

darkness-crash-laughter

E
GOD...

T
..shhhhhhhhhh.....

E
...does not play dice...

T
Don't keep saying to yourself "but how can it be like that" ...

E
An expanding universe does not preclude a creator.

T
Because you will go down the drain.

E
The most incomprehensible thing about the universe is that it is comprehensible.
Who said that?

T
The world may be like many things....

E
Awww, who said that? How is that?

T
...billiard balls...

E
How is that? WHO TURNED ON THE STARS?

T
Who said that?

E
Big and small. Mind and matter. "The most incomprehensible thing about the universe is that its comprehensible" Hunh? Who said that?

T
We cannot ever know what an atom is "really" ...

E
Proton! Classical information can be copied...QUantum information cannot be copied...

T
We can only know what it is like...

E
Somewhere! on the scale of size between an atom and a human being the quantum rules cut out, and the rules of classical physics cut in..just where is that level...the answers strike at the very heart of our concept reality...

T
Macroscopic.

E
....Macroscopic...common sense! Poke an electron here on earth, and in principle evcharge particle in say, Andromeda Galaxy, more than 2 million light years away immediately knows "what has happened".

T
(pause) Oh.

E
(pause) The tiny terrible field inside the atom.

T
(pause) Huh.

E
(pause) Meaning?

T
From the perspective of the photon, neither Time nor Space has any meaning...

E
How many photons do you know?

T
Don't rule out the possibilities of entitiesat travel backwards in time.

E
It was generally accepted that either the universe had existed forever or that it had been created at a finite time. In part this may have been due to people's tendency to believe in eternal truths, as well as the comfort they found in the thought that even though they may grow old and die, the universe is eternal and unchanging.

T

Theoretical physics is a human endeavor, one of the higher developements of human beings and this perpetual desire to prove that people who do it are human by showing that they do other things that a few other humans do is insulting to me.

E

I am human enough to tell you to go to hell.

T

The fact that I beat the drums has nothing to with the fact that I do theoretical physics.

E

Go to hell.

T

New ideas in any field als meet with resistance.

E

Time is the 4th dimension. There must be some ultimate frame of reference...a universal standard of rest!

T

Standard?

E

A universal standard of rest! REST!

T

REST??!

E

Yeah...really resting...REally MOVING...

T

Matter?

E

Stick to the subject!

T

You've lost me here. I not only don't know what you are talking about, I don't see the relevance.

E

Nothing is exact.

T
Exactly?

E
NOTHING IS EXACT!

T
Stick to the subject

E
An observer created universe. Reality happens when you look at it...If a tree falls in the forest...

T
....Reality is a matter of choice..

E
Yes...reality is a matter of choice...

T
A watched atom...never boils.

E
It is the act of observing a wave that makes it collapse into a particle.

T
Oh.

E
Either light is a wave or it is a particle?

T
It is impossible to say that an electron "is" a wave or "is" a particle...the ultimate outcome depends on the whole experimental setup. Is there a past? Is there a future?

E
When we look for particles we find particles.

T
New ideas often meet with resistance. If we try and understand everything at once we often end up understanding nothing.

E
The act of observing the electron wave makes it collapse and behave like a particle!

T

Everything either is or is not...is or is not...everything.

E
Reality!

T
Everything.

E
The time has come the walrus said
To talk of many things
Of shoes and...
Awwwwww...who turned on the stars? Hunh? Let us ask..who turned on the
stars? If I were an electron what would I do?

T
Take a deep breath...

E
AWWWWWWWWWWWWWWWWW!

T
Just take a deep breath...

E
AWWWWWWW. Hey! HEY!
Twinkle twinkle little star
How I wonder what you are....
Do I contradict myself?...Very well then I contradict myself...I am large I contain
multitudes..Do I contradict myself? Hunh?

T
A particle takes into account every possible route...

E
When a photon is faced with a choice of 2 slits, to go through, the Universe
divides in two.

T
The multiplication of Universes is extravagant.

E
The Universe divides in two.

T
There are a lot of universes that we are ignorant about...

E

Multiple versions of reality!

T

Reality is a matter of choice.

E

Each can never communicate with one another!

T

What?

E

Uh...without mass there is nothing!

T

(thinking about it...then...) Yes there is, there is energy.

E

There is what?

T

There is energy without mass

E

Mass and energy are equivalent. The property called mass is simple concentrated energy. Energy has mass. Mass and energy can be converted into each other as in pair production....as in...

T

Annihilation?

E

ATOMTRAP!

(pause...they both laugh)

Listen there's a hell of a universe next door, let's go! Hunh?

T

Expanding universes, contracting universes, vibrating universes, mysterious universes...mathematics works as a tool for describing the universe.

E

NOTHING IS CERTAIN!

T

The never never land of science...

E
Is four square miles in one bomb not enough?

T
Just tell me how big you want it. (pause....they both laugh) Hello.

E
Hello. Everthing in the universe from the most distant galaxy to a rose petal is made of quarks.

T
...more or less...

E
IS MADE OF QUARKS!

T
Even the theorist who invented quarks wanted to be reassured that they were a figment of his imagination and did not really exist.

E
We don't know yet, just what quarks and leptons are...If quarks really are the fundamental building blocks of the world-why should anyone want to explore alternative theories?

T
There is no way to know with absolute certainty the movements of such tiny particles of matter. For, example, I am now sitting in a chair...The thought of my body suddenly zapping through the molecules of the wall next to me and reassembling, uninvited, in someone else's living room is an unpleasant one...also an unlikely one.

E
Probability.

T
Oink! Oink!

E
Ha, ha, ha HA! You are agiven.

T
AN elementary particle is not an object that is given, we must construct it.

E
I'm in limbo until you look.

T

Collapse!

E

The very act...of seeing something alters it...

T

There's no way of knowing which path a particular electron might travel, not why it finally chooses to settle down...

E

Nobody's seen an electron...only the spots they make when they strike suitably sensitive screens...

T

In some orbit all we can say is its path...will be in discontinuous quantum jumps...

E

...I mean a black hole, a cipher.....

T

The electron may go to the next lowest state, it may go the next highest state, it may leap over several intermediate states or even double back on itself...

E

....zero....

T

...all at the same time....

(Doorbell rings)

E

Motion! Change!

T

All bodies fall with the same acceleration.

E

The world is my idea.

T

The rules create the game.

E

Force equals mass times acceleration.

T

...Tycho Brahe h false silver nose...

(Doorbell)

E
SPACETIME! It seems that god does play dice!

T
The fact that waves are waves of probability is a vital componeof quatum mechanics. (stops) It is the quantum fluctuations of the gravitational field that create not only baby wormholes but other distortions.

E
Baby wormholes? Baby wormholes? This is where wormholes come in?

T
Baby wormholes. Some of these distortionll take the form of entire baby universes...

E
So much for theory, what about the real world?

T
...Connected to our own space time by a wormhole, asby an umbilical cord.

E
Just like the parallel universes we discussed before. (Knock) Spacetime. Spaced Time behave differently inside the wormhole.

T
Just what happens when you arrive at the center of the hole, nobody knows for sure.

E
All the laws of physics break down. You would crushed into nonexistence!

T
(moving to the door) So anything that happens to you inside the hole lies beyond the infinite future as far as the outside Universe is concerned. It is for this rn that a journey into a black hole is normally regarded as a one-way trip. TO enter a black hole and emerge again would mean that a distance observer would have to see you come out before you win. In other words you would have traveled backwards in time.

E
CHEMIST!

D
Tell me, someone, are we halting?...

T
...Paradox...

D
TELL ME, SOMEONE, WHERE WE STARTED?

T
Where we started?

D
If atoms are not things then what are they! Hunh? What are they?

T
She skins you and she scores...

D
Paradigm! One couldn't do it with a whole encyclopedia of words...A whole encyclopedia...

T
A paradigm is not a theory as such...

D
There would be no dance, and there is only the dance! I only say, *there* we have been: but I cannot say where. And I cannot say, how long, for that is to put it in place...

T
To place it in time.

D
In time! KWUK! It avails not, time nor place - distance avails not. Whatever it is, it avails not - distance avails not and place avails not.

T
(Pause)Oh.

D
(Pause)It avails not.

T
(Pause)Oh.

D

Tell me, someone, are we halting?

T

I can connect nothing with nothing.

D

Shall I say it again?

T

The true mystery of the world is the visible not the invisible.

D

Nature shows us only the tail of the lion. But I do not doubt that the lion belongs to it even though he cannot at once reveal himself because of his enormous size.

T

What am I? I'm sure the question has crossed your mind as often as it has crossed mine. Am I simply a machine? Is my mind an illusion, a simple construction that arises out of my mechanical brain.

D

I AM NOT A CONSTRUCTION!

T

I feel I am more than that.

D

I am not a construction.

T

New ideas in any field always meet with resistance.

D

Stick to the subject. An observer created universe.

T

Universe?

D

Observer. OBSERVER.

T

OBSERVER!

D

We are at once the creators and the victims of our creation.

T
Non?

D
OUI!

T
You've lost me here. I not only don't know what you are talking about, I don't see the relevance.

D
Reality is a matter of choice.

T
Matter?

D
REALITY IS A MATTER OF CHOICE!

T
Matter is condensed energy.

D
Reality happens when you look at it. We have to imagine this room...

T
...is the universe..

D
Yes...the You-niverse...

T
I can't believe that.

D
If you keep saying that to yourself, you will go down the drain.

T
Oh.

D
Plus ca change, plus c'est la meme chose.

T
Objectivity takes it's toll...Is there a past? Is there past in the future?

D
How do we begin?

T
If we try and understand everything at once...we often end up understanding nothing.

D
One persons *acceleration* is another persons gravity.

T
Everything either is or is not...is or not... everything.

D
Simply start.

T
Everything.

D
Hope and love new imagined. Awwwww...the first principle is that you must not fool yourself and you are the easiest person to fool. So you have to be very careful about that.

T
Take a deep breath.

D
AWWWWWWWW!

T
Just take a deep breath...

D
AWWWWWW Eh! EH! Eh. Twinkle, Twinkle little star,
How I wonder what you are...Ha ha, ha, HA! Do I contradict myself?...Very well then I contradict myself...I am large, I contain multitudes, hunh?

T
What's done is done, little star...

D
Each idea opens up a new possibility.

T
You are behind the times, dear cousin...What's past is trite.

D
Each idea a new possibility.

T
What's done is done...

D
The quantum is tiny.

T
The universe is large...yes.

D
Without mass there is nothing!

T
What!

D
Uh...Without mass there is nothing.

T
Oh yes there is...there is energy.

D
Energy contains mass...

T
There can be energy with no mass.

D
Matter is condensed energy. Mass and energy can be converted into each other...as in pair production...as in...what?...

T
Annihilation?...

D
PRINCE OF PARADOX! *(Pause. They both laugh)* You gullible fool...Everything in the universe from the most distant galaxy to a rose petal is made of quarks.

T
...more or less...

D
IS MADE OF QUARKS!

T
We don't know yet, just what quarks and leptons are...they are not just tiny chunks.

D

There is no way to know with absolute certainty the movements of such tiny particles of matter.

T

For, example, I am now sitting in a chair...The thought of my body suddenly zapping through the molecules of the wall next to me and reassembling, uninvited, in someone else's living room is an unpleasant one...also an unlikely one.

D

Probability.

T

Oink! Oink!

D

Ha, ha, ha, HA! There are no "whys" or causes...necessarily.

T

Things may just happen...as they happen.

D

Electrons....in a stable atom, may move into different orbits...

T

There's no way of knowing which path a particular electron might travel, nor why it finally "chooses" to settle down....

D

...in some other orbit...All we can say is its path....

T

...will be in discontinuous quantum jumps...

D

...black hole, cipher

T

The electron may go to the next lowest state, it may go to the next highest state, it may leap over several intermediate states or even double back on itself...

D

...zero...

T

...all at the same time...

(Doorbell rings)

D

Motion and Change !

T

All bodies fall with the same acceleration.

D

Speed equals distance over time.

T

Time is motion through space.

D

Force equals mass times acceleration. $F = MA...$

T

Tycho Brahe had a false silver nose.

(Doorbell rings again)

D

PARTICLES! Idealized, as points...

T

...are the simplest kind of objects we can imagine. And strings, idealized as lines are the next simplest. *(Doorbell)*

D

Strings? Strings? In string theory all infinities are banished at the source. *(Doorbell)*

T

If particles are little strings...

D

Their quantum mechanical attributes...

T

...mass, charge, strangeness, charm and so on...

D

...are spread out along the string. *(Doorbell)* Instead of being concentrated at one point.

T

They do not produce an infinite concentration.

D

String theory is free of infinities. (*Doorbell*)

T

Every particle has an antiparticle, with which it can annihilate. In the case of the force-carrying particles, the antiparticles are the same as the particles themselves.
[BLACKOUT]

[LIGHTS]

D

VANISH!

T

Eureka!

D

ENTROPY! Vacuum...space!

K & S

Chaos, expansion...normal force, lepton, hypercharge, isospin....

T

This is really quite a bomb-shell.

D

Ha, ha, ha, HA! I have committed the ultimate sin. I have predicted the existence of a particle that can never be observed.

S

Our universe began with a big bang.

K

This is called a naked singularity.

D

The big bang took place about fifteen billion years ago. It's not a theory, it's the way things really are.

T

What's a few billion years among friends.

S

Nobody has yet seen a black hole.

D

The easiest thing in science is to find what you're looking for.

K

Like charmed.

T

Hee, hee, hee, hee.

D

You never can be sure where an electron is.

T

Schrodinger! Schrodinger's cat wasn't simply found dead when we looked at him.

D

He died precisely because we looked at him.

K

Curiosity killed the cat!

S

It is always as complicated as that.

D

Observation killed the cat.

S

He...he is both alive and?...

D

dead? at the same time...

T

...Imagine a cat sealed in a box.

K

Oh, ho, ho, ho, HO.

S

The story of Schrodinger's...cat...

T

There's a cat in a box?

S

....goes like...this....

T

Oh. (*Pause*) Now then on the box there is a button?

S

When the button is pushed....

T

Now then...uh...there is a fifty-fifty chance radiation is emitted.

K

If the radiation is emitted.

S

The cat will die.

(*Silence*)

T

If not...the cat will live. The button is pressed. Is the cat dead or alive?

D

Ha, ha, ha, HA! The cat's probability wave has two possible values, huhn?

S

The cat is dead? The cat is alive?

K

Or...it is neither dead or alive. It is hovering in a potential state of half dead half aliveness. (*Giggles*)

T

Alive? Dead? Half dead; half aliveness. Neither...nor.

S

When someone opens the box, they'll see either a live cat or a dead cat.

T

At this moment the cat moves from a potential state into an actual state of being.

D

Probability wave collapses to a single point.

T

This box is a small quantum world in which all things are possible. So long as he is not observed, the cat is *both* alive *and* dead at the same time. It is only when we open the box to look at him that the cat's state must collapse into a choice.

D

You can never be sure. Eh; eh! (*Sings*)

Twinkle twinkle little star.

How I wonder what you are.

Up above the world so high,
like a diamond in the sky.

K

Things on a small scale behave nothing like things on a large scale.

S

This is really quite a bombshell.

D

Where do we draw the line? Huh! There was a time, called the big bang, when the universe was infinitesimally small and infinitely dense.

T

In a sense each of us has been inside a star; in a sense each of us has been in the vast empty space between stars; and - if the universe ever had a beginning - each of us was there.

K

Well, take a deep breath...quantum mechanics is not nice.

S

I think quantum mechanics is just wonderful. I never did like the way that in Newtonian mechanics, if you knew the position and velocity of every particle at one moment, you could predict everything about the future. In quantum mechanics predictions are vague and probabilistic...and...

K

...nothing has a definite state until we observe it.

S

There is no way to know...

K

The Heisenberg uncertainty principle states that nothing is locatable. If you wanted to take a picture of a solid particle, by the time you received the picture, the particle would no longer be at the location.

D

Well, *I* can live with doubt and uncertainty.

S

If we try to understand everything at once...

D

We end up understanding nothing.

T

It makes no good sense to talk of an objective world of real facts if those facts cannot be apprehended without altering them in the process. There is no longer any meaning to be attached to the idea of a real, objective world.

D

Indeterminacy is built into quantum reality.

T

What is measured depends on the nature of the measurement.

D

NYYYYYAAAAHHHHH!

K

As soon as we start putting our thoughts into...

T

words...

S

...and sentences, everything...

K

gets distorted, language is just no damn good.

T

I use it because I have to...

D

but I don't put any trust in it. We never understand each other.

T

Neutrinos, they are very small.

D

They have no charge and have no mass...

T

and do not interact at all.

D
The earth is just a silly ball.

T
Through which they simply pass.

[BLACKOUT] (*K & D exit*)

[LIGHTS]

T
Mixing of space and time.

S
How can it possibly be that I see your time flow slowed.

T
Einstein's theory of relativity.

S
While you see mine slowed.

T
...links space and time.

S
And how can I see your space contracted?

T
A moving clock marks time more slowly than one at rest.

S
While you see my space contracted. The relativity of simultaneity.

T
What? Oh...For a person on a platform, the watch on the wrist of a train's passenger actually moves more slowly - time slows down. Time is measured differently for persons moving relative to one another. Eh?

S
Speed of light is always the same.

T
Imagine twins at a train station.

S
Bullet?

T

One of them gets on a train. The train speeds up and then the train slows down - which twin is older? Hm? Well?

S
Clocks really do slow down when they move.

T
Clocks slow down when they move?

S
Imagine that a gun fires a bullet at some high speed. But the speed of a bullet is not an absolute constant, so that if we take off after the bullet in a rocket we can catch up to it and it would appear to be at rest. There is no absolute meaning to the speed of the bullet...

T
No absolute meaning! No absolute meaning!

S
Because it is always relative to our speed.

T
Or...or imagine two ordinary sized people, one on earth, and the other on a space ship moving at nearly the speed of light...

S
both...have...

T
...front row seats to watch a performance of an eleven million mile tall dancer...

S
...who moves across the solar system as if it were a stage.

T
Oh. OH!

S
It's a...

T
...marvelous performance! And later they discuss it but cannot agree on what they saw. The viewer on the spaceship says the dancer...

S
first moved her arm. And then her foot.

T

But the viewer on Earth saw these events...saw these events in reverse order. Even if they try to analyze the motion of the dancer taking into account the finite speed of light and the motion of the spaceship and the earth they cannot agree. The reason is that the speed of light is an absolute constant. It denies the existence of a universal time for all observers.

S
Seems paradoxical compared to our everyday experience.

T
Special relativity!

S
Special relativity.

T
Special relativity! The Lord is subtle but he is not malicious.

S
What?

T
The concepts - black holes, and their horizons, wormholes, tidal forces, singularities, gravitational waves - fly by too fast. My advice: Just let them fly by; get a rough impression.

S
Warnings...leave me cold.

T
So much for the theory.

S
This is very odd.

T
What do you mean by that?

S
Uh...that is quite false.

T
Do I contradict myself?

S
Sorry.

T

Very well.

S
Very odd.

T
I contradict myself.

S
I...I am large...I contain...

T
Multitudes. Take a deep breathe.

S
Space-time.

T
General Relativity! Let us be definite. Space-time is not flat, as previously assumed: it is curved or warped by the mass and energy in it.

D (*Voice garbled*)
MASS AND ENERGY ARE THE SAME THING!

T
I like relativity and Quantum Theories because I don't understand them and they make me feel as if space shifted. Like [BLIP, *K enters*] a swan!

K
All hope abandon ye who enter here. Everything in the universe tends toward maximum disorder.

S
Chaos...

T
ENTROPY!

D (*Voice*)
MOST EVERYTHING IN THE UNIVERSE CHANGES WITH AGE?

K
The degradation of matter...and energy.

T
In the Universe? Inert uniformity?

K

Entropy. I've never seen a black hole.

T
NOBODY HAS?

S
No!

T
This seems to me unlikely.

K
A black hole is the...

T
A black hole has no hair.

K
Result of the complete gravitational collapse of a celestial body.

S
Trillions of times the mass of the sun.

K
Spacetime is so strongly curved...that no signal of any kind can escape.

T
Your interest...is riveted on...the fiery marriage of general relativity with quantum mechanics. A marriage that may take place at the center of a black hole. You are preaching that the endpoint of stellar implosion is a great crisis. From which deep new understanding may emerge.

S
Speak for yourself. I'm quite pleased with the way the universe works.

K
Although...

T
There are a few details I would like to change...That have nothing to do with quantum mechanics.

(D enters)

D
Quantum Mechanics?

T
Eureka!

S
You know...

T
Let us proceed, then, to our legitimate thesis.

K
The sky here is very strange.

D
I often have the sensation when I look at it that its a solid thing up there,
protecting us from what's behind.

S
From what's behind. Yes. But what is behind? Nothing, I suppose...

K
Just darkness....Absolute night...

T
The quiescent black hole whets our appetites to learn more.

S
Not perfectly black.

D
This quest has led through a labyrinth of exotic objects: black holes, white
dwarfs, neutron stars, singularities, ha, ha, ha, HA! gravitational waves,
wormholes, time warps, and time machines.

T
Maybe someone will come back from the future and tell us the answers?

D
I have never seen a black hole. Nobody has.

T
No...Eventually. The Universe, will be nothing but a collection of dead black
holes in a tenuous sea of discarded radiation whose energy is being steadily
diminished by expansion. All is not quite over yet: black holes evaporate,
slowly losing mass by giving off energy and particles. Black holes of galactic
mass, will radiate photons of hopelessly low energy and will take eons to
evaporate altogether, but in their death throes, they will give up all their
remaining mass in a burst of high-energy radiation and particles.

D

Oh! When you get through wandering around, come on back home, huhn?

K

Eh-hem.

S

Space being...don't forget to remember...Curved...and that reminds me who said...o Yes.

D

FROST! Something there is which isn't fond of walls?

S

Any fool nowadays can switch on a light...or touch off the atomic bomb.

D

I don't have very much more to say. I don't have very much more to say.

T

The bomb will never go off, and I speak as an expert in explosives...

D

I think that the efforts to diffuse and weaken the crisis make it only more dangerous. What have we done?

S

This is not only a great peril, but a great hope...

D

Anyone who expects a source of power from transformation of these atoms is talking moonshine.

T

I don't have very much more to say. (*T exits*)

D

Imagine that the world is something like a great chess game...being played by the Gods...and we are observers of the game. We do not know what the rules of the game are.

S

Unh-hunh.

D

All we are allowed to do is watch the playing. Of course, if we watch long enough, we may eventually catch on to a few of the rules. Even if we knew every rule, however, we might not be able to understand why a particular move is made in the game,

S
Unh-hunh.

D
Merely because it is too complicated and our minds are limited. If you play chess you must know that it is easy to learn all the rules, and yet it is often very hard to select the best move or to understand why a player moves as he does. So it is in nature, only much more so. We must limit ourselves to the more basic questions of the rules of the game. If we know what the rules are, we consider that we understand the world.

T
BANG!!! Plank's constant! BANG!!! Schrodinger's cat! (*Laughs*)

[BLACKOUT]

[LIGHTS]

D
What is light? A wave or a particle?

S
The act of observing determines what's what.

K
I feel somehow as if I was getting invisible! Invisible!

T
If you look for a particle, you will find a particle.

D
Observer created reality.

K
As if I was getting...invisible.

S
If you look for a wave, you will find a wave.

T
Wave particle duality.

D

Reality is a matter of choice. A particle is a tiny object.

T

It is localized.

Oh-ho! Waves are different? They are not localized...they are spread over wide regions of space. Hunh? Hunh?

D

Prince of paradox!

T

We can design experiments...in which light behaves like a series of waves.

D

And others...

T

In which it behaves like a stream of particles.

S

The Gordian knot.

T

Both wave like! And particle like!

S

At the same time?

T

This is known...as wave particle duality.

K

If you're so smart why don't you solve laser fusion.

S

Don't go there.

D

Does anything have existence, without observation?

S

Unh-unh. (*S exits*)

T

The uncertainty principle is intimately related to...wave particle duality.

D
Intimately?

T
You cannot measure...the position and velocity of a particle. Precisely at the same time.

H
Ohhhhhhhhh.....

T
If you make a highly accurate measurement of the position of an object.

D
In the process of your measurement.

T
You will necessarily kick the object.

D
Thereby perturbing the objects velocity.

K
In a...random.

D
Unpredictable way?

K
The more accurate. Your measurement. (*S enters*) The more you perturb the objects velocity.

S
The Heisenberg's uncertainty principle.

D
States that nothing is locatable. If you wanted to take a picture?

S
Of a solid particle.

K
I suppose you've read Schrodinger's paper?

S
By the time you...

D

Receive the picture?

S

The particle would...

D

No longer be at the location.

S

To observe is to disturb.

T

An electron can be here or there at the same moment. You can choose. It can pass through two doors at the same time or from one door to another by a path which is there for all to see until someone looks, and then the act of looking has made it take a different path. Its movements cannot be anticipated because when you know what it's doing you can't be certain where it is, and when you know where it is you can't be certain what it's doing: Heisenberg's uncertainty principle; and this is not because you're not looking carefully enough, it is because there is *no such thing* as an electron with a definite position and a definite momentum; you fix one, you lose the other, and it's all done without tricks, it's the real world, it is awake. It is awake.

D

Hunh!

K

It is awake!

T

Things on a very small scale behave like nothing that you have any direct experience about. They do not behave like clouds, or billiard balls, or anything that you have ever seen.

D

What next!

S

Almost as soon as the electron was born, it began causing problems.

D

I put no faith in the seeming facts of light.

K

I don't believe I believe a thing you state.

S
Billiard balls, people, planets!

K
STARS!

D
So, the old Newtonian picture of a clockwork universe?

S
Moving in absolute determinism is false!

D
The entire universe.

K
Is ultimately...a collection...of quantum mechanical systems.

S
The Newtonian vision.

K
A gigantic clock.

S
Wound at the beginning of time.

K
Ticking ever since. (*Giggles*) This picture of the universe?

T
Replaced?

S
By uncertainty and chance.

T
CHANCE!

K
Quantum...quantum theory...once and for all.

T
Eliminated the controllable dream of controllable measurement process.

D
Demolished the Newtonian dream!

T
Quantum theory...

D
DEMOLISHED THE NEWTONIAN DREAM!

T
What is probability. "Everything existing in the universe is the fruit of...chance and necessity." A matter of...chance.

K
I suppose you've read Schrodinger's cat? (*Giggles*)

T
If the button is pressed...is the cat dead or alive?

S
The cat has a probability wave.

D
Schrodinger's equation describes not the behavior of cats...ha, ha, ha, HA!....but the probability of finding electrons at particular places.

K
Twinkle, Twinkle.

T
The moment of observation, the moment when many-possibility quantum reality condenses into a single actuality, is known as the "collapse of the wave function."

K
Open the box!

D
Curiosity killed the cat.

T
The wave-like state of being.

D
I can live with doubt and uncertainty.

T
Collapses into definite form only

D
Un. Certainty.

T (*exiting*)
When it is observed.

[BLACKOUT]

D
Little Willie, full of glee,
Put radium in Grandma's tea.

S
There once was a lady named Bright

D
Now he thinks it quite a lark
To see her shining in the dark.

K
Who traveled much faster than light.

S
She departed one day in a relative way
And came home...

K
The previous night.

D
Let us now endeavor to conceive what Matter must be

K
Oh, matter!

D
Reason flies at once to Imparticularity - to a particle?

S
To *one* particle...a particle of *one* kind...of *one* character...of *one* nature...

D
Of one size - of one form - a particle, therefore "*without* form and void" - a
particle positively a particle?

S
At all points.

D

All forces are mediated by a set of quantum particles called gluons.

S

Without gluons.

D

The universe becomes unglued.

K

The universe becomes unglued.

D

Little Willie full of glee

T

Put radium in grandma's tea. (*T Enters*) How is it that particles decay willy nilly into other particles?

D

Almost as soon as the electron was born, it began causing problems.

T

Irreducible matter.

K

Every particle has an antiparticle.

T

An unobserved partner.

K

An antiparticle!

S

Particle...antiparticle.

D

Photon photino?

K

Gluinos, winos, zinos.

S

Symmetry.

K

Symmetry.

D

Neutrinos. They are very small...they have no charge...and have no mass...

T

I don't believe I believe a thing you state.

D

And do not interact at all.

The earth is just a silly ball...

T

I don't believe I believe you are the last in space...

D

...To them, through which they simply pass,...

T

I don't believe you are anywhere near the last...

D

Like dustmaids down a drafty hall...

T

I don't believe what makes you red in the face!

D

Or photons through a sheet of glass,
They snub the most exquisite gas.

T

Is after explosion going away so fast.

D

Like tall
And painless guillotines, they fall
Down through our heads into the grass.
At night, they enter at Nepal
And pierce the lover and his lass
From underneath the bed - you call
It's wonderful; I call it CRASS!

(CRASH!)

T

I put no faith.

D

Insult the stallion in his stall,
And, scorning barriers of class,
Infiltrate you and me!

T

I don't believe...

D

Like tall and painless guillotines, they fall
Down through our heads into the grass.
At night, they enter at Nepal
And pierce the lover and his lass
From underneath the bed - YOU CALL
IT WONDERFUL!

T

I don't believe: Twinkle twinkle little star,
How I wonder what you are,
Up above the world so high...

D

I CALL IT CRASS!

(Silence)

K

I feel somehow...I feel somehow as if...as if I was getting invisible. *(Exits)*

S

Any fool nowadays. *(Exits)*

D

What next! *(Exits)*

[BLACKOUT]

[LIGHTS]

T

For instance, I stand at the seashore,...

S

Alone, and start to think...There are rushing waves...

T

Mountains of molecules,...

S

Each forming white surf in unison...Ages on ages...

T

Before any eyes could see...

S

Year...

T

After?...

S

Year. Thunderously pounding the shore as now.

T

For whom, for what?...

S

On a dead planet, with no life to entertain...

T

Never at rest...Tortured by energy...

S

Wasted prodigiously by the sun...

T

Poured into space...A mite....

S

Makes the sea roar.

T

Deep in the sea,...

S

All molecules repeat the patterns of one another?...

T

Till complex new ones are formed.

S
They make others like themselves...

T
And a new dance starts...Growing.

S
In size and complexity...

T
Living things,...

S
Masses of atoms,...

T
DNA, protein...Dancing a pattern...

S
Ever more intricate...

T
Out of the cradle....

S
Onto the dry land...

T
Here it is standing...

S
Atoms with consciousness...Matter with curiosity...

T
Stands at the sea...

S
Wonders at...

T
Wondering...

S
I...

T
A universe of atoms...An atom in the universe.

D (*VOICE*)
HEY!

T
Space is curved.

S
Hm?

T
Gravity bends light.

D (*Pops her head in*)
Hey!

S
Ritual!

T
Warped.

D
Space is warped by the presence of mass.

S
Heavier bodies, create larger dimples and greater curvatures.

D
Nayh. Space and time are elastic. They can be...

T
Bent!

D
Shrunk!

T
Stretched!

D
Twisted!

T
Buckled!

D

Yaaahhh! M - Mass is a form of energy - E. (*M exits*)

T

No, eventually, the universe will be nothing but a collection of dead black holes in a tenuous sea of discarded radiation.

S

All is not quite over yet?

T

Black holes?

S

Evaporate slowly losing mass?

T

By giving off energy and particles...Black holes of galactic mass?

S

Trillions of times the mass of the Sun!

T

Will radiate photons of hopelessly low energy and will take eons to evaporate altogether.

S

But in their death throes!

T

They will give up all their remaining!

S

Mass.

T

In a burst?

[BLACKOUT]

There is so much we still don't know.

S

Such as?

T

What happens to objects that fall into a black hole.

S
Do they reemerge elsewhere in the Universe? Or in another universe?

T
Can we warp space and time so much that one can travel back in time? And can we warp space and time so much that one can travel back in time?

S
There's so much we still don't know.

T
These questions are part of our ongoing quest to understand the Universe.

S
Maybe someone will come back from the future.

T
And tell us the answers...
[BLACKOUT]
But the hole is not a solid body, general relativity insists that the.

S
Ten Solar masses.

T
Of stellar matter...which created the hole...by imploding

S
Long ago.

T
Are now concentrated at the hole's very center. ... concentrated into a minuscule region of space called *singularity*. ...

S
God. Abhors a naked...singularity.

T
Singularity.

S
The singularities produced by.

T
Gravitational collapses occur only in places like... black holes.

S

Where...they are decently hidden... from outside view... by an event horizon?

T

That singularity.

S

Roughly... 10^{-33} centimeter in size (a hundred billion billion times smaller than an atomic nucleus), should be surrounded by pure emptiness.

[BLACKOUT]

We know there is a lot of dark matter out in the universe that we can't identify.

T

Black holes are certainly interesting.

S

I have long believed that the center of every galaxy is in fact a black hole.

T

Black holes hold light.

S

Not only can black holes spin, they can pulsate.

T

Some massive stars...and even galaxies must create black holes when they die.

S

I HAVE NEVER SEEN A BLACK HOLE!

T

Nobody...has.

[BLACKOUT]

S

To sum up: it seems that particles can fall into black holes.

T

Which then evaporate...and disappear from our region...

S

...of the universe?

T

The particles...

S
Go off into baby universes?

T
Branching off from our universe.

S
These baby universes can join back on. SOMEWHERE ELSE!

T
Hm?

S
Somewhere else!

T
Your interest is riveted on the fiery marriage...of...of general relativity with quantum mechanics, a marriage that may take place at the center of a black hole. You are preaching that the endpoint of stellar implosion is a great crisis, from which deep new understanding may emerge.

S(Pause and then applause)
Ha, ha! Ha, ha ha!

[BLACKOUT] [LIGHTS]

(D and K enter)

K
Red shift...red shift.

D
The world is a game of chance.

T
Pulsate.

S
Proton...neutron...baryon.

K
Strong force...holds the quarks.

S
Fermion....hadron.

K

Black hole, hair.

T

Linear....phenomena.

K

Antiparticles? Antiparticles.

S

Meson...Kaon.

K

Antipeople.

T

Complement each other!

S

Photon, neutrino...

K

Antiworlds.

D

You are really asleep?

T

To argue whether the electron is really a wave or a particle is futile. An electron is an electron and it behaves as an electron behaves.

D

Space is warped by the presence of mass.

T

It is like neither...neither.

K

Spooky action at a distance? Annihilate.

S

Strange quark...

K

A! Nnihilate.

S

Charm quark...

K
A Nni! Hi Late!

T
Let there be light!

K
Squarks. Sleptons and Squarks?

D
There is such a thing as absolute acceleration.

S
Up quark.

T
Shame.

K
Isospin.

D
Friction?

T
This is called the art of war?

D
Space is not uniform?

T
The universe...is a closed system...and hence its entropy increases with time.

K
Geodesic...isospin.

S
Down quark...

K
Isospinnnnnn.

T
Atoms are often liken to little solar systems.

[MUSIC STARTS]

K
De dum de da da da da!

S
Bottom quark...

D
Entropy!

K
De dum de da da da da!

D
Entropy!

T
Hear the tolling of the bells?

S
Top quark...

D
ENTROPY!

T
IRON BELLS?

D
Oh, the future, how it tells, of the rapture that impels....

T
The clamor and the clanging of the bells?

D
Oh the future....

K
Big crunch?

S
Red quark...

K
Geodesic!

T
Gravity and acceleration must be the same.

D
Which neutrino?

K
Absolute time.

S
Green quark.

K
Ga...lileo!

T
Imagine a race of two dimensional creatures...living on a sheet of paper.

K
Gravity.

S
Blue quark

K
G...alileo.

T
Put these bookworms on a crumpled piece of paper...what would they think about their world? Rubbery.

K
Oooooohhhh!!!

T
Ha, ha, ha, HA! The world does not happen it simply is!

D
It has no electrical charge!

T
Winos, zinos, squarks and sleptons?

S
Higgs boson?

T
Big whimper!

K
Black holes have no hair.....

D
Let us be definite. [MUSIC]

S
Electron.

D
Oui.

K
I didn't make any of this up.

T
Fluctuation!

D
Gravitational forces are attractive?

S
Detonated.

D
Color.

S
Before dawn.

K
I'm a hungry hyena.

T
The needle pricking stimulus.....of conversations.

D
Going, going, gone.

S
Brief...moment...

D
This is the beauty of geometry.

S
A great blinding light.

T
Six flavors and three colors.

K
James Joyce.

D
Imagine having x-ray eyes.

T
Unobserved partner?

S
Long rumbling.

D
Little Willie full of glee,
Put radium in Grandma's tea...

T
Motion...

D
Now he thinks it quite a lark...
to see her shining in the dark!

T
All bodies attract each other.

S
Not quite like thunder.

D
Some say the world will end in fire...

T
What are the weak interactions, imaginary time?

D
Some say in ice. From what I've tasted of desire,

S
Plutonium?

D
I hold with those who favor fire...

T
The strong nuclear force!

S
Before dawn.

D
But if I had to perish twice...
I think I know enough of hate.

T
DEEP SPACE!

D
To say that for destruction...

T
Force has no life of its own! Apparent effect!

S
Now he thinks it quite a lark?

K
Acceleration! Acceleration!

D
Ice is also great and would suffice?

T
DISTORTION OF GRAVITY!

D
Ha, ha, ha, HA!

S
Before...dawn!

K
Infiltration...Infiltration!

D
It gets easier further on...

T
The moon falls each second!

S
I simply can't stand disorder.

T
Exactly as an apple! BILLIARD BALLS!

D
It gets easier further on?

T
The ordinary world!

S
Blinding.

D
In the present critical situation, there is no alternative...FULL STEAM AHEAD!

T
SIMULTANEOUS!

S
LIGHT!

K
PENETRATION! PENETRATION!

D
FULL STEAM AHEAD! AHEAD!

T
KILOMETERS PER SECOND!

S
GREAT HOPE! GREAT PERIL!

K
ANNIHILATION! ANNIHILATION! [EXPLOSION]

S
Without any sound!

K
Oh....oh....oh.....

T
A story...a story.. logically begins at...the beginning.

D

S

T

Unfortunately there are *no data* for the Very Beginning.

D

S

T

We don't...we don't... know anything about the universe until it reaches the mature age of... a billionth of a trillionth of a second.

S

T

THE BIG BANG! This was a time called the big bang?

D

T

When the universe was hot and dense and seething with particles.

D

T

Protons and neutrons could not combine to form the nuclei of elements heavier than hydrogen.

S

T

For the simple reason that it was too hot.

D

T

Any neutrons and protons that happened to get together would be instantly blown apart...

N

K

T

By all the hugely energetic particles bashing into them....

K

T

...But as the universe expands and cools, neutrons and protons can stick together...through chance collisions....

K

S

D

T

...and stay together? Ha - ha.

S

T

Atomic nuclei.

D

T

...can be born and can survive.

S

NO!

T

YES!

S

T

There is a brief window of opportunity lasting for just a few minutes in the early life of the universe when it is neither so hot that nuclei are blown apart.

K

S

T

Nor so cool...that they are immune to further reaction and change....

K

T
...In this brief interval...

K

T
...Neutrons and protons...

K

S

T
...pair up... and swap partners and form...groups!

S

K

T
...At the end of it.

S

K

S

K

S

K

T
The universe contains seventy-five percent hydrogen.

K

T
Twenty-five percent helium!

S

K

D

T
And a trace or two of other light elements.

(K exits)

S
Shall I say it again? In order to arrive there, to arrive where you are...

D
To get from where you are not...

T
You must go by a way wherein there is no ecstasy.

S
In order to arrive at what you do not know, you must go by a way which is the way of ignorance.

T
In order to possess what you do not possess

S
You must go by the way of dispossession

D
What is this thing?

T
Called entropy.

D
That increases.

T
Entropy is a measure of the degree of disorder of a physical system. But how do you measure disorder? The answer comes from probability theory, the mathematical study of randomness.

D
A drinking glass explodes into several fragments...it is irreversible: a motion picture film of the explosion, if played in reverse, would instantly be spotted as trickery because it would show the miraculous self-organization of the fragments into a well-ordered system.

T
This behavior is never observed in ordinary life.

D

How does order arise? Hunh?

T

In a universe ruled by disorder.

D

Entropy predicts that there can be but one end to the universe.

T

In which...the temperature is so low.

D

As to make life impossible.

T

Heat death?

D

Heat death.

(S enters)

S

Forward...march of...time?

T

Oh?

D

Yeah? The rotting of fruit?

S

The law... of entropy increase...

D

Gives time an arrow.

T

A direction which distinguishes the past from the future.

S

From the future. There is order?

T

Time?

S

Time. There is chaos?

T

Entropy?

S

Disorder. Yes.

D

Entropy.

T

Time!

D

We shall see.

T

The way we look at a group of people.

D

Can actually affect the group's behavior.

T

Or vice versa...or vice versa. (*T exits*)

D

Every atom of every body attracts every other atom of every other body.

Ummmmmmmmmm.

With a force between the attracting and attracted atom.

S

There must be something unusual...

D

Gravitational forces are always attractive.

S

About the force...

D

...And never repulsive...

S

...That holds quarks together...

D

Without gravitational force...

S

The force binding quarks together...

D

We would be flung into space like rag dolls by the spin of the earth. (*T enters, then exits*) Force.

S

Must somehow grow stronger....

D

...has no independent life.

S

The further apart quarks are.

(*T enters*)

T

...Twinkle twinkle little star, how I wonder what you are....ah! The gravitational force is the oldest force known to man and the least understood.

S

Quiff! Pop!

T

By observing the universe, each observer is disturbing the universe.

D

By observing.

T

Each observer is... separating himself or herself from the rest of creation?

D

By observing?

T

The observer is gaining knowledge but also paying a price.
He is becoming more and more alone and isolated.

D

If the world exists?

T

And is not objectively solid and preexisting before I come on the scene, then what is it?

D

The world is only a potential and not present without me or you to observe it!

S

It is in essence.

D

A ghost world that pops?

S

Into solid existence.

D

Each time one of us observes it.

T

All the world.

D

Is potentially present.

T

Able to be.

D

But not actually seen until one of us sees.

T

Consider the electron.

D

But not actually seen.

T

The electron springs into existence only when we observe it.

S

As long as you are not looking.

T

At an electron.... It behaves as a wave of probability...

S

The moment you look.

T

At the electron, it is a particle. (*Laughs*)

D

But! As soon as you are not looking, it behaves like a wave again. (*S exits*) The moment of observation...

T

Reality is created by the observer....

D

The moment when many possibility quantum reality...

T

CONDENSES INTO A SINGLE ACTUALITY?

D

Is known as the collapse of the wave function. (*She exits*)

T

"...all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system, and that the whole temple of human achievement must inevitably be buried beneath the debris of a universe in ruins." [BLACKOUT]

(*K enters*) [LIGHTS]

K

Hear the tolling of the bells--Iron bells!

T

No!

K

What a world of solemn thought their monody compels!

T

TO KNOW!

K

How they tinkle, tinkle, tinkle,

T

No way.

K
In the icy air of...night!

T
Certainty.

K
While the stars...!

T
Know absolute?

K
that oversprinkle
All the heavens...!

T
Know with certainty?

K
Keeping time, time, time,
In a sort of Runic rhyme,
To the rolling and the tolling of the bells--
Bells, bells, bells, bells, bells, bells--

T
No way to know.

K
And the people! ah, the people!

T
There is no way to know. Absolute! Certainty!

K
They that dwell...up in the steeple...

T
To know with absolute certainty?

K
All alone!

T
There is no way to know....

K
On the human...heart a stone--

T
Matter

K
All alone
Hear the mellow wedding bells?

T
Tiny.

K
How it swells?
How it!...

T
Movements...

K
DWELLS!

T
Movements...of...matter...

K
On...the...future...

T
Tiny...particles...matter...

K
Alarum bells.

T
To know, to know. There is no way to know. There is no way to know.

K
Keeping

T
There is no way to know the movements of matter. Particles of matter.

K
Time...time...time.

T

Such tiny particles of matter.

K
To the moaning
and the groaning of the bells.

T
There is no way to know with absolute certainty the movements of such tiny particles of matter.

[BLACKOUT]

[LIGHTS]

D
Heh, heh. Non. Non. Non. Savoir. Certitude. Savoir absolument. Savoir avec certitude. Pour savoir absolument. Aucun moyen de savoir. Aucun moyen de savoir. Savoir avec un absolute certitude. Il n'y a pas moyen de savoir. La matiere. Miniscule. Du mouvement. Le mouvement de la matiere. Toute petite particule de matiere. Savoir. Savoir. Il n'a aucun moyen de savoir. Il n'y a aucun moyen de savoir. Il n'y a aucun moyen de connaitre les mouvements de la matiere. Petites particules de matiere. Il n'y a aucun moyen de savoir avec une absolute certitude les mouvements de si petites particules de matiere. GLING!... GLING!... GLING!...GLING!... GLING!...GLING!

S

Time could flow backwards.

D

Gling?

S

The arrow of time could change direction.

D

Probability...probability.

S

Or say that the end proceeds the beginning.

D

Well, now that's done and I'm glad it's over.

S

The fate of the universe.

D

Almost as soon as the electron was born, it began causing problems.

S

The rotting of fruit...?

D

Began causing problems...

S

Perhaps there will be an infinite future.

D

The world does not happen! It simply is!

S

But whether the universe expands forever or one day falls in on itself depends...

D

If there were water and no rock.

S

On it's birth.

D

If there were rock and also water. But, there is no water. Drip, drop. Drip, drop. Drop, drop. Of course the planets are important in some ways. We live on one of them.

S
We shall see.

D
Shall we?

S
To know the fate of the universe.

D
Space is blue and birds fly through it. Ha, ha, ha, HA!

S
We must first understand its creation.

D
HAH!

S
And to know that.

D
HAH! Let's pretend. Hahahahahahahahaha!

S
We need to know how gravity is joined.

D
Aw! With a little patience.

S
To quantum theory.

(The door chimes)

D
We shall see.

S
Shall we.

D
We shall see? *(The door chimes)* We shall see?

S
The world does not happen.

(The door chimes)

D
We shall see. Are we halting. Tell me someone where we started.

(The door chimes)

S
What is that noise!

(The door chimes)

D
Ha HA! *(Sings)*
Almost as soon as the electron was born it began causing problems.

(The door chimes)

S
DO YOU SEE NOTHING!

(The door chimes)

D
Tell me someone, are we halting or advancing.

S
All is vaulting.

(T enters)

D
Oh, $F = MA$!

T
Time travel, worm holes, extra-terrestrial civilizations.

D
Ha, ha, ha HA!

T
Young man let me explain to you about something new and exciting in physics!

S

Take a deep breath.

D

Ha, ha, ha, HA! We're still in for a lot of surprises.

S

Any fool nowadays can switch on a light or touch off the atomic bomb.

D

Ach! You must now pay very close attention.

S

We shall see.

T

Every subatomic process has the power to multiply the world.

S

What is now proved...

T & D (*Singing*)

Was once only a, once only a, once only imagin'd.

T

Let us take any object near at hand.

D

Awwwwwww

T

This little fruit basket for instance.

S

What is now proved.

T

This fruit basket is nothing more than a frame.

S

WHAT IS NOW PROVED!

T

A frame, yes, which serves to unite certain sense perceptions, yes, some of which are actual where as the majority, yes, are only virtual.

S

They were discovered mathematically.

D

Speak in French when you can't think of the English for a thing.

T

You cannot analyze it.

S

Thank you.

D

Stick to the subject.

T

Parallel worlds we just don't know. TIME!

D

Turn out your toes.

T

SPACE!

S

Nothing has a definite state.

T

Nothing has a definite state.

S

Nothing has a definite state!

T

GRAVITY! Can highly advanced civilizations build wormholes through hyperspace. FORCE!...

D

Relative to what?

T

MASS!... And machines for traveling backwards in time.

D

Space is blue and birds fly through it.

T

Nonsense. FRICTION! Everything around us. Trees, mountains, the stars themselves are but vibrations in hyperspace.

S
What next...

D
Einstein...

T
The world as an infinite series of times. This web of time embraces every possibility.

S
They were discovered mathematically.

T
We do not exist in most of them. In some you exist and not I. While in others I DOOO! and you DOOO NOT!

S
Mathematically!

T
You look at me and think; which is he? Plus or minus? If only you could figure it out. And then you still wouldn't know. We are all doubles. Even you. (S exits)

D
A tree must either be a tree or not a tree.

T
Even a pea sized pebble of antimatter striking the earth would cause a kiloton explosion.

D
I know nothing about routes - but I do know the machinery of the universe. (Slap)

T
Domain walls made of curved space separate universes!

D (*Faint cry of alarm*)

T
If you go there you encounter a boundary. (Slap) If you cross the boundary you die. (Slap)

D
Theory!

T(*Slap*)

So you don't want to go there. (*Slap*) There is always the possibility that the most exciting things to come will be something no one can predict or even imagine.

(*Slap*)

D

Here, it seems we pass the gateway?

T

Into magic dreams and mazes.

D

No charge!

T

No mass.

D

NO SPACE DIMENSION!

T

No shame!

D

YOU DO DEFY CONVENTION!

T

Little neutrino in the world, with the speed of light you're hurled.

D

Nowhere!

T

This is not only a great peril but a great hope.

D

Let us be definite

(S and K enter; S supporting K, who still has her brandy bottle)

S

Try to wiggle out of this.

K

Quiff, pop. Quiff, pop.

S

Suddenly everyone out there is you.

K
There! There, a universe.

T
This is really quite a bombshell.

K
A universe! This big!

S
Nothing.

T
Diverging, converging and parallel times!

D
Collision!

T
Gigantic multifoliate!

S
Time is a man...

T
But how do we begin. If we start with pure induction we have no way of knowing which data to gather.

D
Stick to friction.

K
Something looks to me like whatever I say it looks like.

T
And if we start with pure deduction.

D
Why is gravity left out?

T
We are isolated from nature.

D
Why?

T

The way out is to break the closed loop of induction deduction.

D

Deduction?

T

Imagination, intuition.

D

The beginning had nothing behind it or before it - that it was a Beginning in fact - that it was a Beginning and nothing different from a beginning - in short...

T

Or genius.

D

That the beginning was...that which it was.

T

F of omega is equal to negative M over two pi H squared times integral E to the IQ dot R times V of R d-tau.

D

And so each venture is a new beginning.

T

Where Q equals K-nought minus K and Q is equal to Z K sine one-half theta.

D

Or say that the end precedes the beginning, And the end and the beginning were always there before the beginning and after the end. And all is always now. Words strain, crack and sometimes break under the burden,

T

And cosine theta is equal to K-nought dot K over K squared.

D

Under the tension.

S

How can it be that mathematics is the correct description of reality?

T
Shhhhhh.

K
Shhhhhh.

S
O.K. (*Shrugging*)

D
Slip, Slide. Slip, slide, perish.

D (*Voiceover*)
Shall I say it again? In order to arrive there, to arrive where you are, to get from where you are not, you must go by a way wherein there is no ecstasy.
And what you do not know is the only thing you know. And what you own is what you do not own. And where you are is where you are not.

T (*Math starts*)
The force F is equal to Q times the quantity E plus one over C times V cross B . F is equal to Q times the quantity negative grad ϕ minus one over C times dA dT minus V cross grad cross A . Grad V dot A is equal to V dot grad A plus V cross grad cross A . V cross grad A is equal to dA dt minus dA dT . Grad cross A is equal to negative one-half grad cross the quantity R cross B is equal to negative one-half times the quantity R grad dot B plus B dot grad R minus B grad dot R minus R dot grad B . Grad cross A is equal to negative one-half B minus three B is equal to B . Thus, grad dot A is equal to negative one-half B dot grad cross R minus R cross grad dot B is equal to zero. dI dE is equal to the integral from A to B of dF dY d dX dF dY -prime dY dI dE , where E is equal to zero, is equal to zero is equal to the integral from A to B of dF dY d dX dF dY prime, dY d where E is equal to zero dX . Thus, for the integral to vanish we must have dF dY d dX dF dY -prime equal to zero. We conclude that dF dX is equal to zero.

[LONG SILENCE]

S
The birth of the universe.

T
Singularity?

S
Infinitely small and infinitely dense.

T
The smaller the thing you are looking at, the more energy you must use to see it.

K
Stability and life are incompatible.

T
We therefore conclude.

K
That dF/dX is equal to zero.

T
I always brood in my free time about the quantum problem from the standpoint of history.

S
Atoms are made of quarks and electrons.

T
Matter is condensed energy.

S
Space is curved.

K
Time is motion through space.

T
Entropy increases with time.

S
Nothing is locatable.

K
To observe is to disturb.

S
There's no way to know.

T
Eureka.

(S and K exit)

D *(Sings)*
Le soleil a rendezvous avec la lune
Mais la lune n'est pas la
Et le soleil attend
Dans la vie chacun sa chacune

Chacun doit en faire autant
La lune est là
La lune est là
La lune est là
Mais le soleil ne le sait pas.
Pour la trouver il faut la nuit
Il faut la nuit mais le soleil
ne le sait pas et toujours nuit
Le soleil a rendezvous avec la lune
Papa dit qu'il la verra samedi.

T
The influences of the senses have in men overpowered the thought to the degree
that the walls of time and space have come to look solid, real, and
insurmountable... Yet time and space are but inverse measures of the power of
the mind. Man is capable of abolishing them both.

[BLACKOUT]

CURTAIN