

24 hour clock

Last 2 minutes

1 million years

800 lifetimes... the last 2 seconds
or 500 ... (4)

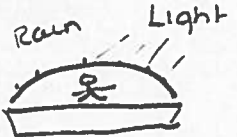
Going through timeline

ANCIENT

MAGIC

AWE + MYSTERY

ACCUMULATIVE KNOWLEDGE



How foretell my future

IBM machine.. magic.

car.

Back in the earliest times, it is hard to name, but I put magic up there. Human beings were not stupid than, they were sophisticated..sophisticated systems of government, ways of telling time, processes,,that have never been duplicated.

Way you found yourself in being in those times you had mystery and awe around you. The jungle, the desert, the lightness, the darkness. You were clear that you might walk out of the hut, the cave and walk into the desert, the jungle and you might never come back. You had to build some kind of mechanism to deal with that power you could not explain. You looked to the stars, you looked to the trees, after a while there was a body of information. That was carried down from generation to generation. Ytsfiyi Traditions that say you do it this way, you bury your dead after so many hours, you bury them in a certain way.

Picture of universe under a crystal dome. Human under glass. Very fragile, little holes in it. Rain, had to go somewhere, pot down below. If rain goes down here, how get back to heaven.

Much the same concern for the microcosm. How foretell the future? Maybe if open the belly of sheep and study entrails. Be particulare where put this particular house so don't disturb the dragon. Sacrificed members of my community to pacify, feed, or take care of the spirit. Some way to control the spirit.

Now, I don't know about your, but I ~~not~~ left that universe. Find this is true when I get close to machinery. I have special relationship with IBM copier. Do research, best time to go is 2 A.M. in the morning. Treat it very nicely, bow to it. I've never been rude to copier. Never sworn at it. (It's

When you go out to your car do you have aritual for your car? Kick tires, How start it.

That kind of sense of your universe and control of it is still present.

500 B.C. FATHERS OF PHYSICS



ZENO...

lots of little frames

ZENO about 100 years before Aristotle. Had several theories, one about motion, was that an arrow doesn't really fly. What it does, like a big, little book...lots of little frames in it, and you draw the arrows, and it happens in jumps.

ARISTOTLE ARISTOTLE SPECULATIVE Ordering

Each tree, you met own GENERALIZATION Appleness..

One of his gifts was ordering and classifying things. Before that in society and still in some societies today (rarely now) people had no way of ordering things. Each tree you met had its own name. This tree was,,, and this one, and this one. Every tree had specific name. This is very helpful when talking about specific tree, or if you want to meet somebody. Can meet someone at jim tree, but they had no way to talk about tree-ness. Generalization. Apples are apples because they are apples. There is apple-ness. They all know that an apple fell off a tree. Why did it do that? Well, that's what apples do. They get old and ripe and they just fall off a tree. That's being a good apple.

SUBSTANCE (ether...physis) earthy↑ fiery↓ watery↑ airy↓ LEVITY GRAVITY

There were substances. Earthy ones. Watery substances Airy, Fiery substances. Finally all substances could be divided into those categories. Except Chinese added paper. They had certain propensities. They were supposed to do certain things. There was levity. (rise, go up) There was gravity.

Concept of Force

He did add the concept of force. When a horse was pulling a wagon, he was pulling against something. He must be working against something. Life was a tension between forces.

1000

Microcosm: Human beings showed up with all kinds of little bottles and things inside them. One might be fiery. * Urination, upside down bottle. These propensities go on inside a person.

Perfect form Circle..



Look at macrocosm. pick what was perfect form at that time. Circle. Had way to get the stars and the sun. One woodcut still around when Newton was alive. showed two little handles on it, with angel on each side. Crank like an old phonograph. Crank, so things move, becuz they knew the sun did not always set in exactly same place. Six planets and the sun. Just like clockwork, the good old wheel of fate. Good times and bad times. life went on and on.

WHEEL OF FATE.. Good times..

2000 years later, Found I haven't left that? How many saw the sunrise? sunset. How should talk about that today. Do you talk about someone bing down to earth, fiery temper, watering down an idea, How about being light-headed? Seventh heaven. Cloud nine. And it works. People sailed across the seas, the Mediterranean, they invented many things. (Middle of earth)

NOW Sunrise?

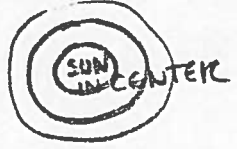
down-to-earth Fiery temperament watered-down idea light-headed

1473 COPERNICUS born in Poland. Looked at the paths of the seven planets, and the sun. They were so complicated. (spirograms) He asked the impertinent question.

Why paths so complicated

Why does this have to be so complicated. Goes on day after day, does not make sense to be so complicated. Maybe I'm looking at it from the wrong place, I'm standing here in the center, looking at the heavens. Maybe if I get off the center stage and go up in the balcony, I'll see that it is different. He discovered a new different world. He put the sun in the center. Copernicus was a very, very, very religious person He had a problem on his hands. He discovered this when he was 40. Well over 70 before wrote it down. Only saw the book the day or so before he died. He knew it was going to be upheaval to his whole society. He knew it was right, but doubt cuz of his religion. Knew when it got published it would disturb whole worldview. The person in the pulpit, the people in the street were committed to the wheel of heaven. Called book, Revolution of the Heavenly Orbits. Not clear, he knew about the revolutionary implication

Look at from wrong place.



person in street wheel of heaven

1564 GALILEO

Born, shortly after his death. He is the salesman in the music man. Anything he discovered. He knew how to market it right away. Practical invention that the Venetians hired him for. It was a compass. Called it a military compass cuz they were worried about wars, etc.

salesman practical invention

spectacle spyglass

1608 spectacle maker came from Flanders. Spyglass, being to see distance, he thot really neat idea. We're merchants of Venice. Step this up and make a better lens. we can goback on the hill, campanilles, and we can see the ships coming in. Had discovered that as a ship comes over the horizon, you see that mast first. That information was important to market cost, commerce, advantage if first, etc. for commerce. It was a hot item. Then one day instead of looking at harbor. He turned the spyglass towards the heavens. Wow, wow was that sensational. Copernicus, was right. If he just hawked this book, Starry Messenger. the world would buy it. Got published. 1 Made 2 mistakes.

Copernicus had been right

Naive---if I show people the way it is, they'll believe. they'll understand, if just look thru my telescop. Second, he got tired, being teacher in university and being salesman, he moved back to Florence. About this time the Church was concerned about the Propagation of Faith. How people be faithful to their religion. Faith should persuade people and Galileo believed that the truth should persuade people. Trial, trying to get Galileo to recant. He saw himself as churchperson, but it was difficult, for he had seen a new world.. He did sort of recant. wrote book where dealt with New Science, life on earth. According to legend. On the day he died. Newton was born.

2 mistakes:

1) naive. if just show way it is

2) moved left his protection

faith dominate people

truth persuade..

Wouldn't even look

He was in new world.

When moved, lost protection

NEWTON

Concerned with optics

experimental verification

most think of law.

MOTION

GRAVITY

Earth + heaven governed by same

MACROCOSM Great machine



Determinism

Caused by something

Young PARTICLE THEORY



proves waves

Invented ether

or reinstitute ether

Was a lonely, wild person. He would not be on anyone's list for person to invite to dinner. He never got married.

He was still in the mariner's world, was concerned with optics, the way rays of light behave. With Galileo and Newton began the time of experimental verification. He did set up some experiments. He set up prisms, and it showed that the rays of sunlight separated. Most of his work, he would just think up the principle or theory, or law and then he would work from that.

LAW. When something was in motion, stay in motion, unless something intervene.

(Contrary to Aristotle and things coming to rest) It was not observable. There was not way to prove it. People would ask, how can you prove it? I make not hypothesis. Make a law, then do the work underneath that. If you want to prove it different, then you just go ahead and do that.

GRAVITY--The same force that make apples fall, keep moon in orbit, and the planet around the sun. I can't explain it any better than anyone else. But I can tell you it moves at 32 feet/ second/second.

His gift was that he built these theories that began to unify whole systems or build one system. Look at the macrocosm, like this great system. The great machine. Just cause and effect. A great machine. A single system.

What to know what going on down in the microcosm. same kind of thing. Cause and effect. Great period of determinism. What happens to people is determined. Marxism, Freud. You have a certain kind of feeling, it is caused by something. Look for the cause and therefore find the effect.

During this time, there was a question whether light was particle or ray. Man named Young who did the single and double slit experiment. If there was a solid wall, with a single slit, and the light came through what you would have on the opposite wall, was this kind of glowing spot. (circle of light.) If you had 2 slits. shown light thru two slits, what you'd get is a series of light and dark. Center would be the brightest and then get darker around the edges. That proved that there is waves. (Same kind of thing when you drop a stone in water and you see waves coming out) Still had the question of whether wave or particle. Two slits prove that is is wave.

Also invented ether. If it's a wave, it has to have something to wave in. Have to have hair, or water or something to wave in. So they talked about ether, not a new concept, been around since Aristotle.

MICHAELSON AND MORLEY...in Cleveland, Ohio. Started working on this.

rotation of moon...
speed of light...
ether breeze

Were interested in trying to explain the rotation of the moon around the earth. It would be important to figure out the speed of light. If there really was this ether, as the world turned there is an ether breeze. *As world turns...* They believed that back in Aristotle's days also, Can't you feel the wind? Ether is like the condition or state you're in, like in Tillich, it's all around you.

if go with wind

If this is true, this ether thing, and you make waves in it. and you go with the direction that the waves are going. When you are running or sailing if you go with the wind you go faster. If you go against the wind it's harder. It's harder to go up hill.

Speed of light always...

They set up these mirrors, it finally didn't matter how they set it up. With the wind, with the ether, against the ether, whether they put the mirrors this far apart, or this far apart, the speed of light was always the same.

No ether... became ~~more~~ mere word

They said there is not ether. This is shocking. What does this do to light as a wave theory. This was crisis around the beginning of 1900s..

MAX PLANCK 1900

Why do things radiate light
always light-blue light

The other question, besides the wave? Was why do things when they get heated up radiate light? You drop a piece of metal in a fire and after a while, it glows. People back in Newton's time, had theory and said it always turned in light-blue light first. People observed it. Lower heat red, and got whiter at they went on. He sat down and he thought of a reason ~~why~~ don't behave like waves, is because they're not waves. They are little bundles, they can be quantified. They are discontinuous.

rays
LITTLE BUNDLES.. they can be quantified.
Discontinuous.

The way for me to get thinking about discontinuous is to think about the population of Chicago. It can grow and get bigger and it can get smaller. It has to grow in jumps. Population cannot grow by 0.7 of a person, it can grow by 12.8 percent of the people.. Get bigger by one person or 15 people or it can get smaller it has to do it in little things that can be quantified. Little jumps. Discontinuous is what the scientist call it.

Population Not grow
.7
12.8

Word QUANTUM was invented or first used.

Grow... by little jumps..

QUANTUM

QUANTUM

EINSTEIN
26 years old
patent clerk.

was sort of a babe in the woods, at this time. He was 26 years old. Some people today would say he had a learning disblty, found it hard to read as a child. He was a ppatent clerk. He looked at new experiments that came through patent office and deekded which things should be patented. They say he did not know about Planck. He was the new kid on the bloek. Think about the story of the Emperor's New Clothes. and for years people had been going around and saying look at mee, look at the fine ether I have. I'm a wave. Motion is absolute. He just looked and said that's silly, You are not a wave. He cameup with that it was a bundle too, and he called it a PHOTON.

new kid on block..
fine ether
I'm a wave.
Motion..is not absolute

PHOTON

He did not have problem, other people have. Sitting in armchair, said. There is not Ether, Magnetic fields just are--involve no object nor states of medium.

Why light same.

And there is not concept of absolute motion. Now how can the speed of light always be 186,000 miles/sec. per second regardless of spectator, How can that be?

Measurers change,
clocks measuring rods
get slower

Maybe the things that we measure it with are wrong? They change. They measurers change. That's the theory he came up with. The things that measure the timè (clocks) and the things that measure the spce (measuring rods).....get shorter)

ex...
Barbara A
Barbara B..
message every 15 min.

An example of that. There is Barbara A and Barbara B Now Barbara B gets on a space ship and goes up into the heavens. Barbara A says I'm worried about you. Nobody has every done this before. I just want to be sure that you send a message home every 15 minutes. Tell me where you are, now you be sure you do that. Sure. Get on this space ship and as it goes faster and faster, I remember how concerned Barbara A is and i press this little button to let her know what's happening to me. As I'm back here I suddenly realize it is 17 minutes since the last time I heard fromher, 22 mins.it got as long as two days between messages. As the rocket ship is going faster and faster my time is slowing down. When I come back and I'm just a couple of years older and here's Barbara A....old ...Where have you been , I didn't think that I would live to be 105. I wouldn't even sound like that if I could just hook into the sound system. W'ere....haveyou....been? I come back and I'm only a couple of years older. If I could talked to them down there. my talk would have sounded like Donald Duck. (very fast, very fast.

17 min.
22 min..
2 days..
my time.. slowing up
105

Donald Duck
bu

$E=mc^2$

If you can just take this piece of chalk and just get it going fast enuf, the mass will increase and you will have more energy. Just get it propelled fast enough. Skpeed of light or beyond. If I could take a kilo of coal and (how much is a kilo of coal?) If could just get it moving fast enough, it could release the energy to heat all of the United States for two months. Then you wonder if it is an energy crisis or method crisis?

$E=mc^2$

chalk..

2.2 lb/kilo..
speed of light..
coal.

dynamics
could
create
models

The mechancism was dynamical, kHe believed that you could create models. If you just look out there there was something that explained it.

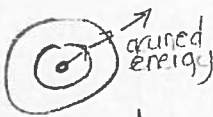
Newton's rules
worked in
external

SUBATOMIC

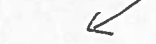
With Einstein there became a break SUBATOMIC You were going into the atom. Before that it was external. Newton's rules, worked fined in the external world. That's mainly how we got the space module out into space.

BOHR

1915



red heat
or white



.....Also said things, light was particles. And the way you got radiant heat. In a particular atome something jumped. It did it in jumps. (Discontinuously or in steps) As it jumped out in the orbits, it gained energy. As it jumped back it give off all the energy it had gained. Depending on how far it jumped out and how far it jumped back, you would get red hear, or whitel-- hot heat.

Both Einstein and Bohr believed in things being particles.

Came change..

There came a change, Something that Einstein could not accept. He could not go all the way into Quantum theory

Einstein
could explain
everything

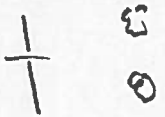
Einstein said you could explain everything. The only thing that was incomprehensible about the universe was that it was finally comprehensible.

Predict for
whole

You get out here in quantume theory out here you can't explain things. You can begin to predict possible things for whole big systems. But you cannot predict for one little item.

ex...
Slit experiment
took one particle

For example, the slit experiment. If you took one photon, one particle. You kshine it one time and it may go up here, You shine it the second time it may go down here.



gate A -- run
 B -- upstair
 down

Nobody can explain why? No way to explain it. Thre's like little beams at the doorway. and if it hets beam gate A a, I run upstairs. If it hits gate be, i run downstars. Nobody knows why. kThey can predict that I'm going to run upstairs or downstairs, but knobody knows why.. Not only that while I'm running upstairs, I say, hgy folks, this is the only universe.

Can predict,
but don't

While I'm running downstairs I say hey, folks this is the only universe.

How do you explain that, you go looking for something you find what you get. LOOKING for

Look for wwave, you find waves.
You look for particles, you find particles.

PHYSICS

L. NIKSEN

500

INTUITIVE ACCUMULATION

NOT SYSTEMATIC, BUT NO LESS PHYSICS

ANCIENT

CALLED UPON THE WISDOM ~~OF ANCESTORS AND COMMUNITY~~. HUMAN EXPERIENCE OF THE RAW FORCES OF NATURE. IT WAS THE FEAR

AND FASCINATION OF ENCOUNTERING THE WORLD. HUMANS SEEN AS AN EXTENSION OF NATURE. [THE METHODS FOR RELATING TO

THIS MYSTERY WHERE YOU MIGHT ONE DAY WALK OUT INTO THE FOREST AROUND YOUR HOME AND DISAPPEAR FOREVER WAS

MAGIC.

CERTAIN ACTIONS WERE ACTIONS OF POWER: FASTING, SINGING, DANCING. GREAT RITUALS CREATED RIGHT RELATION-

SHIPS WITH LIFE: THE YEARLY SACRIFICE OF THOUSANDS OF PRISONERS BY THE INCAS TO ENSURE GOOD HARVESTS, THE READING

OF THE ENTRAILS OF GOATS AND CHICKENS TO FORESEE THE COURSE OF BATTLES AND POLITICS IN GREECE AND ROME, ^{IN CHINA} THE STUDY

OF THE MOVEMENTS OF THE STARS TO DETERMINE WHERE CITIES WOULD BE LAID OUT IN ORDER TO AVOID ANGERING THE INVISIBLE

DRAGONS WHO DWELT ON THE EARTH.

HUMANITY'S WORLD VIEW WAS ONE OF BEING INSIDE A KIND OF POT, SET OF LIKE THE JAR YOU KEEP ANTS IN, WITH HOLES IN

THE TOP TO LET IN THE LIGHT FROM THE STARS.

THE MICROCOSM WAS VERY MYSTERIOUS, FULL OF SPIRITS AND THE MANY GODS WERE DELT WITH IN ORDER TO RESOLVE LIFE'S

PROBLEMS AND UNKNOWNNS.

HOW TO START THE CAR IN THE DEAD OF WINTER. CREATE A RIGHT RELATIONSHIP WITH IT. HAVE DECIDED IT'S A WOMAN AND

A FRIEND. NAMED HER HONDA HONEY. HAVE A RITUALISTIC WAY OF STEPPING ON THE GAS PEDAL -- THREE TIMES BEFORE TURNING

ON THE IGNITION. AT THE SAME TIME I TELL IT ABOUT THE GREAT JOURNEY WE ARE ABOUT TO BEGIN. I ALWAYS LAY OUT THE

DAY. GOING TO SEE THE MOUNTAINS TODAY. ISN'T IT GREAT TO BE UP THIS EARLY IN THE MORNING, NOT TRAFFIC JAMS, THE

ROAD TO YOURSELF.

SPECULATIVE ORDERING

1642

A LOGIC FORMED ON THE OTHER SIDE OF THE RAW WISDOM OF 6000 YEARS OF LIFE ENCOUNTER. THE GREAT PARADIGM WAS THAT REALITY COULD BE UNDERSTOOD BY REASONING AND DISCERNING THE PATTERNS AND THE ESSENTIAL QUALITIES OF THINGS. ARISTOTILE

NAMED 4 BASIC ELEMENTS: EARTH FIRE AIR WATER

THIS WAS AN EARTH-SHAKING HAPPENING, TO LOOK AT ALL THINGS IN TERMS OF THEIR COMMONNESSES. WE HAVE LIVED WITH THIS UNDERSTANDING SO LONG IT IS HARD TO IMAGINE LIVING IN A TIME WHEN THERE WOULD BE A NAME FOR EVERY TREE AND NO WAY TO SPEAK ABOUT TREENESS. LIFE WAS SEEN TO BE IN RELATIONSHIPS OF TENSION, WITH THE MAJOR ONE BEING THAT OF LEVITY AND GRAVITY. SOME THINGS WANTED TO RISE AND EXPAND AND OTHERS WERE MORE EARTH-BOUND, AND ALL THINGS SOUGHT THEIR OWN LEVEL. THEREFORE APPLES FELL BECAUSE THEY WERE "EARTHY."

THE MACROCOSM WAS SEEN AS BEING EMBODIED IN WHAT THE GREEKS THOUGHT WAS THE PERFECT FORM. REMEMBER SYMONDS LECTURE ON THE ~~TEXT~~ YELLOW UR? WHAT DO YOU SUPPOSE IT WAS? A CIRCLE. ABOVE PTOLEMY SAID EVERYTHING REVOLVED AROUND THE EARTH AND THE HEAVENS WERE PICTURED AS A GIANT WHEEL THAT SLOWLY SPUN AROUND THE EARTH. LATER AS CIVILIZATION GOT NEW DATA, IT WAS UNDERSTOOD TO SPIN AROUND THE EARTH EACH DAY. THE MICROCOSM WAS THOSE ELEMENTAL TENSIONS.

THE IMPLICATION OF THIS UNDERSTANDING OF REALITY WAS ONE OF FATE-FILLED LIVING. THINGS WERE FIXED. LIFE WAS LIVED ON A WHEEL OF FATE. OUR RESIDUE OF THIS UNDERSTANDING IS CONCEPTS LIKE SUNRISE AND SUNSET, AND DESCRIPTIVE ANALOGIES LIKE FIREY TEMPER, SOMEONE WHO IS DOWN TO EARTH, BEING LIGHTHEADED, OR THE WATERING DOWN OF AN IDEA.

cont.

3
1642
SPECULATIVE ORDERING

CAME ALONG

~~AN ITALIAN~~, A POLISH SCIENTIST ~~HAD BORN~~ COPERNICUS, HE WAS A DEVOUT CHURCHMAN, BUT SOME OF HIS FINDINGS WERE TROUBLING HIM. HE HAD ASKED THE QUESTION OF WHY THE PATHS OF THE PLANETS IN THE HEAVENS WERE SO COMPLICATED? HE DECIDED THAT THINGS MIGHT LOOK DIFFERENT IF HE MOVED HIMSELF IN THE UNIVERSE, AND THEN PROCEEDED TO LOOK AT THOSE PATTERNS FROM THE POSITION OF BEING ON THE SUN INSTEAD OF EARTH. HE MADE HIS INITIAL DISCOVERY WHEN HE WAS 40 YEARS OLD, BUT DIDN'T PUBLISH THEM FOR THIRTY MORE YEARS. IT IS SAID HE SAW HIS DISCOVERIES IN PRINT BEFORE HE DIED, BUT HE NEVER KNEW IF THEY WERE ACCEPTED. HE DIED IN 1564, THE YEAR GALILEO WAS BORN. GALILEO WAS A VERY PRACTICAL MAN, TAUGHT IN A UNIVERSITY OF THE DAY AND DID SOME INTERESTING WORK IN BUILDING ON SEVERAL INVENTIONS WHICH HAD BEEN DISCOVERED DURING HIS LIFETIME. ONE WAS THE EYEGLASS WHICH HE IMPROVED TO THE POINT WHERE HE COULD MAGNIFY THINGS 8 TIMES THEIR NORMAL SIZE. HE SOLD HIS TELESCOPE TO THE MERCHANTS WHO USED IT TO GET A FIRST LOOK AT THE SHIPS COMING INTO HARBOR WHILE THEY WERE STILL FAR OUT AT SEA. IF THEY KNEW WHICH SHIPS WERE ARRIVING, THEY COULD REGULATE THE PRICE OF THEIR GOODS. GALILEO CONTINUED TO IMPROVE ON THE TELESCOPE AND INSTEAD OF LOOKING OUT TO SEA, HE LOOKED UP AT THE HEAVENS. WHAT HE DISCOVERED WAS THAT COPERNICUS' WAS RIGHT, AND IN 1610 HE PUBLISHED HIS FINDINGS. HE IMMEDIATELY RAN INTO TROUBLE. FOR THE CHURCH, IT WAS SCIENCE VERSUS RELIGION. IT TOOK 23 YEARS TO SILENCE HIM, BUT IT WAS NEVER IN DOUBT. GALILEO SAID TRUTH SHOULD PERSUADE WHERE THE CHURCH SAID FAITH SHOULD DOMINATE. WHEN HE CAME TO TRIAL IN 1633 GALILEO BASED HIS DEFENSE ON THE PREMIS THAT THE ULTIMATE TEST WAS IN NATURE, BUT THE CHURCH SAID THERE WAS NOT ULTIMATE TEST OF GOD. FINALLY GALILEO AGREED TO RECAT, AND IT WAS LEFT TO THE SCIENTIFIC MINDS OF THE NORTH TO FINISH THE WORK HE HAD BEGUN. HE DIED IN 1642, AND IT IS SAID THAT THAT IS THE YEAR NEWTON WAS BORN

experimental verification

Newton to Carriger.

interested not in self evident principles but how things happen.

1900

CAUSE & EFFECT

MODERN SCIENCE WAS BORN WHEN GALILEO BEGAN TRYING TO EXPLAIN HOW THINGS HAPPEN AND THUS ORIGINATED THE METHOD OF CONTROLLED EXPERIMENT WHICH NOW FORMS THE BASIS OF SCIENTIFIC INVESTIGATION. OUT OF GALILEO'S DISCOVERIES AND THOSE OF NEWTON IN THE NEXT GENERATION THERE EVOLVED A MECHANICAL UNIVERSE OF FORCES, PRESSURES, TENSIONS, OSCILLATIONS, AND WAVES. THERE SEEMED TO BE NO PROCESS OF NATURE WHICH COULD NOT BE DESCRIBED IN TERMS OF ORDINARY EXPERIENCE, ILLUSTRATED BY A CONCRETE MODEL OR PREDICTED BY NEWTON'S AMAZINGLY ACCURATE LAWS OF MECHANICS.

CAUSE & EFFECT.

It was a single system w/ a single set of laws

The microcosm was the solar system

The macrocosm was a little solar system.

if you saw we lived in a dynamic universe.

relationships



DISHARMONY

HARMONY

PRESSURE

relationships

CONCEPTION REVOLUTION

1900

THE FIRST STEP IN THE RETREAT FROM MECHANICAL EXPLANATION TOWARD MATHEMATICAL ABSTRACTION AS A WAY OF TALKING ABOUT THE ACTION OF THE UNIVERSE WAS TAKEN IN 1900. MAX PLANCK PUT FORTH A THEORY TO MEET CERTAIN PROBLEMS THAT HAD ARISEN IN THE STUDIES OF RADIATION. HE SUGGESTED THAT INSTEAD OF ~~HEAT~~ BEING A WAVE IT WAS ACTUALLY LITTLE CLUMPS OF ENERGY. RATHER THAN A STEADY STREAM, IS WAS DISCONTINUOUS BITS WHICH HE CALLED QUANTA. NOBODY KNOWS HOW RADIATION WORKS BUT THE QUANTUM THEORY FIT THE FACTS, NOT ONLY FOR HEAT, BUT LATER EINSTEIN SHOWED THAT IT WAS RELATED TO ALL FORMS OF RADIANT ENERGY: LIGHT AND X-RAY, FOR INSTANCE.

THIS MEANT GOING BEYOND THE ORDINARY WORLD OF OUR EXPERIENCE. OUR SENSES WERE NOT ENOUGH. SCIENTISTS BECAME AWARE OF THE ALARMING LIMITATIONS OF MAN'S SENSES. WE CAN'T EVEN SEE ALL THE LIGHT THERE IS! WE CAN'T HEAR ALL THE SOUNDS THERE ARE! THE GULF BETWEEN THE WORLD AND THE OBSERVER BECAME MORE AND MORE PROFOUND WITH EACH NEW PIECE OF DATA.

THERE WAS ANOTHER PIECE OF THEORETICS THAT SCIENTISTS HAD CALLED THE ETHER. THIS WAS A MEDIUM, LIKE WATER, THAT EVERYTHING WAS SUPPOSED TO BE IN, AND THUS YOU COULD EXPLAIN THAT LIGHT COULD TRAVEL THROUGH A VACUUM BECAUSE IT WAS TRAVELING THROUGH THE ETHER. BUT NOBODY HAD BEEN ABLE TO DISCOVER THE ETHER. THEN TWO SCIENTISTS, MICHELSON AND MORLEY WORKED ON SOME EXPERIMENTS WHICH WERE OUT TO PROVE THE ETHER WAS THERE. THEY ASSUMED THAT IF LIGHT WAS TRAVELING THROUGH ETHER IN THE DIRECTION IT WAS GOING, IT WOULD MOVE FASTER THAN IF IT WERE MOVING IN THE OPPOSITE DIRECTION. BUT DISCOVERED THERE WAS NO DIFFERENCE. IT WAS THIS TRUTH THAT LED EINSTEIN TO A THEORY WHICH STATED THAT THE LAWS OF NATURE ARE THE SAME FOR ALL UNIFORMLY MOVING SYSTEMS. THIS IS THE THEORY OF RELATIVITY. WHAT HE WAS SAYING WAS WITH OUT SOMETHING TO OCCUPY IT, SPACE IS NOTHING. AND AT THE SAME TIME

HE DISCARDED THE CONCEPT OF ABSOLUTE TIME. JUST AS THERE IS NO SUCH THING AS COLOR WITHOUT AN EYE TO LOOK AT IT, SO A MOMENT, AN HOUR, A DAY IS NOTHING WITHOUT AN EVENT TO MARK IT. JUST THINK ABOUT TIME ZONES. WHAT'S ONE IN THE MORNING FOR ME IS ONLY 11 P.M. IN SAN FRANCISCO.

(READ GRAVITY TWISTS & TURNS)

EINSTEIN ALSO SAID THAT ENERGY IS MASS, WHICH MEANT THAT IF SOMETHING WERE MOVING FAST ENOUGH, IT WOULD GIVE OFF ENERGY. FOR INSTANCE, 2.2 POUNDS OF COAL IF IT WERE TRAVELING AT THE SPEED OF LIGHT WOULD GIVE OFF ENOUGH ENERGY TO MEET ALL THE ENERGY NEEDS OF THE U.S. FOR TWO MONTHS. PERHAPS WE DON'T HAVE AN ENERGY CRISIS, BUT RATHER A METHODS CRISIS ON OUR HANDS.

WHAT HAPPENED WAS THE ENVISIONING OF A UNIVERSE WHERE THERE WERE NO ABSOLUTES, WHERE THERE WERE TEMPORAL MODELS AND THEORIES

THE MACROCOSM WAS FULL OF BLACK HOLES, AND QUASARS AND AN EVER-EXPANDING UNIVERSE CANSTANTLY MOVING AWAY FROM US.

WHAT'S A BLACK HOLE? WHO ARE OUR SCIENCE FICTION BUFFS? WHAT ARE SOME OTHER WILD NEW THINGS THAT THEY HAVE FOUND IN THE UNIVERSE IN THE LAST COUPLE OF YEARS? IT IS GETTING PRETTY OBVIOUS THAT SCIENTISTS MUST COUNT ON INTERPRETATION. SCIENCE IS NOT EXACT AT ALL. AND GOING IN THE OPPOSITE DIRECTION DOESN'T GIVE ANY MORE SOLIDITY TO THEORIES. TO GET INTO THE MICROCOSM IS TO RUN INTO WORDS LIKE QUARKS AND GLUONS, TO DISCOVER THAT THE LITTLE SOLAR SYSTEM OF NEWTON'S IS NOT SO CLEAR. ELECTRONS USED TO BE THOUGHT OF AS CIRCLING THE NUCLEUS AS EARTH DOES THE SUN, BUT IN QUANTUM MECHANICS THEY COULD BE ANYWHERE. IS LIGHT WAVES OR PARTICLES? SCIENTISTS THINK MAYBE LIGHT COMES IN WAVICLES.

BUT WE KNOW WHEN SOMETHING IS ALIVE AND WHEN IT'S NOT, RIGHT? WELL, HAVE YOU HEARD ABOUT THIS NEW METAL THAT REPAIRS ITSELF. IF IT BREAKS IN SPACE, IT STARTS TO GROW TENTICLES, ~~AND~~ ^{WINKERS} REPAIR THE BREAK, AND IT SEND OUT ONE WATT OF POWER WHILE IT DOES IT. IN ANOTHER EXPERIMENT, THEY HAVE DISCOVERED IF YOU PUT A DROP OF MERCURY IN A FEW TEASPOONS OF NITRIC ACID AND LEAVE IT CLOSE TO A SMALL CRYSTAL OF POTASIAM DICHROMATE, SOMETHING STARTS TO HAPPEN. THE MERCURY IS JUST SITTING THERE AND THE POTASIAM DICHROMATE PUTS OUT THIS LOVELY PINK CLOUD. THEN AS THE CLOUD GETS CLOSER THE MERCURY PUTS OUT A LITTLE FOOT SEVERAL TIMES BEFORE IT TOUCHES THE CLOUD THEN IT STARTS TO CHASE THE CLOUD AROUND THE BOWL QUIVERING AND BOILING UNTIL IT CLIMAXES INTO A BEAUTIFUL ORANGE-BROWN CLOUD AND SUBSIDES.

ANOTHER EXAMPLE

PULSARS

ALUMINUM

water

OR THE QUESTION OF WHAT'S REALITY. HAS ANYONE SEEN SUPERMAN II? DURING ONE SCENE, TWO CONVICTS ARE SEEN PLAYING CHESS IN THEIR CELL, BUT THEY DON'T ~~QUIT~~ **RESPOND TO** THE GUARD WHEN HE TELLS THEM LIGHTS OUT. WHEN HE GOES INTO THEIR CELL, THEY DISAPPEAR, WHEN HE MOVES ~~BACK~~ OUT, THEY ARE BACK. IT'S ~~OVER~~ A HOLOGRAM. A THREE DIMENSIONAL HUMAN BEING WHO IS NOT THERE, ~~AS~~ MERELY A PROJECTION. ~~XXXXXXXXXXXX~~ **IT IS** THIS IS ONE WAY ~~XXXXXXXXXXXX~~ **ED** SUGGEST THE MIND FUNCTIONS. IT READS HOLOGRAMS. THE QUESTION IS WHO IN THE BRAIN IS DOING THE READING? WHO DOES ACTUAL KNOWING?

ST. FRANCIS SAID: WHAT WE ARE LOOKING FOR IS WHAT IS LOOKING. (**READ PAPER**)

WE ARE INDEED PARTICIPANTS IN REALITY _____ OBSERVERS WHO AFFECT WHAT WE OBSERVE.

IMPLICATIONS? HUMANS ARE CREATORS NOT VICTIMS. THEY MAKE A DIFFERENCE. YOU BE THE ONE WHO BUILDS TEMPORAL

MODELS. UNCERTAINTY IS NO EXCUSE FOR NOT LIVING. THE MYSTERY OF THE UNIVERSE IS NOT BIGGER THAN THE MYSTERY OF

THE MICROCOSM: THE MYSTERY OF LIFE ITSELF IS NO BIGGER THAN THE MYSTERY OF MY LIFE.