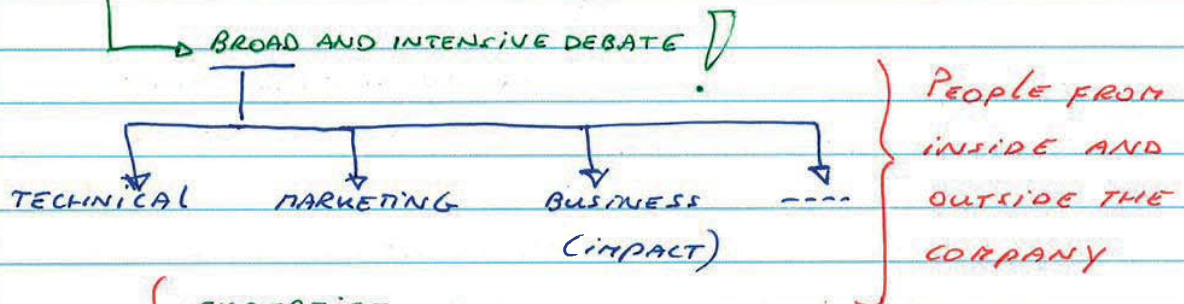
SOMEONE WHO MOVES RESOURCES  
FROM AREAS OF LOWER PRODUCTIVITY  
AND YIELD TO AREAS OF HIGHER  
PRODUCTIVITY AND YIELD !

THE TRAP OF THE FIRST VISION ⇒ FIRST VERSIONS OF MOST THINGS  
USUALLY ARE DISAPPOINTING.



HOW?

DISCIPLINE YOURSELF TO THINK  
THINGS THROUGH → LONGER TERM POTENTIAL  
OF /AND SIGNIFICANCE.



BIASES { EXPERTISE  
+ INTERESTS  
+ EXPERIENCE

EVERYBODY IS INVITED  
CLEARLY AND FORCEFULLY.

ALL OPINIONS HAVE VALUE  
IN SHAPING THE RIGHT  
ANSWER.

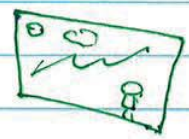


{ KNOWLEDGE POWER + ORGANIZATIONAL POWER }

10

STRATEGIC RESULTS.

DEBATES ARE LIKE A PROCESS THROUGH WHICH A PHOTOGRAPHER SHARPENS THE CONTRAST WHEN DEVELOPING A PRINT



⚡ INACTION MIGHT RESULT TO A BAD OUTCOME.

SHARPEN YOUR VIEW BY BRINGING IN ARGUMENTS AND VIEWS AND FACTS.

DOING NOTHING IS NOT AN OPTION.

\* How to use DATA?

ALL TOO OFTEN, PEOPLE SUBSTITUTE OPINIONS FOR FACTS AND EMOTIONS FOR ANALYSIS.

STRATEGIC INFLECTION POINTS ARE THE FUTURE.

DATA IS ABOUT THE PAST.

WHEN DEALING WITH EMERGING TRENDS YOU MAY VERY WELL HAVE TO GO AGAINST RATIONAL EXTRAPOLATION OF DATA AND RELY INSTEAD ON ANECDOTAL OBSERVATIONS AND YOUR INSTINCTS.

> SPEAK YOUR MINDS WITHOUT FEAR OF PUNISHMENT <

FEAR PLAYS A MAJOR ROLE IN CREATING AND MAINTAINING SUCH PASSION.

W. EDWARDS DEMING (QUALITY GURU)

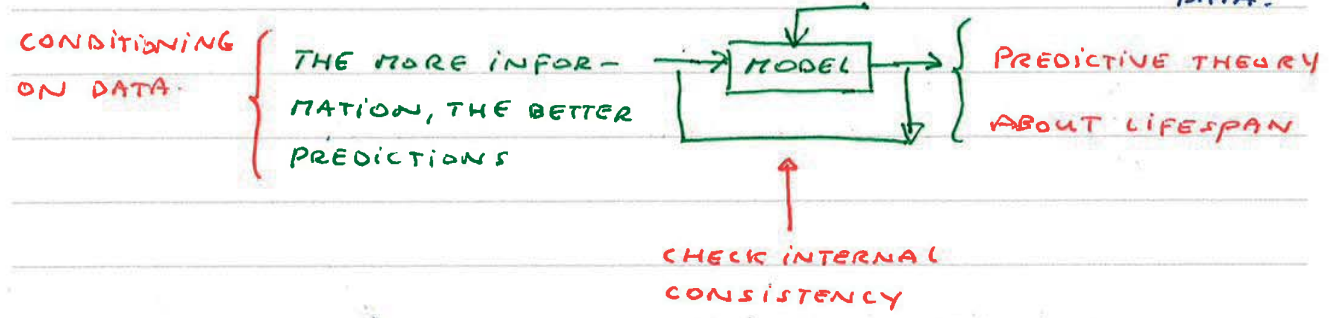
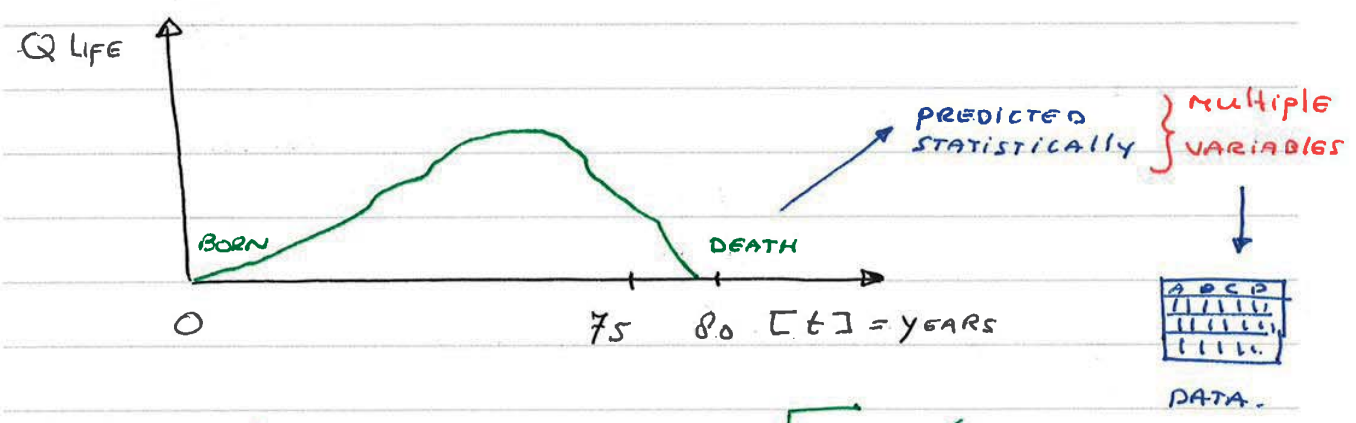
"NEVER SHOOT THE MESSENGER"

FEAR HELPS TO KEEP PEOPLE ALERT. } CAN BE THE OPPOSITE OF COMPLACENCY

IT SHARPENS THE SURVIVAL INSTINCTS. } IT'S PART OF BEING SUCCESSFUL.

# = CH34 SICKNESS UNTO DEATH =

IT IS VERY, VERY RARE THAT ONE ATTAINS  
THE HUMAN STATE - BHUDDHA.

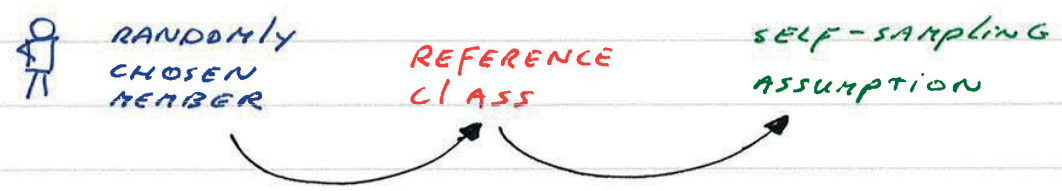


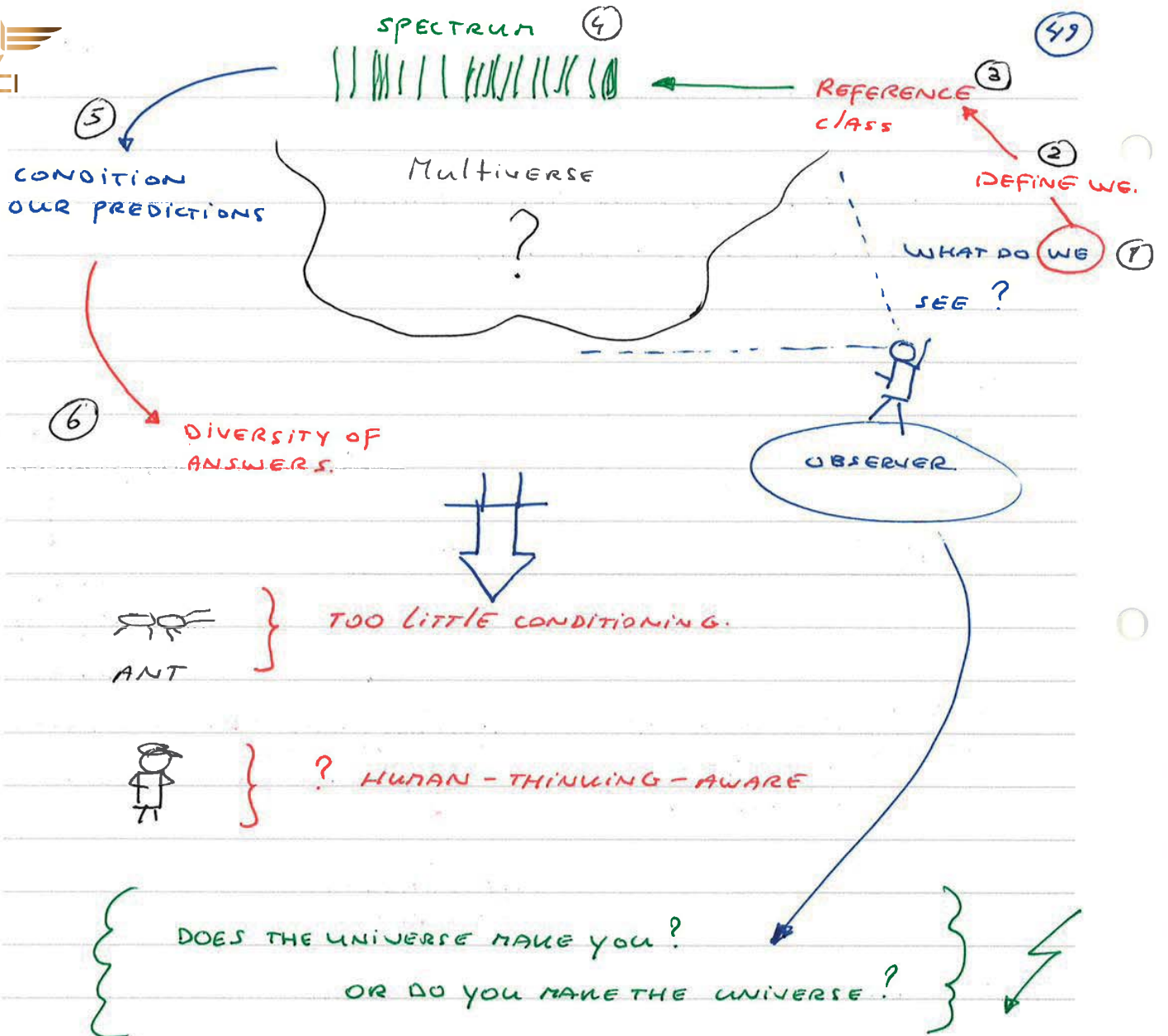
i.e.: DREAMING V.S. AWAKE

- OBSERVATIONS
- COMPARE
- REASON
- EVALUATE

(PAST - FUTURE)

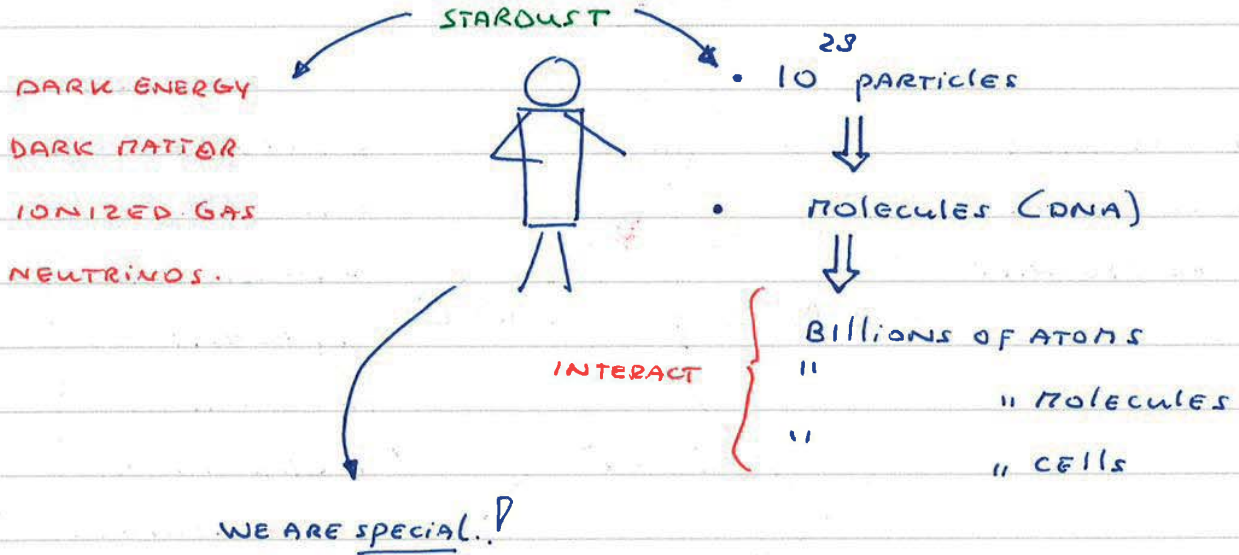
ASSUME LESS.







= CH35 AN HONORED GUEST =

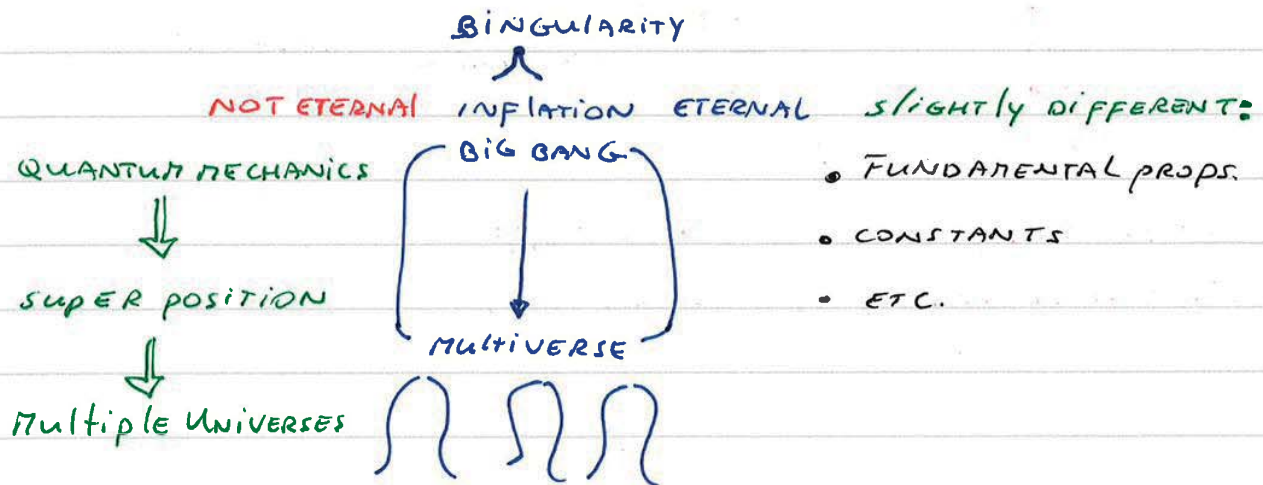


- WE THINK, IMAGINE, FEEL, PREDICT, EXPERIENCE, EVOLVE, LEARN  
WONDER

WHY WOULD YOU CREATE SOMETHING AND NOT LOOK BACK  
AT IT? DOES NOT MAKE SENSE.

↳ SO THERE MUST BE A REASON  
WHY WE MATTER!

↳ AND EXIST



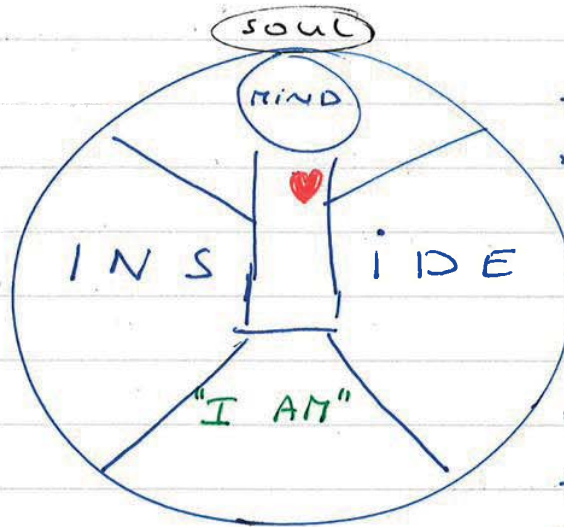
① WHAT DOES IT MEAN FOR US TO EXIST?

② WHAT DOES IT MEAN FOR SOMETHING OTHER THAN US TO EXIST?

PS

= CH36 WHO SLEEPS, PERCHANCE =  
TO DREAM?

- \* THE ACTOR
- \* SINGULAR
- PROTAGONIST



- \* THE EXPERIENCER
- \* THOUGHTS
- \* DECISIONS.
- \* PERCEPTIONS.
- \* SENSATIONS.
- \* DISPOSITIONS.
- \* CONSCIOUSNESS
- \* COGNITION

AGGREGATES

THE YOU FEELS DISTINCT -- UNITARY

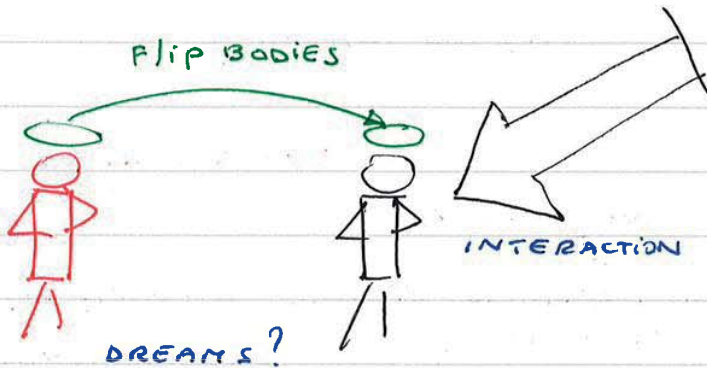


YOU ARE ALWAYS YOU  
NOT HALFWAY OR  
SOMETIMES.



SINGULAR.?

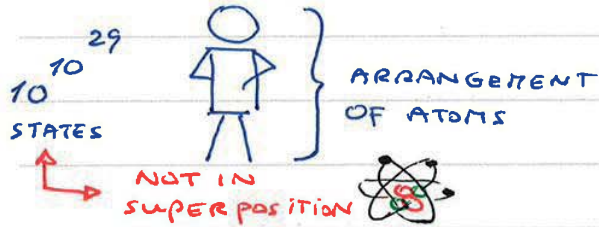
SEPERABLE FROM  
ALL THE PROCESSES  
IN YOUR MIND,  
IT COULD BE  
DETACHED FROM ALL  
THOSE THINGS.



IN A DREAM YOU ARE OFTEN CUT OFF  
FROM MOST MEMORY OF YOUR DAILY LIFE.

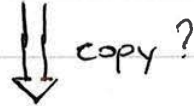
# = CH37 A SIMPLE ARRANGEMENT OF = SOME BITS

METAKALPA



- SOUL  
? - CONSCIOUSNESS  
- INNER LIFE

TELEPORTATION



PHYSICAL STATE

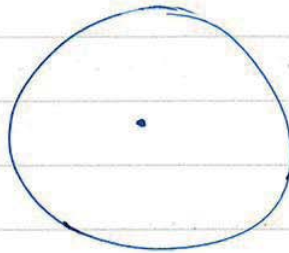
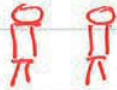
MENTAL STATE

Duplicate

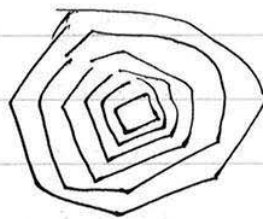
THINGS THAT WILL NEVER HAPPEN

DIFFICULT + IN PRINCIPLE IMPOSSIBLE

WHAT ABOUT TWINS?

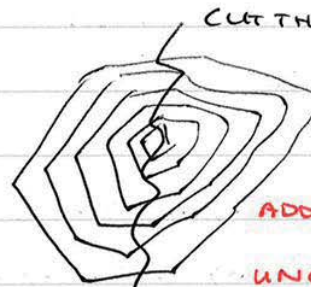


A SPHERE ONLY HAS ONE CENTER.



WEB.

SYSTEM WITH A QUANTUM STATE



WEB

MIXTURE OF QUANTUM STATE

CUT THE WEB.

ADDED AN  
ADDITIONAL  
UNCERTAINTY

NO-CLONING THEOREM

CANNOT BE CLONED INTO ANOTHER SYSTEM WITH THE SAME QUANTUM STATE.

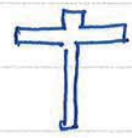
! { SO A PERFECT, LITERAL COPY IS PERFECTLY, LITERALLY IMPOSSIBLE



# = CH38 WHAT SURVIVES =



BORN



DEATH.

THERE IS NO DEATH.

THE MIND IS NOT SEPERATE FROM THE BODY.

CAN YOU EXIST AND NOT EXIST?

DECOHERE  $\Rightarrow$  QUANTUM ASPECTS OF THE SUPER POSITION  
BECOME UNDETECTABLY HIDDEN

$\hookrightarrow$  ALL BRANCHES OF THE SUPER POSITION PERSIST.

Epistemic

SCHRÖDINGER

ONTIC

MATHEMATICAL FORMALISM

MATHEMATICAL OUTCOMES

V.S.  
REALITY

CORRESPOND TO ACTUAL  
REALITY.

PHYSICAL REALITY IS NOT WHOLLY  
DESCRIBABLE BY MATHEMATICS

ONE TO ONE CORRESPON-  
DENCE IS MAINTAINED.

$\Downarrow$   
SUPERPOSITION REPRESENTS  
ONE REAL PHYSICAL OUTCOME

WILD MULTITUDE OF  
PARALLEL AND EQUALLY  
REAL BRANCHES

$\Downarrow$   
OBSERVER  $\left\{ \begin{array}{l} \text{WHO?} \\ \text{HOW?} \end{array} \right.$



# QUANTUM MECHANICS.

→ QUANTUM PHENOMENA (INTERFERENCE)  
ARE UNOBSERVABLE FOR TRULY MACROSCOPIC  
OBJECTS.

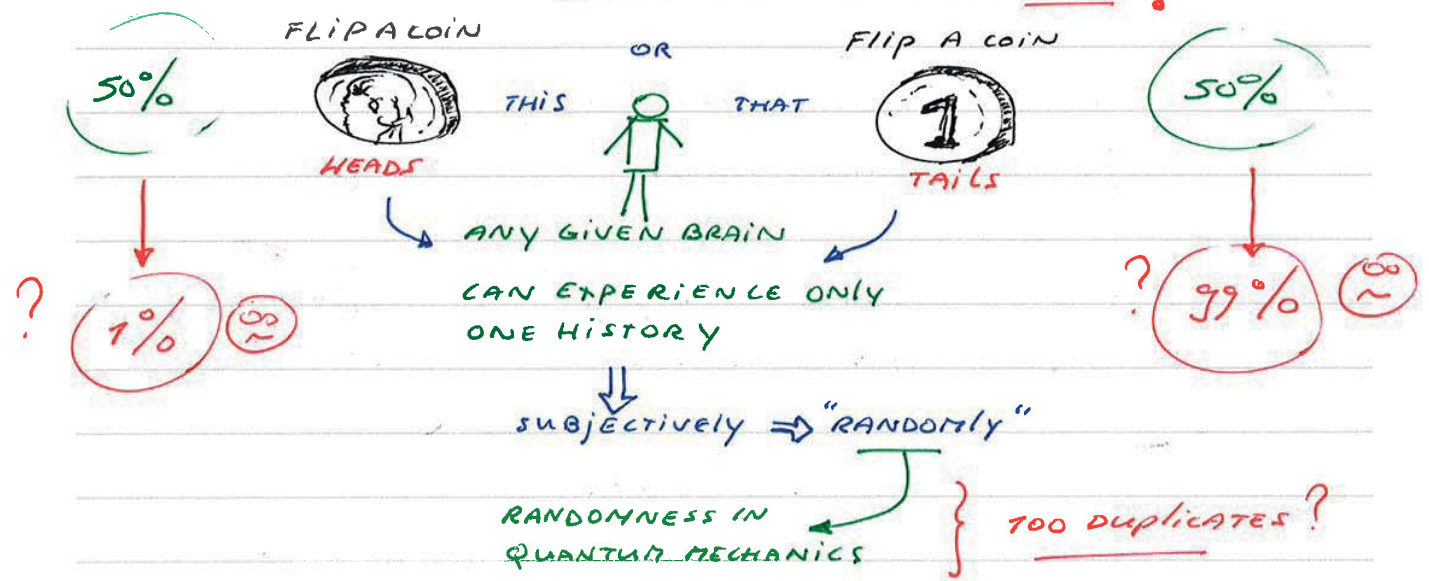
→ DECLHERENCE → EXTREMELY EFFECTIVE FOR  
SYSTEMS LARGER THAN JUST  
A FEW PARTICLES.

⚡ you NEVER "OBSERVE" A LARGE  
SYSTEM IN TWO STATES AT ONCE !

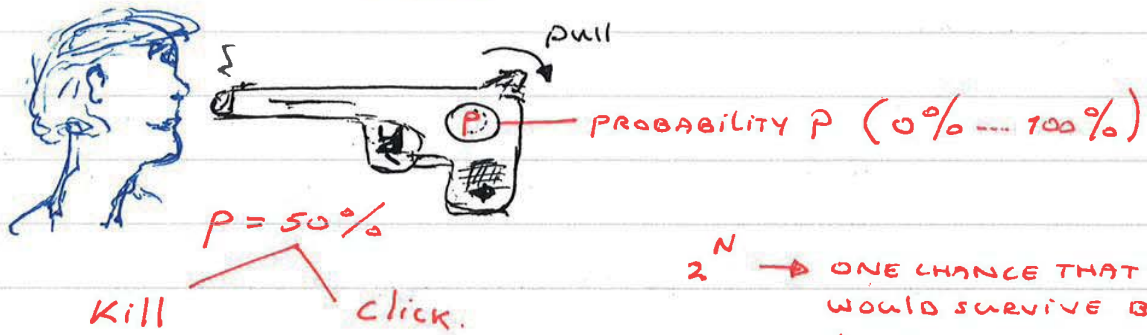
	MATHEMATICALLY		PHYSICALLY	
①	X		✓	OBSERVE
②	✓		X	OBSERVE
③	✓		✓	OBSERVE

HOW TO DISTINGUISH BETWEEN THEM ?

your ALMOST CERTAIN DEATH. !



# QUANTUM GUN BY MAX TEGMARK. (MULTI WORLD)



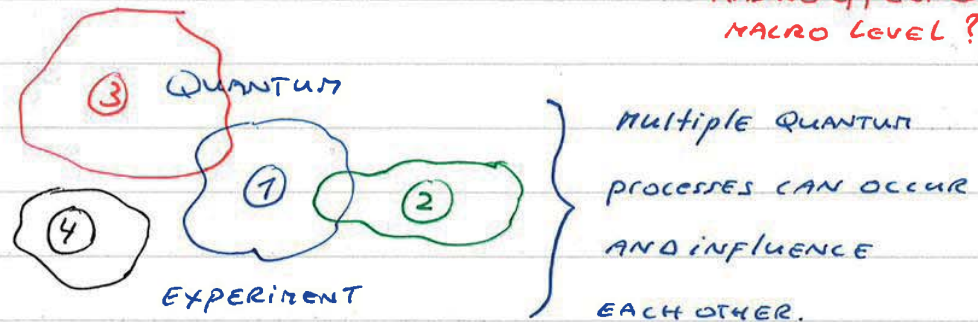
$2^N \rightarrow$  ONE CHANCE THAT YOU WOULD SURVIVE BY LUCK.

CONSCIOUS EXPERIENCE TIED TO YOUR PHYSICAL BODY.

↓  
YOU HAVE BEEN DUPLICATED.  $\Rightarrow$  WITH ONE DUPLICATE INSTANTLY TERMINATED.

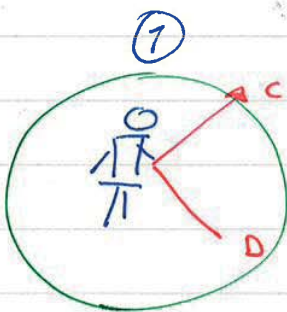
you will always survive a quantum gun! How?

BECAUSE QUANTUM HAS NO EFFECT ON MACRO LEVEL?

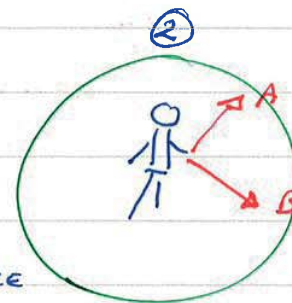


CONSCIOUSNESS IS NOT A BINARY STATE!

Multiple Worlds.

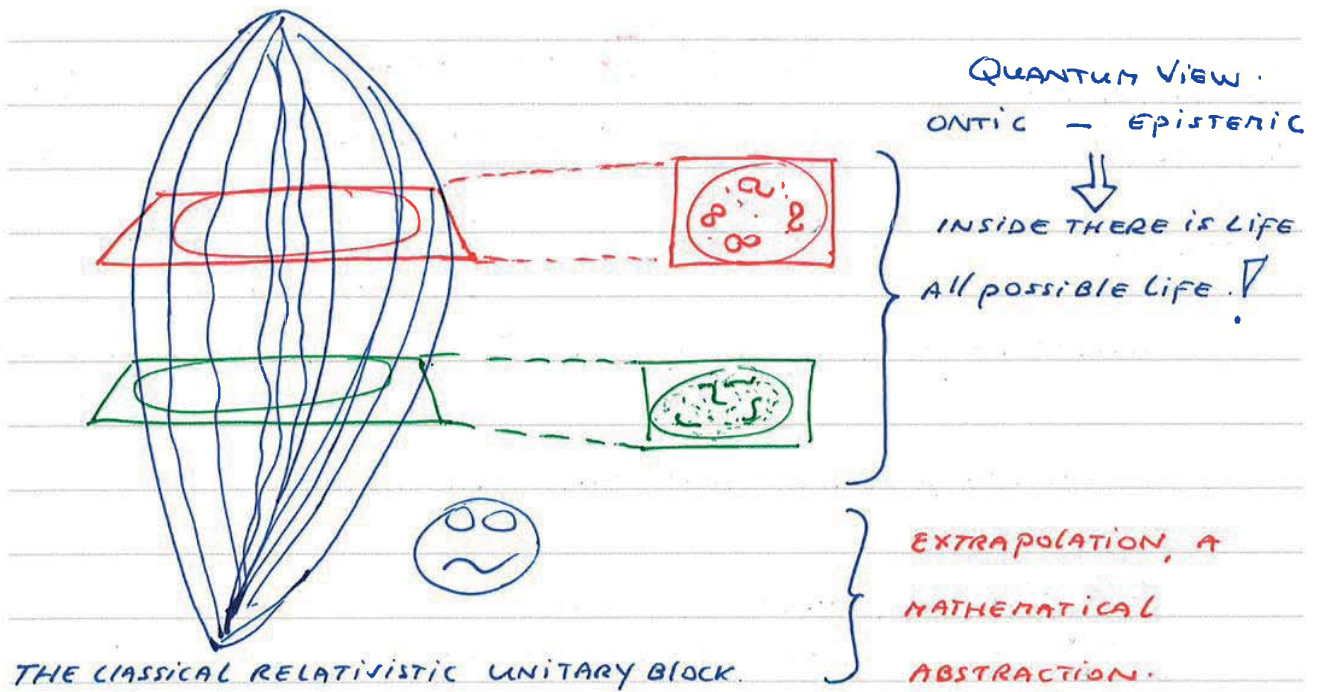


WHICH ONE IS you?  
AND HOW DO THEY INTERACT OR INFLUENCE EACH OTHER WHEN THEY CONTINUOUSLY MAKE CHOICES?





= CH 39 THE ICE GARDEN =



WHO OBSERVES THE UNIVERSE AS A WHOLE?  $\Rightarrow$  NOBODY

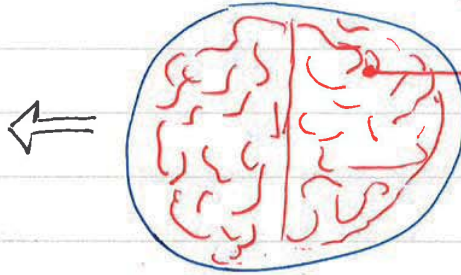
$\Downarrow$   
WHICH REALITY WHICH POSSIBLE OUTCOME?

= CH 40 AN UNFETTERED MIND =

VISUAL, HEARING, FEELING, SMELLING, TASTE

CONNECTED TO  
THE BODY?

↓  
CONTAINED



BRAIN

MIND

- CONSCIOUSNESS
- AWARENESS
- THINKING

} LINKED  
TO WHAT?

WHEN, THEN, AND WHEN, DOES "YOUR" MIND BEGIN AND END?

COGNITIVE PROCESSES AINT (ALL) IN THE HEAD!



- INDEPENDENT CREATURES.
- OUR MINDS ARE ISOLATED ENTITIES
- UNRELIABLE CONNECTIONS TO MOST OTHERS (LOW BAND - WITH)
- BASE LEVEL UNBRIDGEABLE DIVIDE

SOCIAL CONTEXT (THOUSAND OR MILLIONS OF YEARS) → {INERTIA}  
↓  
THINKING, TOOLS, LANGUAGE, INTELLECTUAL STRUCTURES.

↓  
WE CAN'T TAKE SOCIETY OUT OF US!

BREAKTHROUGHS ⇒ HOW COME CERTAIN TIMES DID NOT DELIVER  
(BY THINKERS) BREAKTHROUGHS?

↓  
{Tools}  
↓  
LAPTOP, INTERNET (SAND & STICKS)

↓  
- MATHEMATICS WAS INVENTED JUST ONCE → BY ANCIENT GREEKS.  
- PHYSICS BY GALILEO AND NEWTON.

EXTERNAL GROUPS. { ↓ OUR COGNITION HAS EXTENDED MORE AND MORE  
BEYOND OUR BODIES.

# WHAT DOES MIND DO? (MENTAL LIFE)

SP

## • INTELLIGENCE

• MUST OBSERVE  
↳ GATHER DATA

• MUST LEARN

• SHOULD COMPUTE

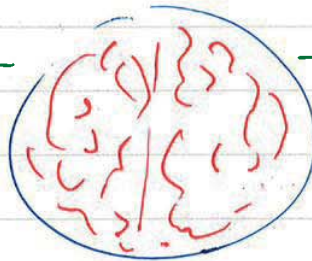
↳ PROCESS INFORMATION

• MUST PREDICT

↳ POSSIBLE ACTIONS

• MUST OPTIMIZE

↳ COMPARE OUTCOMES TO DESIRED GOALS.



ORGANISM OR SYSTEM TO SUCCESSFULLY ACCOMPLISH GOALS.



- BIOLOGICAL

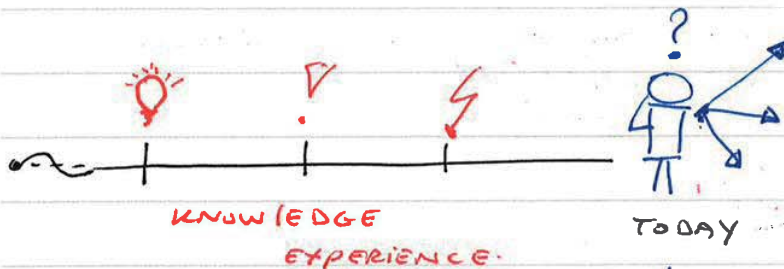
- ORGANIZATIONAL

- PERSONAL

- SOCIETAL



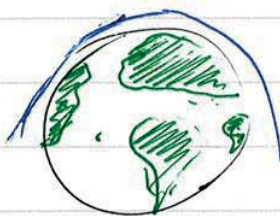
INTELLIGENCE IS A PROCESS THAN A THING. → VERY, VERY EXTENDED IN SPACE AND TIME



YOU USE KNOWLEDGE FROM ALL OVER THE GLOBE, THOUSANDS OF YEARS OLD.

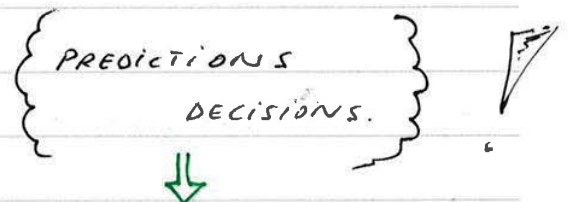
Tools:   

NEURAL ARCHITECTURE



EARTH BIOSPHERE

INTERACTION



## • FEELINGS + EXPERIENCES

• VISCERAL

• INTUITIVE SENSE

• "GUT FEELING"

GENERAL?  
AI

CAUSAL NETWORKS INVOLVING MIND ARE THE RICHEST OF ALL.

Aiming for World Class Performance

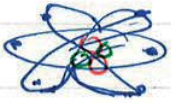
LSS

(HUMAN) BUDDHA → VEDIC RELIGIONS → INDIA. BEGIN - END HIS MIND IS NOW PART OF YOURS AND YOURS PART OF HIS



# = CH 41 THE SIMULATION ARGUMENT =

WHAT IS A HUMAN?



Collection of ATOMS  
Following LAWS

+



FORMATION

INFORMATION  
PROCESSING SYSTEM

- DREAM
- HALLUCINATION
- ILLUSION
- ?

?

⇒ ALGORITHM. ⇒ PREDICTION

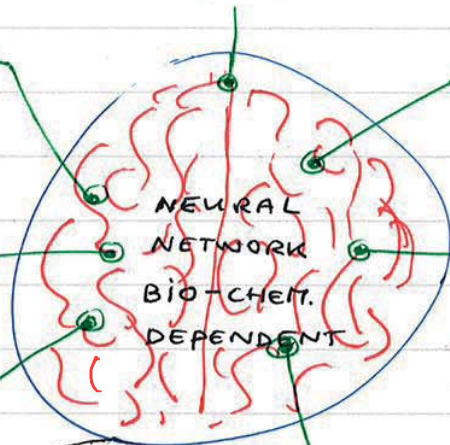
↓  
SIMULATION?

ROBUST OPTIMIZATION

MASSIVE  
PARALLELISM

CHAOTIC  
DYNAMICS

CHAOTIC



LOOPING FEEDBACK

NON-LINEAR

HIERARCHICAL  
STRUCTURES

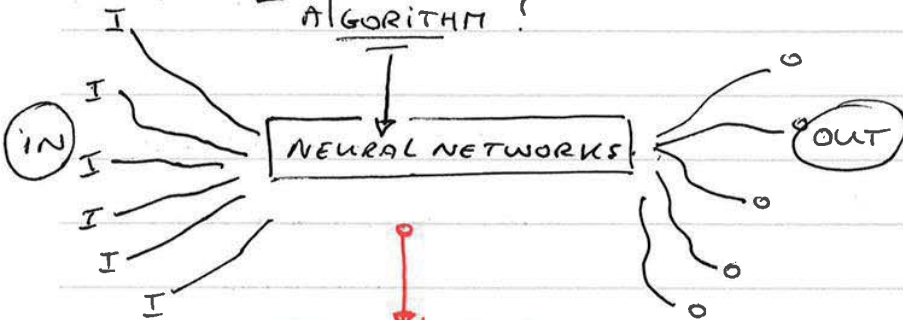
NEURAL  
NETWORK  
BIO-CHEM.  
DEPENDENT

THE BRAIN FUNCTIONS : DESPITE UNCERTAINTY

- RANDOMNESS

- IMPERFECT I/O (SENSES)

ALGORITHM?



HUMAN'S FULL

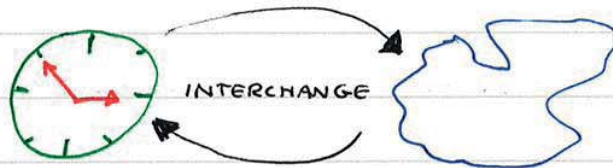
QUANTUM STATE

= CH42 TIME AND FREE WILL =

IS TIME SPACE ?

TIME AND SPACE ARE THE  
VERY SOMETHING AND COMPLETELY  
DIFFERENT

SPACE CAN BE INTERCHANGED WITH TIME

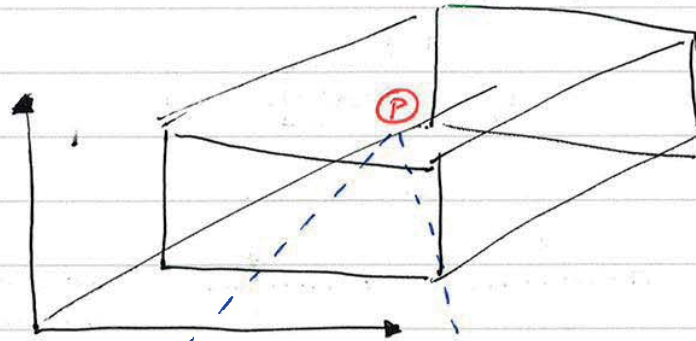


⇒ SPACE-TIME EINSTEIN & MINKOWSKI



ONE TIME, THEN ANOTHER, AND ANOTHER (SEQUENCE)

TIME



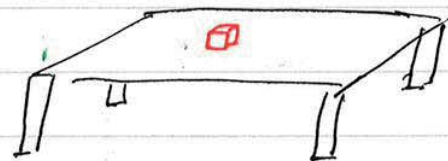
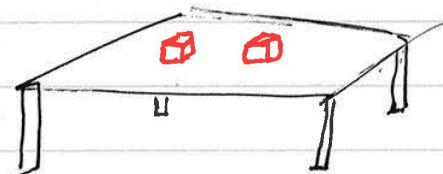
t1

A SHORT TIME  
LATER

t2

PARTICLES LAST THROUGH  
TIME ?

SPACE



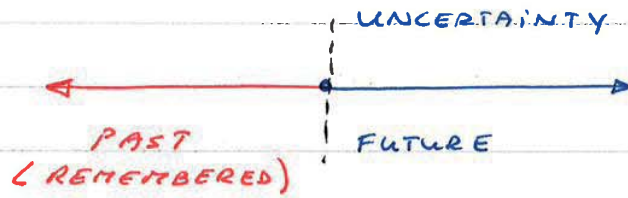
DIVERGE

MACROSTATES AND ORDER

2ND LAW OF THERMODYNAMICS : DISORDER INCREASES  
IN TIME

↓  
DOES NOT EXIST ON  
PARTICLE AND  
FIELD LEVEL

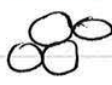
2ND LAW OF THERM. DYN. → AFFECT




RELATED TO THE VAST AMOUNT OF ORDER.

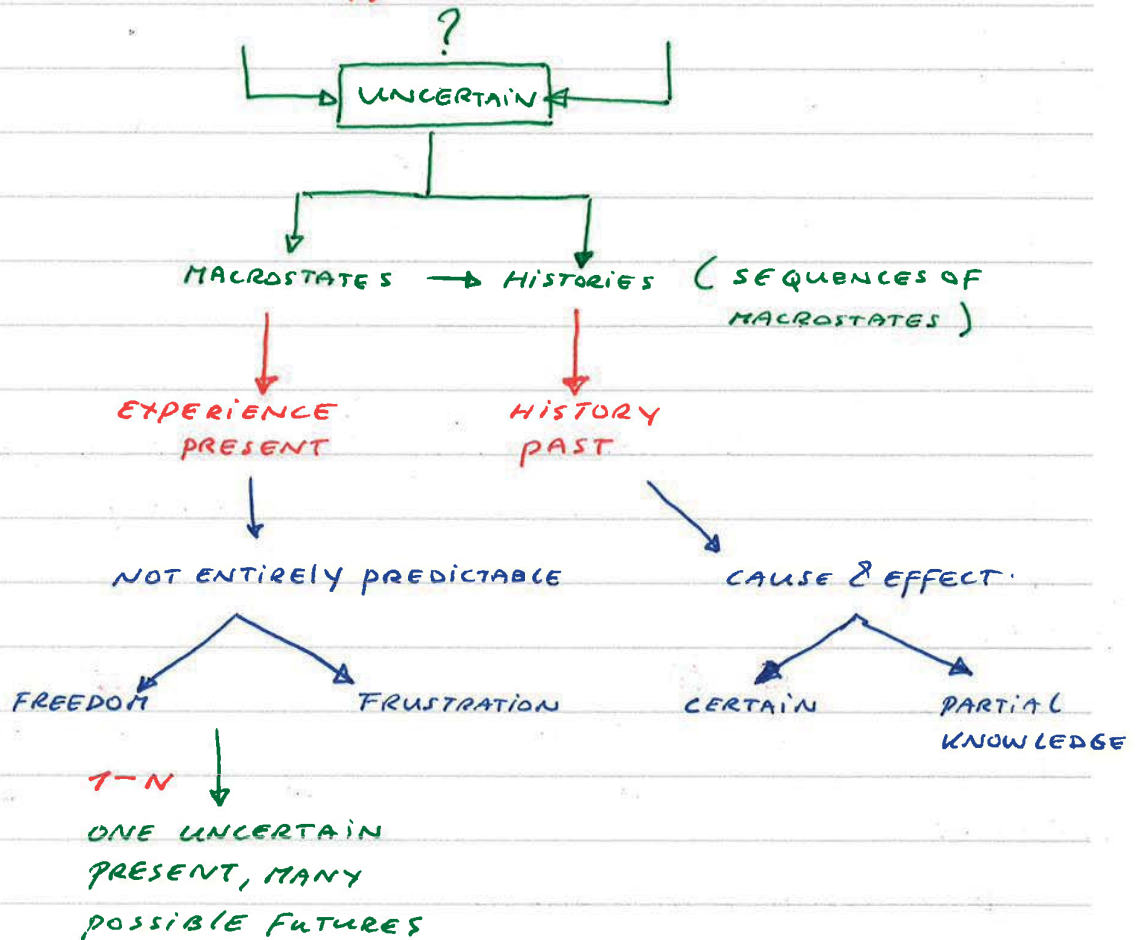
QUANTUM MECHANICS → MOST OBJECTS ARE ENTANGLED.

CLASSIC.

STATE  
 - POSITION  
 - VELOCITY  
 -  $t(x) \rightarrow t(y)$

QUANTUM MECHANICALLY

STATE EVOLVES IN TIME  
 SCHRÖDINGER EQUATION



"LEARNING ABOUT THE WORLD": SELECT A SUBSET OF ALL POSSIBLE HISTORIES.

SMALLER SUBSET → PRESENT STATE → GREATER KNOWLEDGE

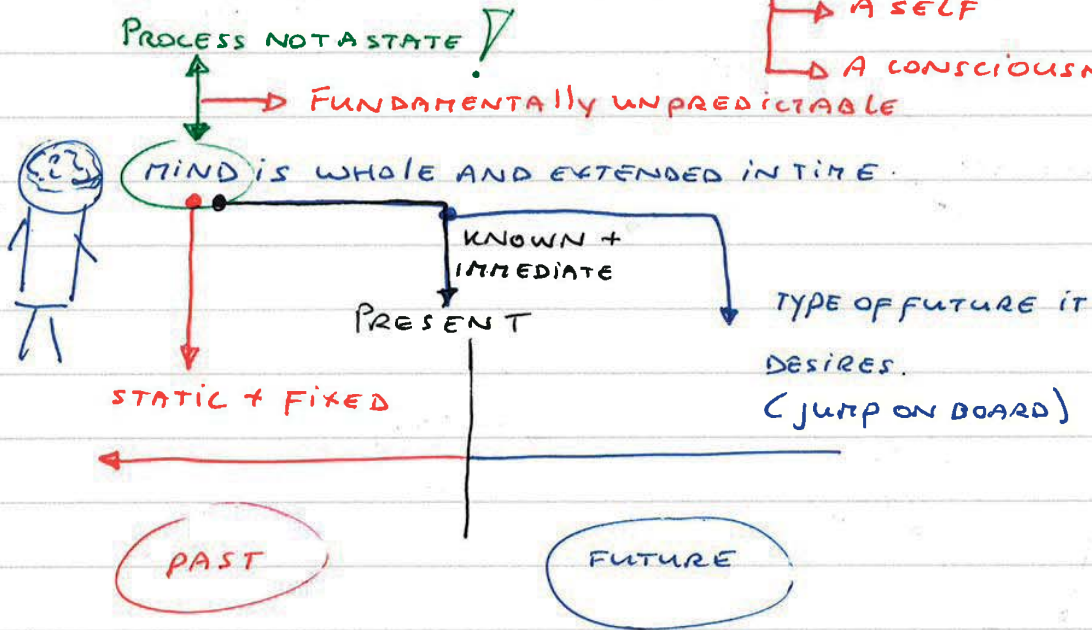


OUR MENTAL LIFE IS BUILT LARGELY OF MEMORY!

[ PREDICTING  
 ENVISIONING ] } TOWARD THE FUTURE.  
 (WAS OR MIGHT BE)

OUR VERY EXISTENCE IS CONTINGENT ON BEING EXTENDED  
 NON/LOCALLY IN TIME.

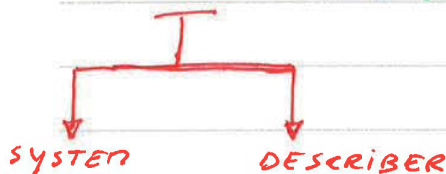
ASSUMPTION:  
 → STATE OF MIND  
 → A SELF  
 → A CONSCIOUSNESS



RIGHT FIXED SET ← CORRELATION? | DESIRE CAUSATION?

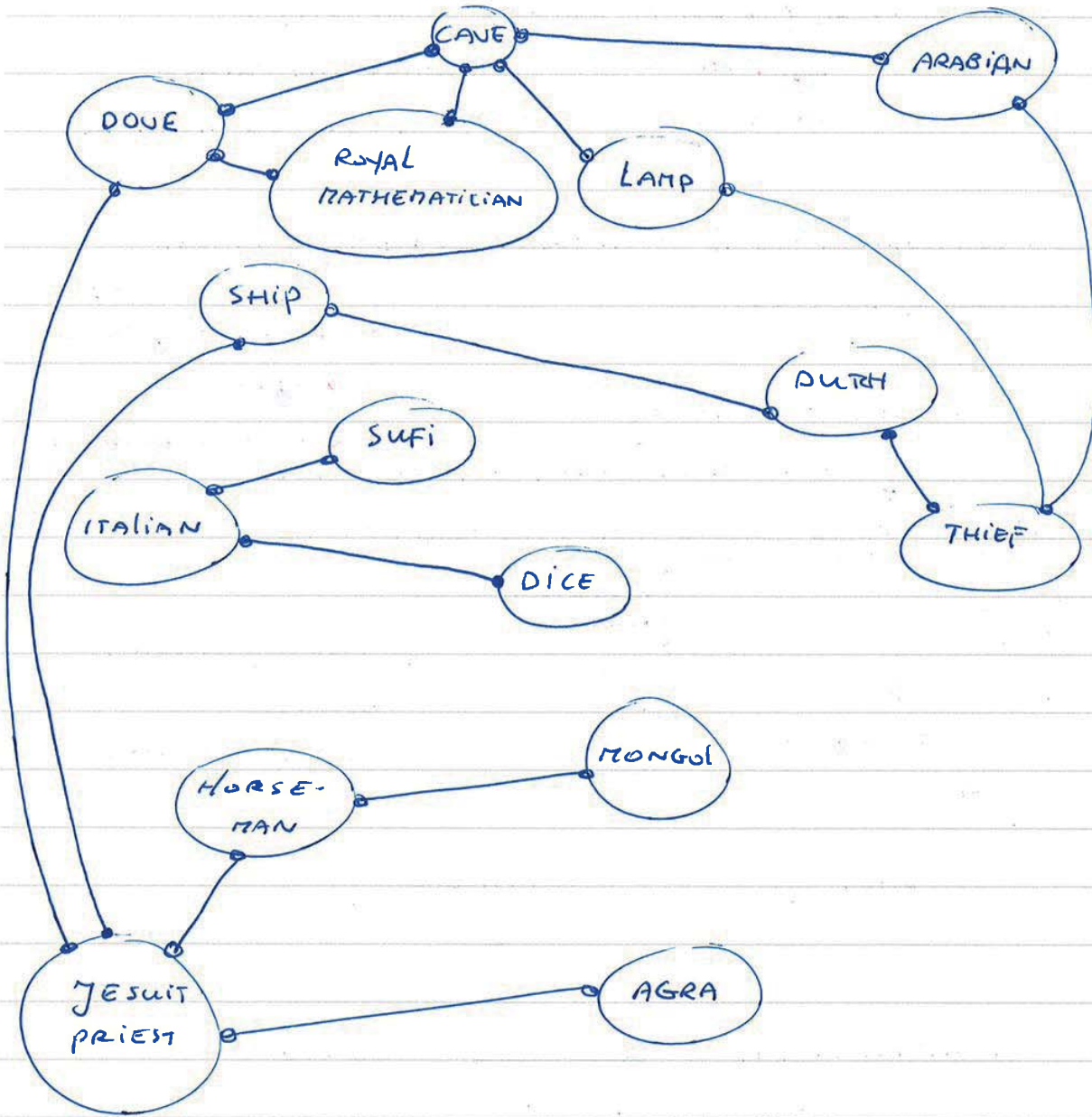
THERE IS NO FACT OF THE MATTER ABOUT  
 THE STATE OF A TYPICAL PHYSICAL SYSTEM. } UNCERTAIN

PROBABILITIES → WHAT MACROSTATE A SYSTEM IS IN



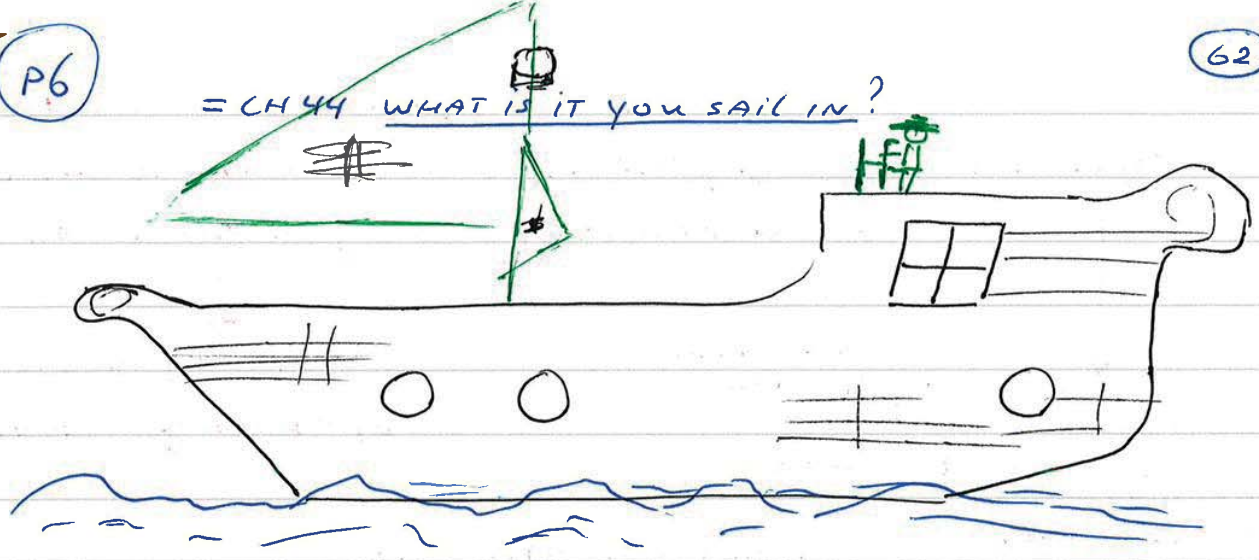
"THE ONLY WAY TO FIND OUT WHAT  
 HAPPENS IS TO, WELL FIND OUT  
 WHAT HAPPENS."

= CH 43 AN ARC OF RECOVERING TRAJECTORIES =

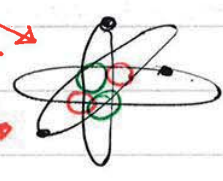


= CH 44 WHAT IS IT YOU SAIL IN?

①



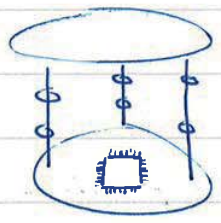
WOOD  
IRON  
CLOTH  
ROBE



ATOMS OF A GIVEN TYPE  
ARE LITERALLY IDENTICAL  
AND CANNOT BE DISCERNED  
FROM ONE ANOTHER.

THE MATERIALS  
+  
ASSEMBLY  
ARE MORE  
VALUABLE THAN  
THE DESIGN  
OF THE SHIP.

②



QUANTUM COMPUTER

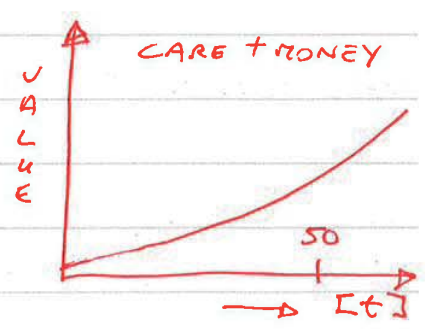
THE DESIGN AND  
ENGINEERING SCHEMATICS  
ARE MORE VALUABLE  
THAN THE MATERIALS (SAND + METALS)

③



HUMANS

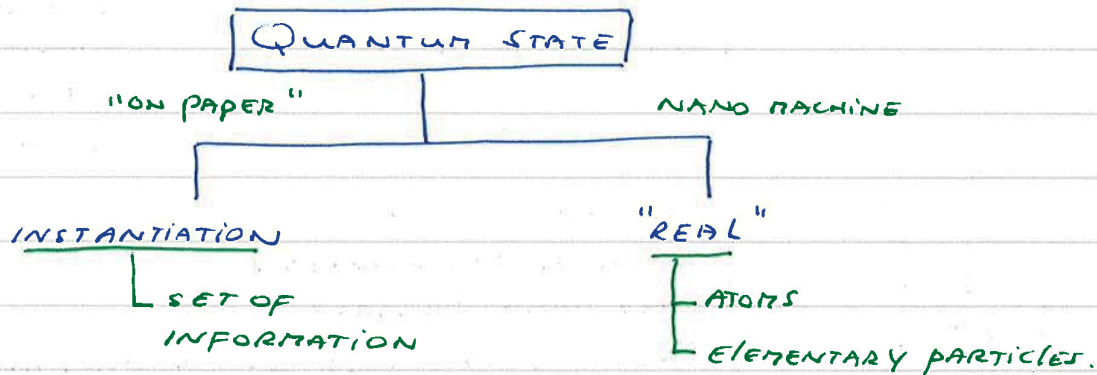
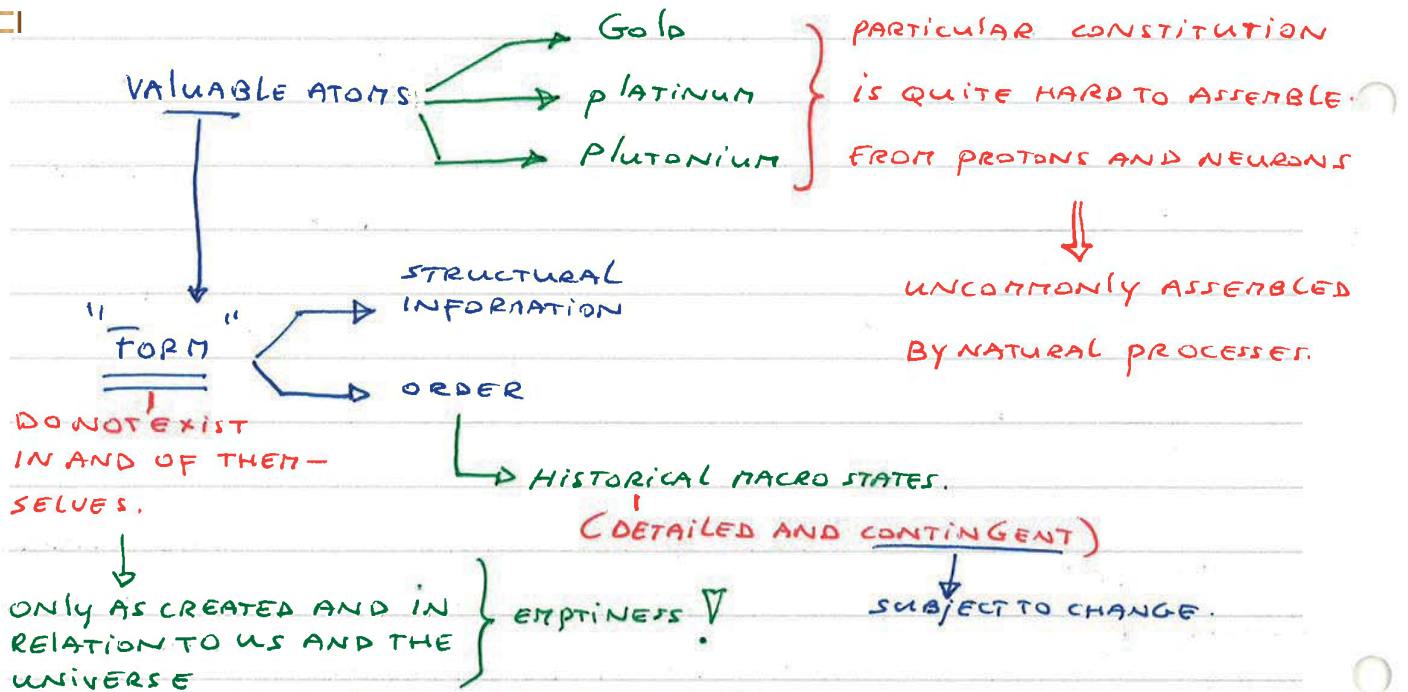
MEN & WOMEN  
GET TOGETHER  
AND PRODUCE THEM  
IN MINUTES FOR  
FREE!



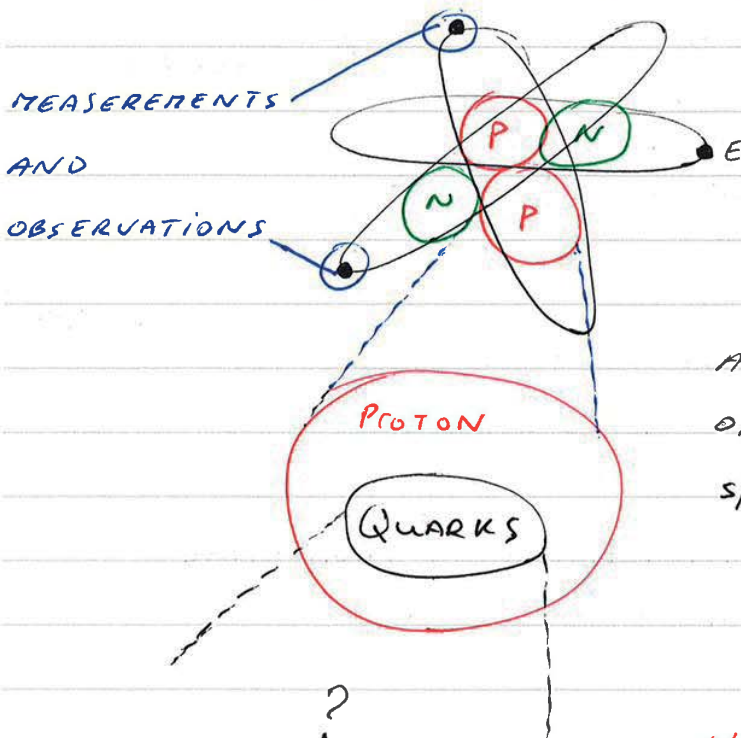
THE ASSEMBLY IS ALMOST  
ALL OF THE VALUE!

LOW VALUE ↓ Wood v.s. AN EFFECTIVE MEDICINE ↑ HIGH VALUE  
FORM CARRIES VALUE





AN ATOM ACTS JUST LIKE A PARTICLE.



P = PROTON

N = NEUTRON

E = ELECTRON.

↳ LEPTONIC NR. = 1  
NO OTHER ATTRIBUTES  
MORE PATTERN THAN SUB

AN ELECTRON IS AN EXCITATION STANCE OF THE ELECTRON FIELD. THROUGHOUT SPACE-TIME

IS AN ENTITY ABLE TO CREATE AND DESTROY ELECTRONS.

∞ ~

WHAT ARE THINGS?

= CH 45 THE CLEAR BLUE SKY =

Galileo



"BOOK OF NATURE"



NEWTON

1687

UNI. LAW OF GRAVITATION

EINSTEIN

1915

UPDATE

228 YEARS

EULER

1748

$e^{i\pi} = -1$

1897

THOMPSON

ELECTRON (-)

BACH

1713

PULSAR

1992

INVENTED  
(CREATIONS)

NEWLY EXIST

BECAUSE OF

EFFORTS OF

THEIR CREATOR.

(PAINTING / WRITING)

V.S.

DISCOVERED

AFTER DISCOVERY

THE FEELING THAT

THE THING HAD ALREADY

BEEN THERE.

(ELECTRON, ...)



KARL POPPER: CATEGORIES

① EXISTING OBJECTS AND EVENTS.  
(BOOKS, MEMORY, ...)

② HUMAN GENERATED INFORMATION  
OBJECTS (THEOREMS, LITERATURE ...)

③ "OBJECTIVE" SUBSET (ABSTRACT THINGS)  
(LAWS OF PHYSICS, MATHEMATICS, ...)

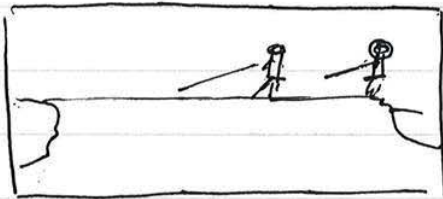
- EULER'S FORMULA.

- NEWTON'S LAW OF G

- EINSTEIN'S LAW OF G

} PLATONIC REALM.

## PAINTING BLIND MEN CROSSING A BRIDGE



EXISTENCE DUE TO HAVING:

- SOLIDITY
  - ENERGY
- BEING MADE OF ATOMS.



- SCALE
- WEIGHT
- COLOR.
- SCENT



PROPERTIES OF THE PAINTING

PROPERTIES OF THE ATOM

ARRANGEMENT OF THE ATOMS.

CONSERVED QUANTITIES.

- ▷ DURABILITY
- ▷ PROPENSITY TO EXIST OVER TIME

BEHAVE IN A PARTICULAR WAY

EINSTEIN :

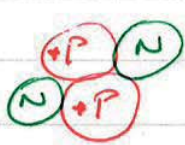
$$E = m \cdot c^2$$

- ENERGY
- MASS.
- LIGHTSPEED.

ENERGY AND MASS ARE INTERCHANGEABLE.



CONSERVATION OF ENERGY INCLUDES CONSERVATION OF MASS.



BARYONS  
(CLASS PARTICLE)

CONSERVED OVER TIME  
OTHERWISE UNSTABLE

3 QUARKS



LEPTONS (NUMBER)

PREVENTS ELECTRONS FROM ANNIHILATING WITH PROTONS.

ELECTRIC CHARGE



PREVENTS ELECTRONS FROM TRANSFORMING INTO NEUTRINOS.



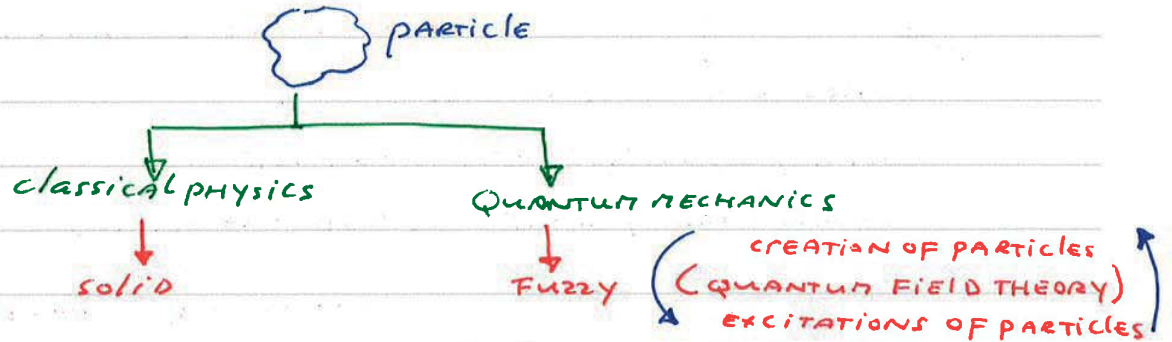
SACROSANCT = ROUTINE → TOO IMPORTANT TO BE REGARDED OR INTERFERE WITH.



BLACK HOLE

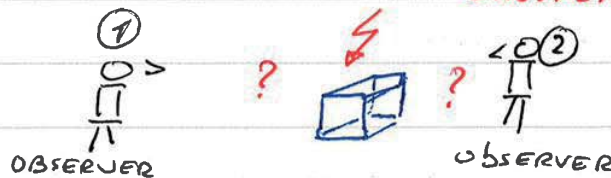
⇒ DESTABILIZE EVERYDAY MATTER AT WILL,  
CONVERTING IT INTO RADIATION.

(LUCKILY THIS IS VERY HARD TO START)



RELATIVISTIC QUANTUM FIELD THEORY.

+ EINSTEIN'S RELATIVITY.



collections → MACROSCOPIC OBJECTS.

QUANTITY (HOW MUCH)

\* INFORMATION ⇒ LACK OF RANDOMNESS.

\* ORDER ⇒ LACK OF DISORDER.

↳ (subjective) probabilities +  
MACROSTATES.

↳ SINGLE QUANTUM STATE  
CORRESPONDS TO  
MULTIPLE OBJECTS.

DECOHERENCE / QUANTUM  
EVOLUTION

Keep in mind:

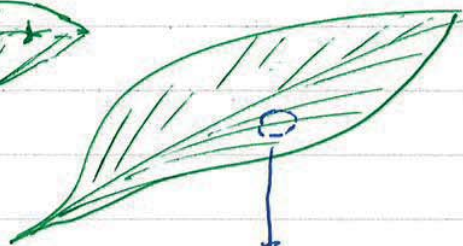
"IT'S IMPOSSIBLE FOR SOMETHING TO COME  
FROM NOTHING."

→ WHERE DOES THIS SUBJECTIVITY COMES FROM?

OBJECTS split in  
multiple versions  
INDIFFERENT LOCATIONS  
WITH DIFFERENT DETAILS

## Quality (ESSENCE OF WHAT A THING IS)

- \* Fairly clearly NOT OBJECTIVE PROPERTIES OF THE SYSTEM, INDEPENDENT OF THE OBSERVER.



collections of molecules.

WITH PROPERTIES REFLECTING PARTICULAR WAVELENGTHS OF LIGHT. (RGB - RECEPTORS)

"GREEN" IS IT REALLY THERE?

EMERALDS WERE GREEN BEFORE HUMANS DISCOVERED IT

\* NO INDIVIDUAL ATOM IS GREEN

\* ATOMS ARE SMALLER THAN COLOR!

SUBJECTIVE COMPONENT  
(WHETHER/WHAT)

BEAUTY, UTILITY

SOLIDITY, SHARPNESS.



DISCOVERY V.S. INVENTION

EULER'S THEOREM IS TRUE  $\rightarrow$  IT CAN BE PROVED!

$$e^{i\pi} = -1$$



SET OF MATHEMATICAL

AXIOMS AND RULES HAS

BEEN FORMULATED.




APPLICATION

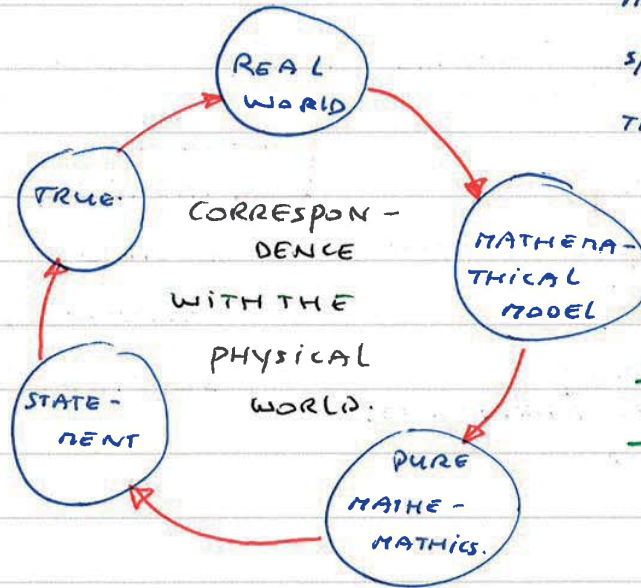
EULER'S FORMULA HAVE BEEN DERIVED.

NOT ALL MATHEMATICAL THEOREMS ARE INTERESTING AND BEAUTIFUL.



OUT OF ALL THE MANY, MANY POSSIBILITIES, ONLY A THINY FRACTION ARE POINTED TO.  
(LHASA RIVER)

?  
  
 DETERMINED  
 BY WHO  
 DEFINES IT,  
 CREATES IT.



MATHEMATICAL "REALITY."  
 SPECIALNESS OF CERTAIN  
 THEOREMS IS "OBJECTIVE"

INFORMATION:

- QUANTITIES
- QUALITIES -



## DEDUCE

# Biology

# ASTRONOMY

sociology

## PHYSICISTS

## 2-PART RELATION

Fl

LD

Fixed & DETERMINED

## SPECIFY THEORY

↓  
INGREDIENTS/ENTITIES/RELATIONS < D

F is a simpler, more elegant theory!

QUANTUM THEORY

## V.S. PERIODIC TABLE OF ELEMENTS.

Helium. 2p  
2n

ATOMS.

H	Be					
Na	Mg	Sc	Ti	V	Cr	
K						

THERE IS NO ELEMENT WITH 56 PROTONS AND 2 NEUTRONS } UNSTABLE

# Human

SOCIETY.

## TWO-WAY

## HUMAN NATURE IS DEEPLY AFFECTED BY SOCIETY

## BIOLOGICAL MAKEUP (LANGUAGE)

## AGRICULTURE, TECHNOLOGY, CITIES, MIGRATION

IF [F] DETERMINES WHAT [D] IS, THEN IT  
ALSO DETERMINES WHAT [D] IS NOT!

MODIFICATIONS → NEW THEORY → NEW UNDERSTANDING  
OF [D]



TEST "FUNDAMENTAL" THEORIES.

WHILE THEORY [F] HAS THE VIRTUE OF GREATER SIMPLICITY,  
IT HAS NO GREATER DETERMINISM THAN THEORY [D] HAS.

LAWS OF HEREDITY → Biologically



REPRODUCTION  
CHROMOSOMES  
GENES



CHEMISTRY IS OF CENTRAL  
IMPORTANCE

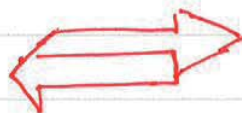
[DNA] → CODING SCHEME  
WITH AMINO ACIDS  
(LEFT HANDED)



THE GENETIC LAWS CANNOT  
BE DERIVED FROM CHEMICAL  
OR ATOMIC RULES.

HISTORICALLY DETERMINED.

SO THE DIRECTION OF DETERMINISM PROBABLY POINTS  
MORE THE OTHER WAY, FROM PUTATIVELY "LESS FUNDAMENTAL"  
TOWARD PUTATIVELY "MORE FUNDAMENTAL"



SELF LEARNING  
PREDICTIVE (FUTURE)

HISTORICAL DATA.

Would AI BE ABLE TO REPRODUCE  
THE SAME PHYSICS?

1 DHARMA → 1 : N RELATIONS  
WHERE WE ARE IN THE MULTIVERSE

## TEXTBOOKS ON QUANTUM MECHANICS. BASED ON:

DOMINANT  $\rightarrow$  (1<sup>st</sup>) • SCHRÖDINGER'S WAVE MECHANICS

• FEYNMAN'S PATH INTEGRAL FORMULATION

• HEISENBERG'S EQUIVALENT  
MATRIX MECHANICS

• BOHR'S HIDDEN VARIABLES THEORY

• FORMULATIONS: THEORIES.



RULES GOVERNING THE SYSTEM

ARE AN IRREDUCIBLE COMBINATION

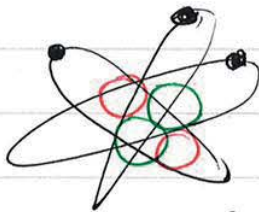
OF SET OF RELATIVELY SIMPLE RULES, AND  
SOME RATHER COMPLICATED SPECIFICATIONS

• CATEGORY

• INFORMATION

• CONSTRUCTOR

• CELLULAR AUTOMATA



COMPUTATION (TURING MACHINES)  
2<sup>ND</sup> LAW OF THERMODYNAMICS.

ATOMS. (SMALL & CONCEPTUAL SIMPLE)



STRICT LAWS.



CAN THERE BE A DEVICE  
THAT VIOLATE THESE  
LAWS?

HUMAN -  
DEPENDENT

TRANSISTORS MICROCHIPS

- LOGIC GATES
- TURING MACHINES

WE DEFINE WHAT A SYSTEM IS AND

WHAT MACRO STATES ARE RELEVANT FOR  
US.

IT FEELS THAT THERE ARE FUNDAMENTAL RULES

TO THE PHYSICAL WORLD

WE SHOULD TAKE THIS SERIOUSLY .... BUT NOT TOO  
SERIOUSLY (DUTCH TRADER)



# = CH 47 THE GREAT INHERITANCE =



?

WHAT IS INSIDE THE BOX ?

ATOMS.

PROTONS.

NEUTRONS.

ELECTRONS

PHOTONS.



- PLASMA OR TINY BLACK HOLE ?

⇒ ASSUMING A STABLE SITUATION FOR A SHORT PERIOD OF TIME.

TECHNIQUE IN STATISTICS: X, Y AND Z

↳ ASSUME THE MOST GENERIC, OR MOST RANDOM CONFIGURATION COMPATIBLE WITH X, Y AND Z.

= LACK OF INFORMATION



"KNOW ONLY"

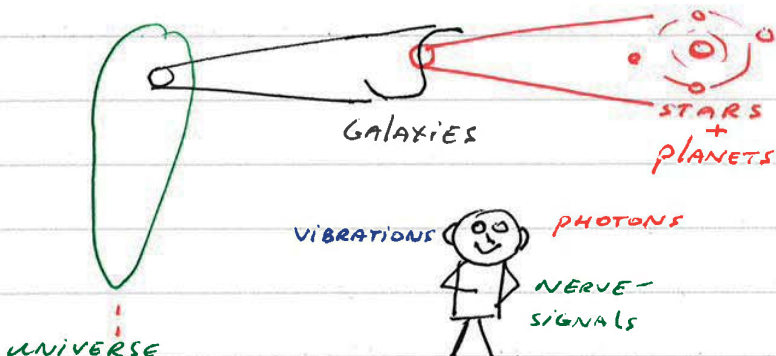
MAXIMUM RANDOMNESS IS MINIMUM INFORMATION

A MAXIMALLY RANDOM AND DISORDERED STATE

WOULD BE SOMETHING LIKE AN ULTRA-HOT GAS

OF FUNDAMENTAL PARTICLES → EVAPORATING BLACK HOLE ?

EXTREMELY HIGHLY ORDERED INFORMATION RICH EARLY :



INFORMATION AND ORDER STORED IN THE COOLNESS OF MATTER, BINDING OF ATOMS, AND MOLECULES, THE EMPTINESS OF SPACE, RESISTANCE OF OBJECTS TO GRAVITATIONAL COLLAPSE.

HIGHLY ORDERED

BILLIONS OF YEARS SHARED HISTORY.

ARROW OF TIME

FUTURE BRANCHES INTO MANY POSSIBILITIES

# MOST VALUABLE INHERITANCE: INCREDIBLE COMPLEX STRUCTURE OF LIVING THINGS

PHYSICAL, MENTAL AND EMOTIONAL

HUMAN  
DESIGNED  
MACHINES

ARTIFICIAL  
TECHNOLOGY DRIVEN  
ARTEFACTS ARE NO  
COMPARISON.

BIOLOGICAL  
CREATURES  
COMPLEXITY

JETLINERS  
V.S.  
BACTERIUM.



100 TRILLION  
ATOMS.  
BILLIONS OF  
MOLECULES.

SENSORY INPUT (GLINTS OF PHOTONS → AWARENESS)  
MULTILEVEL OF FEEDBACK.

CONSTANTLY PERCEIVING, MODELING, PREDICTING, COMPARING  
SORTING, OPTIMIZING, AND ACTING.

AI COMPETES V.S. BIOLOGICAL MINDS

PERCEPTION, PREDICTION AND ACTION.

CONTEXTUAL UNDERSTANDING  
(BIOLOGICAL AND SOCIAL WORLDS)

AN HONORED GUEST

POEMS

PROSE

WHAT IS MEANINGFUL  
ABOUT BEING HUMAN

LEVEL OF AWARENESS AND SPIRIT

WHAT DOES ANYTHING MATTER IF NOBODY IS  
AWARE OF IT, CONSCIOUS OF IT, FEELING...

ROMANTIC LOVE, AWE, NOSTALGIA, PAIN AND

ANGER ⇒ "BRAIN CHEMISTRY" EVOLVED

AS PART OF THE DARWINIAN PROCESS.

UNTRUE  
!

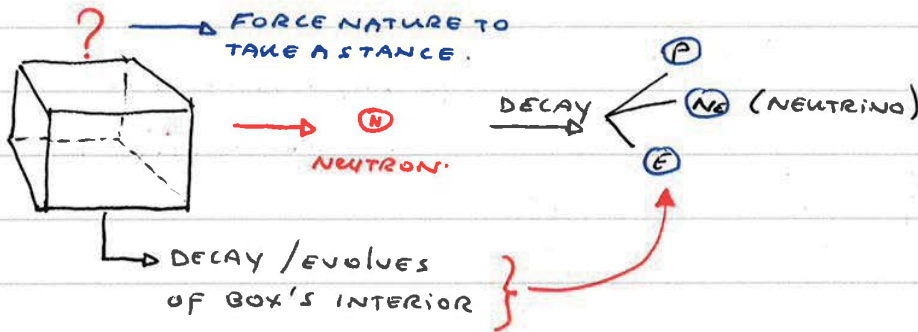
DOPAMINE  
SEROTONIN



↓ SIGNALS



## = CH 48 A LONG HIDDEN GAME =



### SET OF STATES

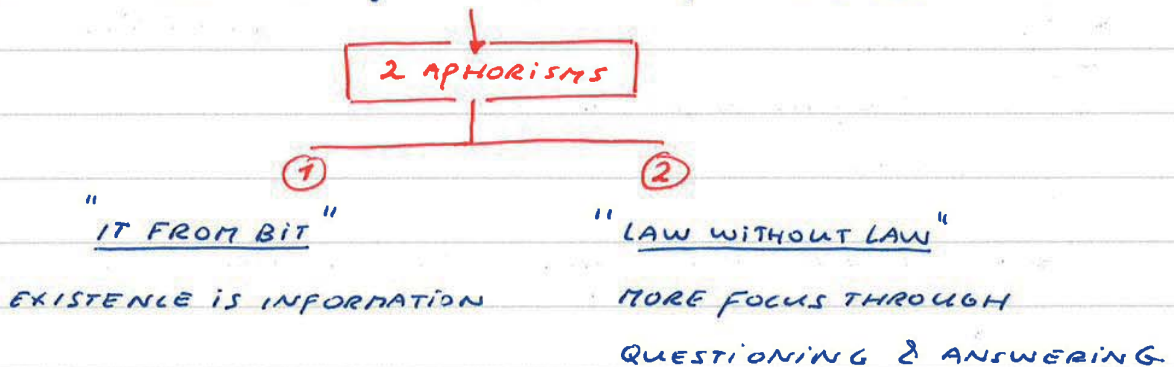
YOU CHOOSE THE QUESTION BUT CANNOT CONTROL THE ANSWER YOU RECEIVE. } PARTICIPATION  
THE SYSTEM CHOOSES WHICH STATE.

THE ANSWER TO THE QUESTION EXISTS BEFORE WE ASK IT?

PRE-DETERMINED SET OF ANSWERS POSSIBLE?

↔ IS THERE A PRE-DETERMINED AMOUNT OF QUESTIONS WE CAN ASK?

QUANTUM MECHANICS: JOHN WHEELER (PARLOR GAME)



ONLY PEOPLE ASKING THE QUESTIONS?



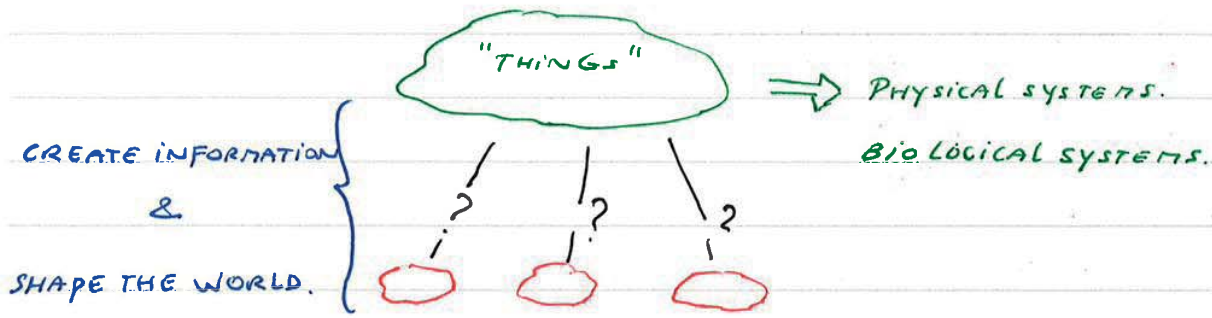
WHAT ABOUT THE TIME THAT THERE WERE NO PEOPLE? → STARS AND GALAXIES EXISTED THEN ALSO.



THE UNIVERSE DID NOT POP INTO EXISTENCE WHEN THE FIRST PERSON ASKED ABOUT IT!



# = HIERARCHICAL STRUCTURE =

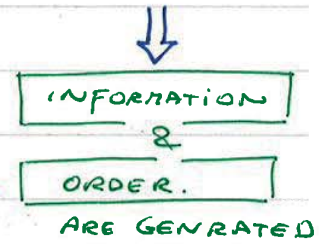


MOLECULES  $\rightarrow$  ? ATOMS  $\rightarrow$  ? PROTONS  $\rightarrow$  ? QUARKS  
NEUTRONS

THROUGH THIS PROCESS OF ASKING AND QUESTIONING

?

THE QUESTION IS, WAS THE INFORMATION ALREADY THERE OR IS IT FORMED BETWEEN THE INTERACTION OF Q & A'S ?



WE ARE CONSCIOUS. COMPLEX INFORMATION PROCESSING BEINGS.

THE STRUCTURE IS NOT SPECIFIED.

DO WE REALLY BRING THE WORLD INTO BEING BY ASKING QUESTIONS ?

WHAT DID WE INVENT ? OR DID WE DISCOVERED IT ?

WAS THERE ALREADY AN INTENTION TO HAVE THINKING SENTIENT BEINGS WITH CONSCIOUSNESS

WHERE DID THESE RULES COME FROM AND HOW WERE THESE APPLIED TO EVOLVE THE UNIVERSE.

UNCOVERED IT  
LAWS OF PHYSICS  
MATHEMATICAL THEOREMS

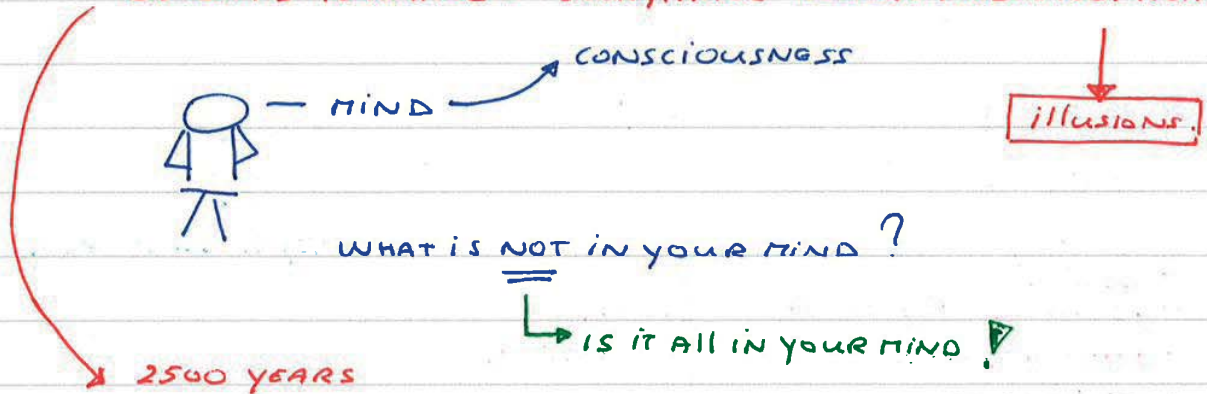
AND EMOTION TO FURTHER EVOLVE THE UNIVERSE INTO .....

UNIVERSAL INDUCTION BY RAY SOLOMONOFF. (1960)

$A_{N+1} = A_1, A_2, A_3 \dots A_N$   $\rightarrow$  MORE DETAILED AND ACCURATE PREDICTIONS

# = CH 49 THE MIND-ONLY SCHOOL =

BHDDHA'S TEACHING: "EVERYTHING IS REAL AND IS NOT REAL"



(NAGADHI → SANSKRIT → ENGLISH)

WHAT HAPPENED TO THE REAL MEANING? ERRODED IN

Form = Emptiness

TRANSLATION.

THE WORLD WE EXPERIENCE IS SOMETHING } CO-EVOLVED  
LIKE A DREAM.

A CONSTRUCT  
OF OUR OWN  
PERCEIVING MIND

[EAST]

BHDDHA MIND-ONLY SCHOOL OF  
THOUGHT ⇒ NAGARJUNA

CONSTRUCTED OUT OF THE  
RAW MATERIALS OF SENSORY  
INPUT, MEMORY, FEELING, PATTERNS

[WEST]

DESCARTES & GEORGE BERKELEY'S

PREDICTION

STRUCTURAL  
INFORMATION



⇒



ATOMS

QUANTUM  
STATE



MEASURE



INFORMATIONAL  
ENTITY

PROBABILITIES  
&  
ORDER


NEUROLOGY & COGNITIVE SCIENCE

PERCEPTION IS NOT A PASSIVE  
ENDEAVOR.

CONTINUOUS  
BIDIRECTIONAL PROCESS



MATTER CAN BEND SPACE-TIME !

↳  - MIND → STRONG WILL → WON'T BEND SPACE-TIME.



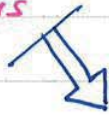
- MONEY WAS INVENTED
- RELIGION
  - SOCIAL CONVENTIONS
  - PHILOSOPHIES
  - LANGUAGES
  - POLITICAL SYSTEMS

BELIEF?



GRAVITY IS DISCOVERED.

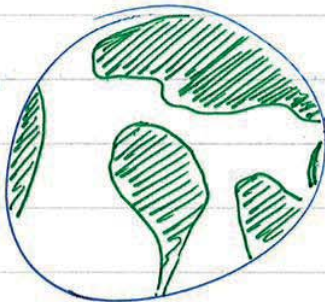
HUMAN INVENTIONS



LEARNED & REFLECTED BY.  
EDUCATIONAL SYSTEM

BUDDIST : "ALAYA" → THE STOREHOUSE CONSCIOUSNESS.

JUNG : COLLECTIVE UNCONSCIOUS



OBJECTIVE  
WORLD ?

INDEPENDENTLY OF US,  
THOUGHT, AWARENESS  
CONSCIOUSNESS



SUBJECTIVITY

"I-NESS"

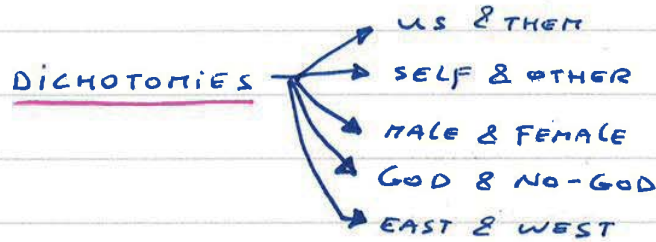


ALL SYSTEMS HAVE  
BOTH MENTAL AND  
PHYSICAL SIDES

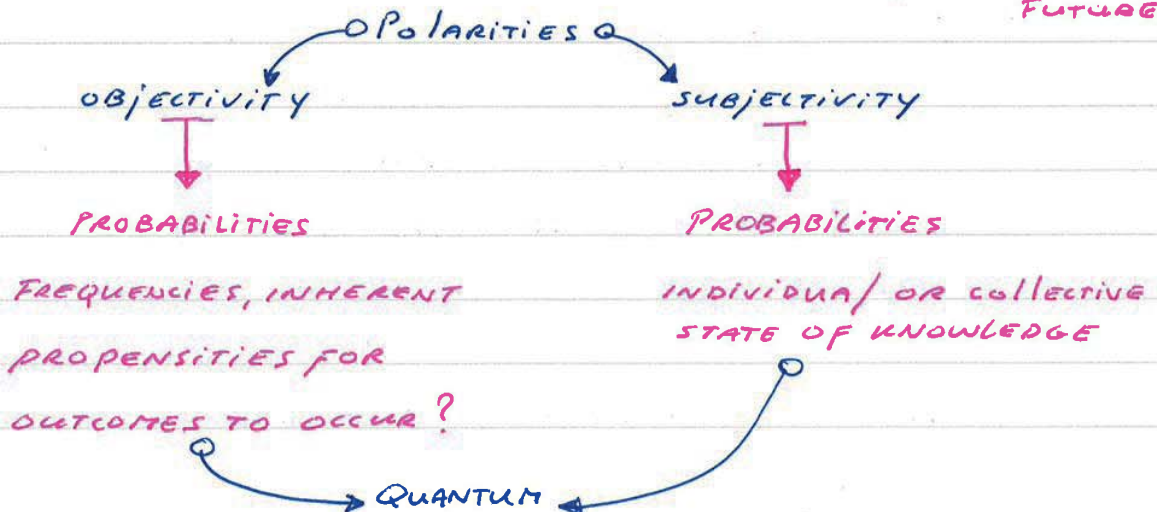
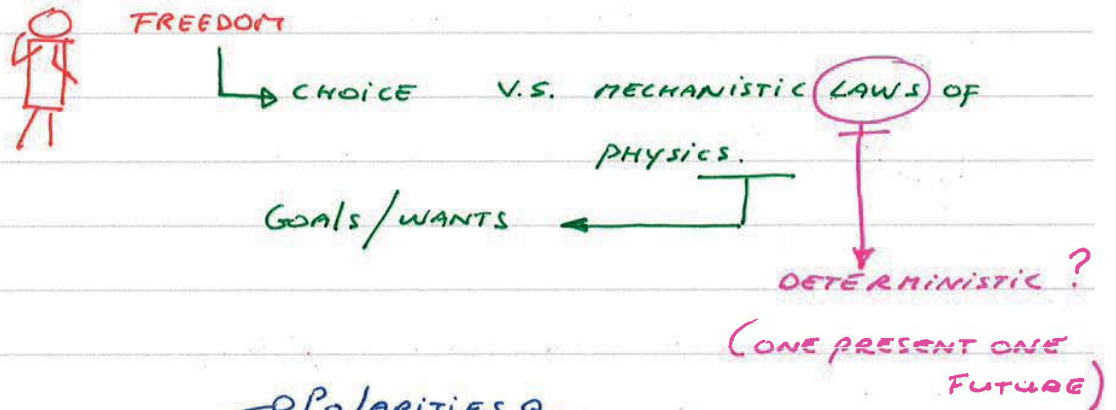
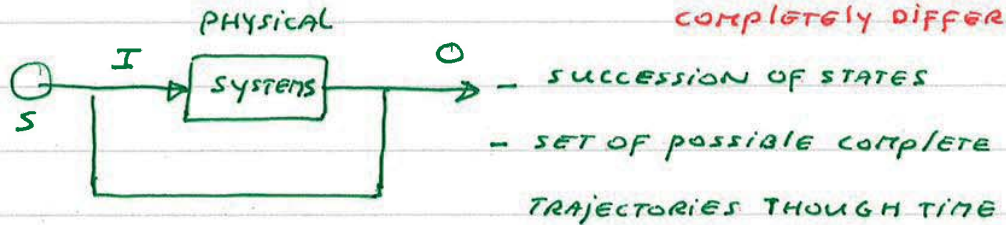
ILLUSION: YOUR THOUGHTS AND IDEAS  
ARE PART OF A LARGER  
MENTAL PROCESS SHARED ACROSS  
MANY BEINGS AND MANY  
MILLENNIA.

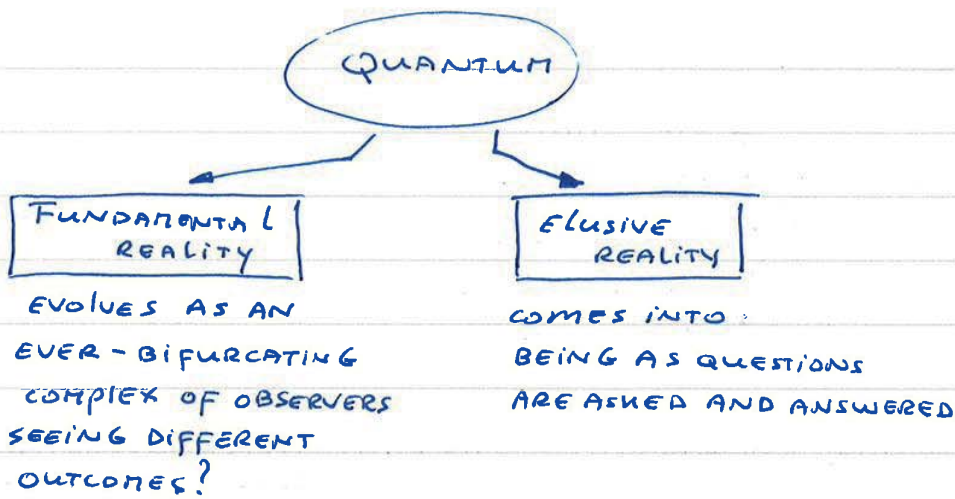


= CH 50 EAST AND WEST =



SPACE & TIME FUNDAMENTALLY THE SAME. INTERCONVERTIBLE REALITY. BUT ALSO COMPLETELY DIFFERENT





ATOMS AND  
THEIR ARRANGEMENT  
OR EXTRACTED BITS  
OF NATURE



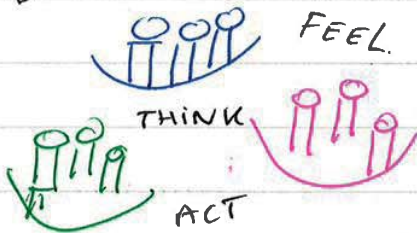
IS INFORMATION ABOUT  
OBJECTS, OR ARE OBJECTS  
MADE UP OF INFORMATION?

### MESSAGE

"THE UNIVERSE IS FUNDAMENTALLY LIKE THIS"

THEN GO AND SIT AND  
THINK SOME MORE

DECIDE



WE ARE !

IT IS NOT ALL ABOUT TRIBALISM.  
THE Q'S ARE HARD.

- THE WORLD IS NOT FLAT !
- ELECTRICITY IS CAUSED BY SEGREGATION OF ELECTRIC CHARGES.
- GRAVITY IS NOT A PROPENSITY TO GO DOWN BUT RATHER A PROPENSITY FOR STUFF TO CURVE SPACE-TIME IN A PARTICULAR WAY.

HOW CAN WE MAKE A FUTURE THAT WE REALLY  
WANT ?

HUMANS ARE AGENTS OF ACTION



**RICARDO ABDOEL'S HAND WRITTEN NOTES OF**

# **COSMOLOGICAL KOANS**

*A journey to the heart of physical reality*

Many books have been written about cosmology trying to explain the why's, what's and the how's. This book really captured the essence of how to make cosmology more accessible for anybody who want to understand where we come from and where we are going. The storytelling of Anthony is just brilliant. Taking the reader on to a journey with just enough details to visualize that journey giving room for your own imagination. The feeling of being there and (re)living that experience while explaining the laws of nature and the impact it has on us humans. This book will take you where ever you want to go and leave you to ask your own questions about our place in the universe which invites and excites to go deeper in finding your own answers. A must read for everybody!

**WRITTEN BY ANTHONY AGUIRRE**

*“A breath taking piece. An experience you can feel, visulize and almost can touch.” - Ricardo Abdoel*

