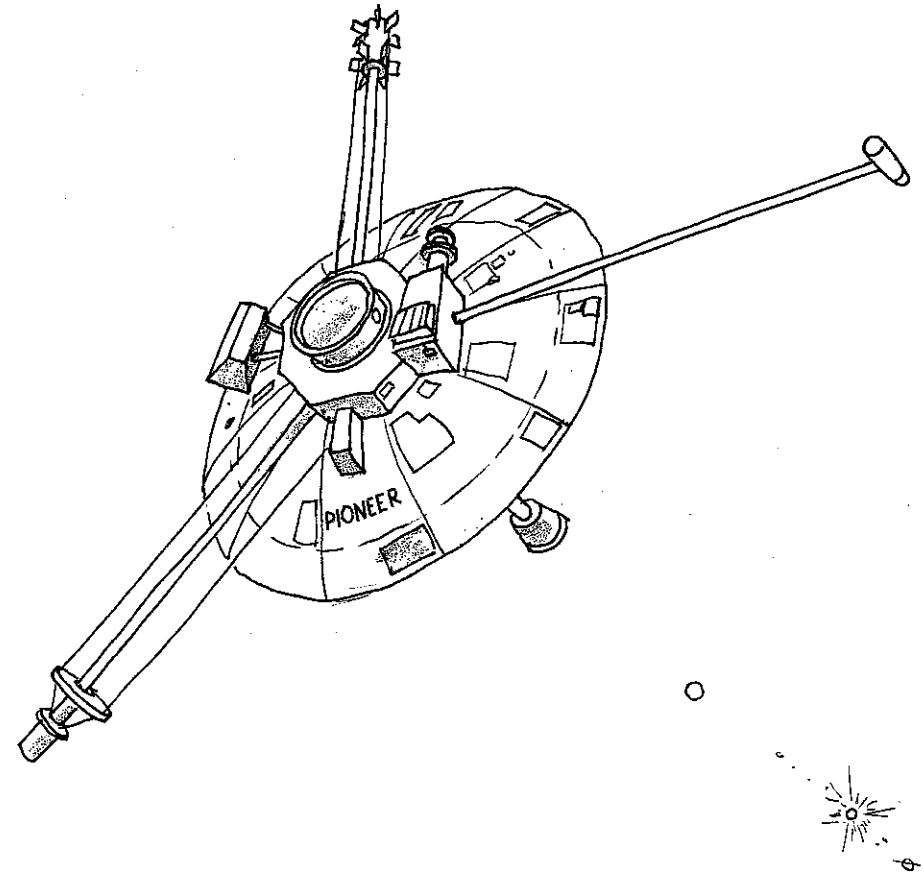
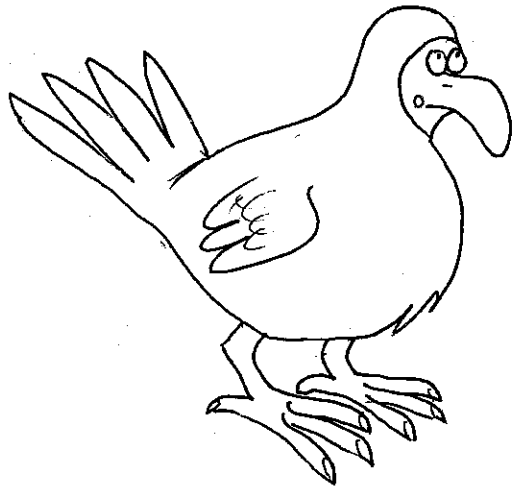


THE TWIN UNIVERSE

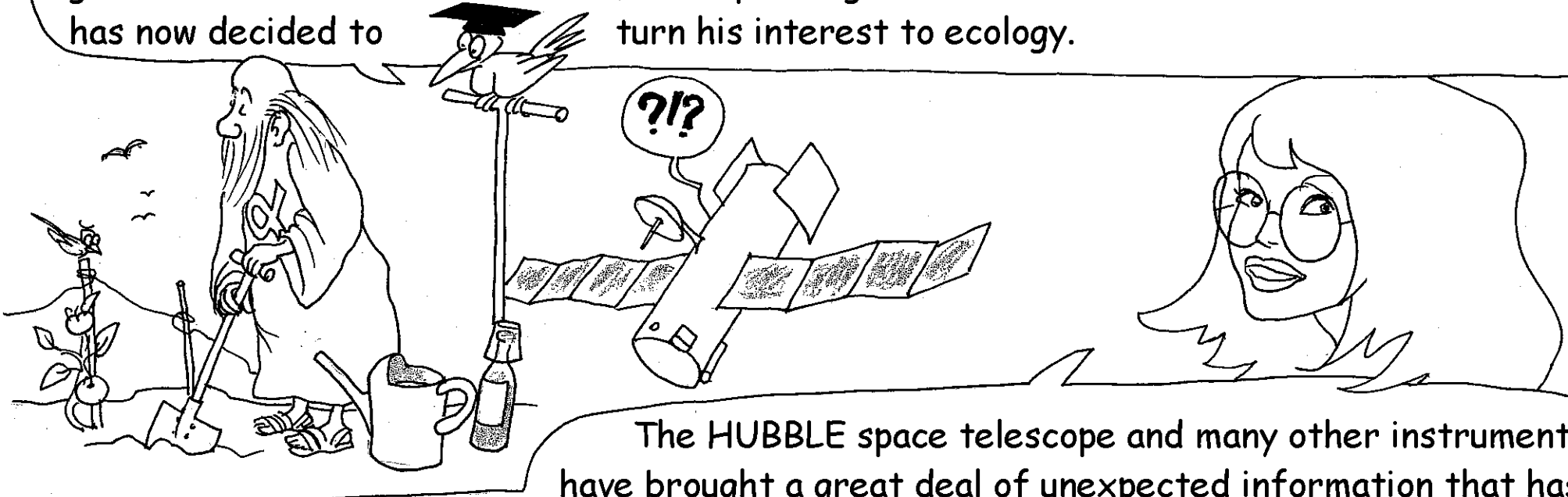
Jean-Pierre Petit

In other words: it's that or
fiddling around with Newton's law..



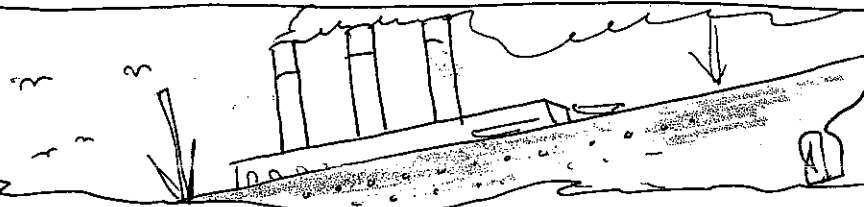
Translated by John Murphy

Twenty six years have passed since the author wrote *BIG BANG* and twenty-two since *A THOUSAND MILLION SUNS* was published. And what can be said about the twenty-seven years separating us from the *BLACK HOLE* album? Things have changed enormously since then. Even good old Herbert Reeves himself, after praising the *STANDARD MODEL* for three decades, has now decided to turn his interest to ecology.



The *HUBBLE* space telescope and many other instruments have brought a great deal of unexpected information that has plunged astrophysicists into the greatest confusion. The Canadian physicist, Lee Smolin, published a book whose title began "*THE TROUBLE WITH PHYSICS...*" (in France, Editions Dupond in 2007*). Perhaps we could also write, in the same vein,

THE TROUBLE WITH ASTROPHYSICS...



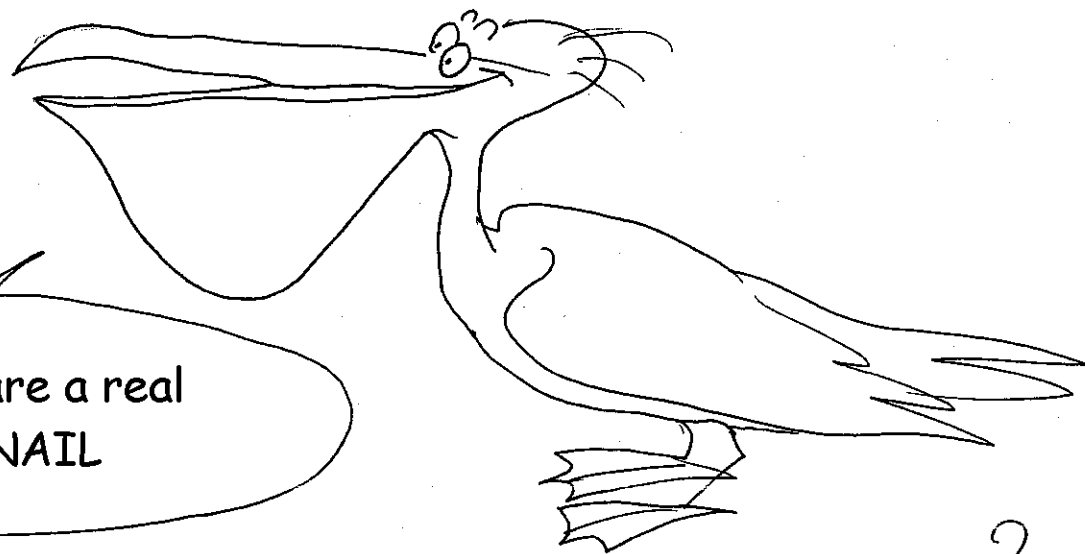
(*) Original title "The Trouble with Physics - The Rise of String Theory, the Fall of a Science, and What Comes Next"

In any case scientific history shows us that our view of the world has always been evolving. Why should our epoch be any different? Periodically we see a PARADIGM CHANGE. The idea that we have of THINGS and PHENOMENA is profoundly modified. So SPECIAL RELATIVITY and GENERAL RELATIVITY reflect above all a revolution in our conception of the GEOMETRY OF THE UNIVERSE. The growing contradictions, which multiply year after year in astrophysics, that theoreticians try to get round by constantly inventing new words and objects such as DARK MATTER or DARK ENERGY, which we believe can only be resolved with the introduction of a NEW PERCEPTION OF COSMIC GEOMETRY, which we will set out in this album.

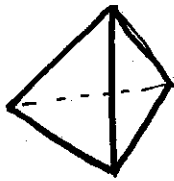


And, as they say:
"may the best man win".

Tiresias, you are a real
TURBOSNAIL



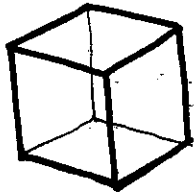
Plato (6th century B.C.) registered four regular polyhedrons (made up of identical faces).



The tetrahedron:
4 equilateral
triangles



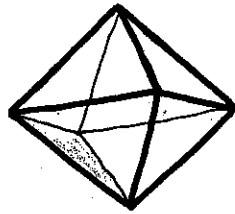
FIRE



The cube:
six square
faces



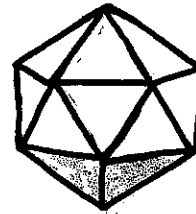
EARTH



The octahedron:
eight equilateral
triangles



AIR



The icosahedron:
20 equilateral
triangles



WATER

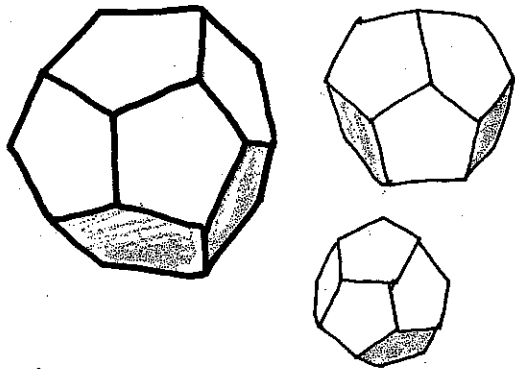


Alchemists and esoterists of all sorts decided to link them to the FOUR ELEMENTS, so to that which everything in the universe was supposed to be composed

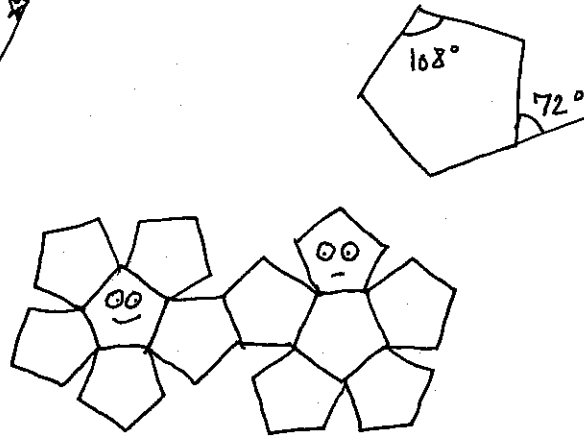
But then there was a catastrophe: a fifth polyhedron was discovered!

QUINTESSENCE

DODECAHEDRON



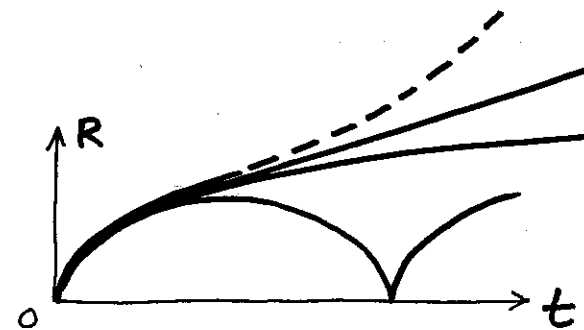
Twelve pentagons



Plato's series of regular polyhedrons continues with the DODECAHEDRON (*). EDROH is Greek for "face" and DODEKA means "twelve". This polyhedron has twelve pentagonal faces therefore. The "scientists" of antiquity, then those of the Middle Ages, who had brought everything down to the fundamental FOUR ELEMENTS, asked themselves which new ESSENCE this polyhedron referred to. They named it QUINTESSENCE, which means FIFTH ESSENCE.

(*) we will show that there are exactly five. But see Annex 1

Since 1917 people have believed that the future of the cosmos will bring a more or less marked slowing down of its expansion. However, a few years ago measures made on very distant supernovae showed an incomprehensible ACCELERATION. Astrophysicists invoke a new and remarkable ingredient: DARK ENERGY (originally named "quintessence"!!!)



Have we any idea what this mysterious black energy is?

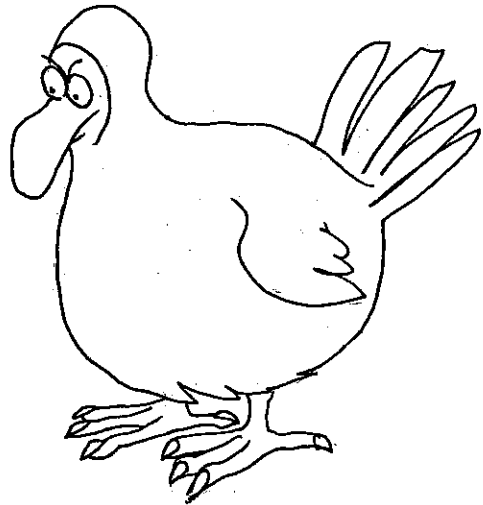
Not a shadow of an idea. All people say is that this component has a REPULSIVE characteristic.

It's like something out of Molière! Once upon a time mercury rose in barometers because nature abhors a vacuum, and everyone knows that sleeping pills work because they have a soporific property. This dark energy completes the menagerie which the mythical DARK MATTER has already joined.

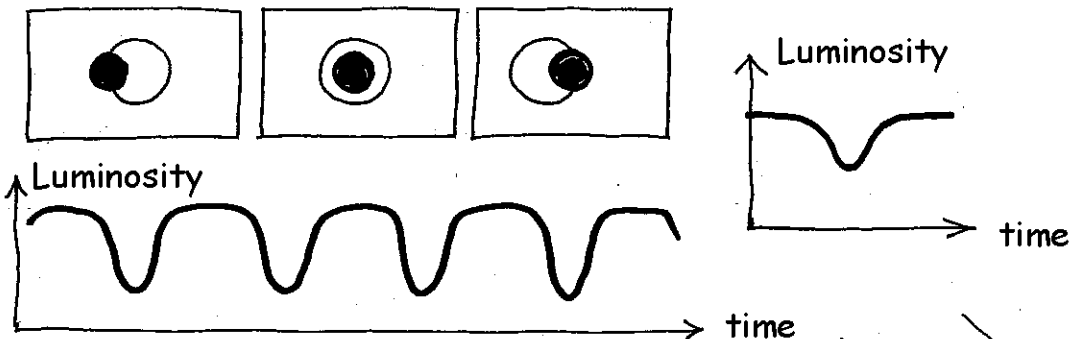
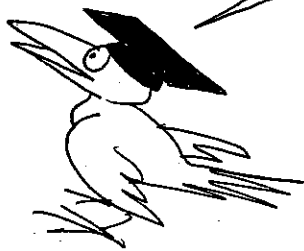


Tiresias, stop there!

The existence of DARK MATTER is an established fact!



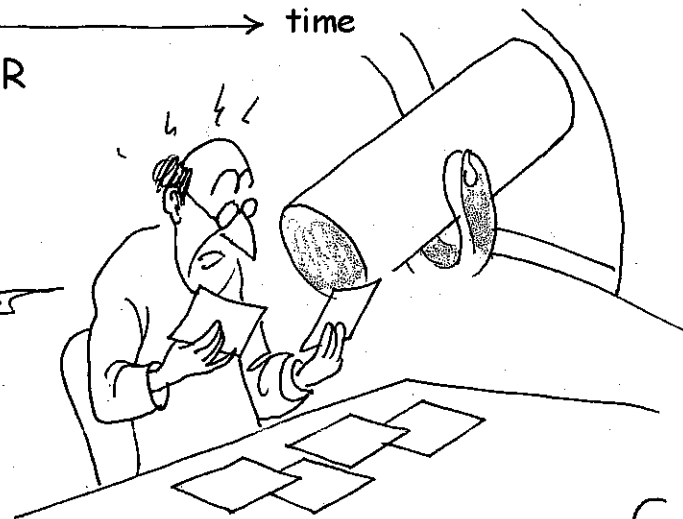
How so an established fact?!? No one has ever managed to show the thing. For twenty years it was thought that it was mini stars or giant Jupiters, MACHOS (*). They were sought in every direction in the hope that their passage in front of stars would create occultation effects. But every time there was a drop in luminosity it turned out to be because the stars were simple variable stars.



VARIABLE STAR

Blast! Just variable stars!!! I've been wasting my time for twenty years!

(**)

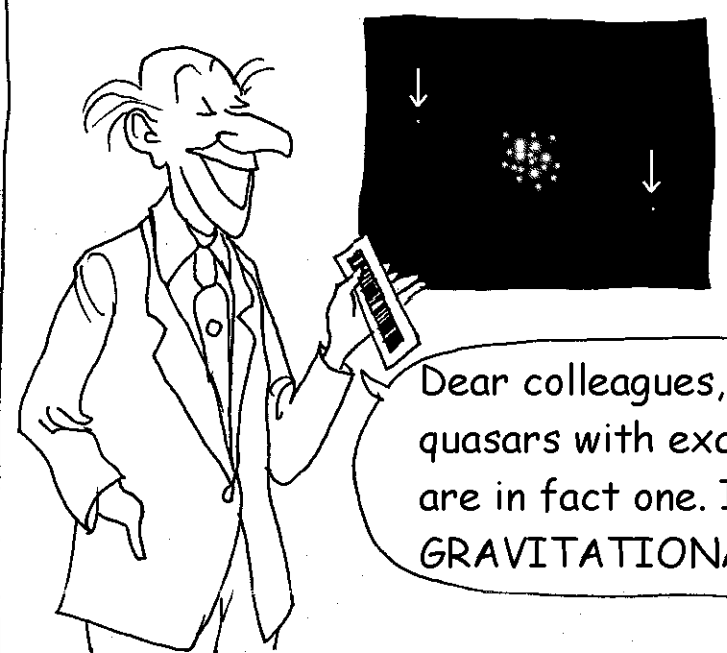
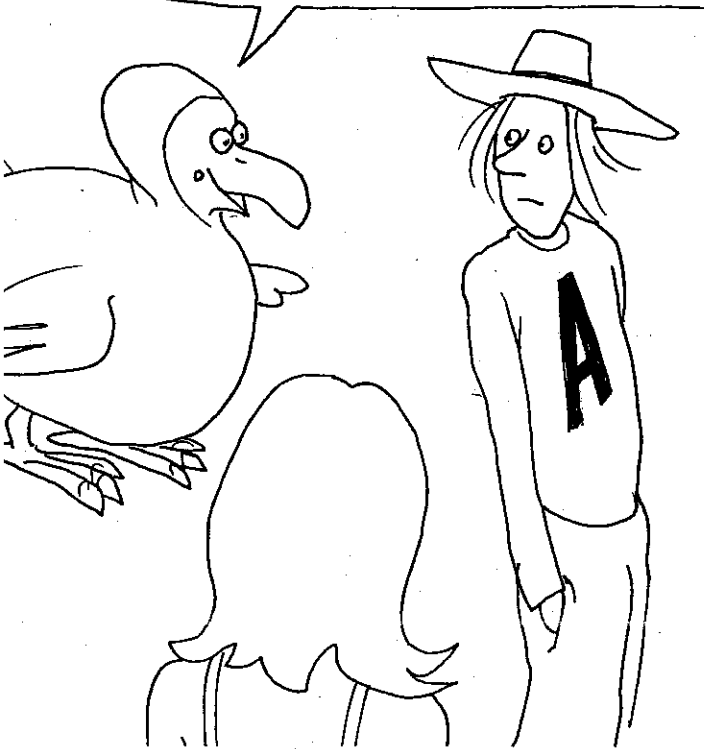
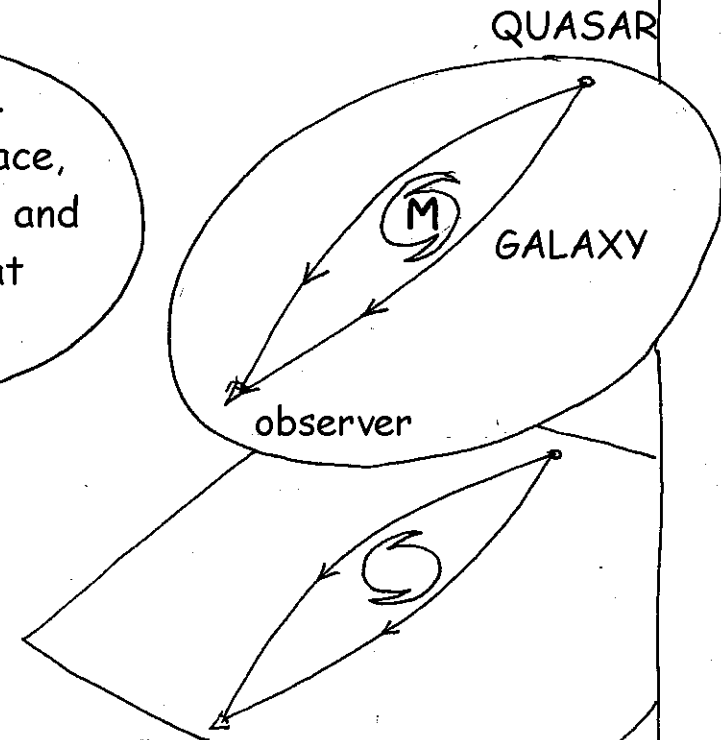


(**) Authentic

(*) Massive Compact Objects: Small objects having mass.

THE GRAVITATIONAL LENSING EFFECT

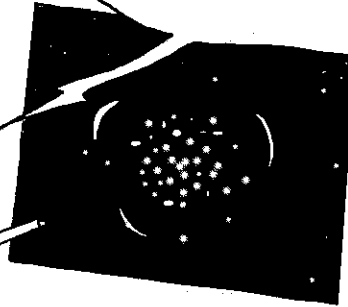
Einstein proposed an identification between mass and curvature in 1917. From then trajectories of photons became *GEODESICS* of a hypersurface, which allowed the **GRAVITATIONAL LENSING EFFECT** to be foreseen and that of **GRAVITATIONAL MIRAGES**, whose existence was confirmed at the beginning of the nineties.



Dear colleagues, the business is done. Two quasars with exactly the same spectrum are in fact one. It is a result of the **GRAVITATIONAL MIRAGE** effect

This observation, gentlemen, is crucial. It shows, with no contestation possible, that **DARK MATTER** exists. For to obtain such a mirage effect, the mass of the galaxy must be the **DOUBLE** of what we observe.

OPTICAL observation has become something secondary, old fashioned. And I shall now give you a second confirmation, absolutely unstoppable.

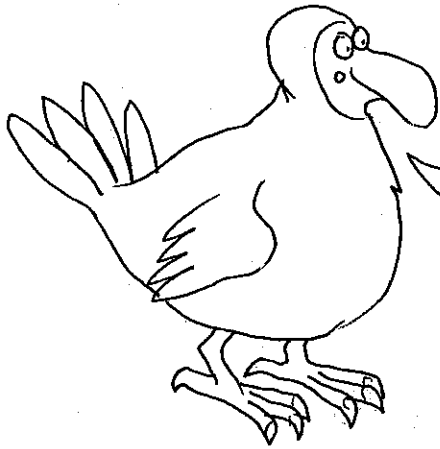


Around these **CLUSTER** forming galaxies you see images in the shape of **ARCS**. They are distorted images of galaxies far beyond and behind the cluster.

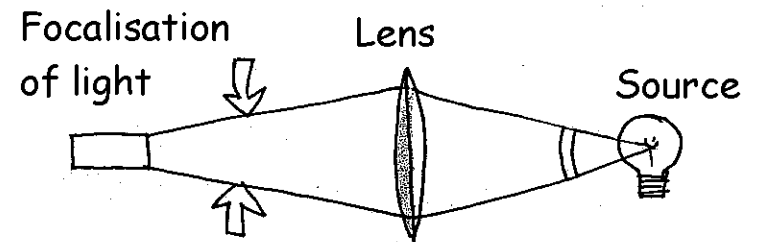
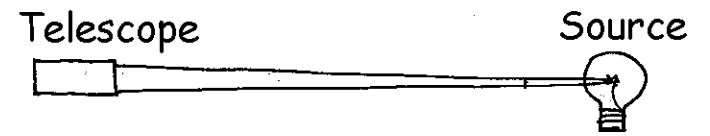
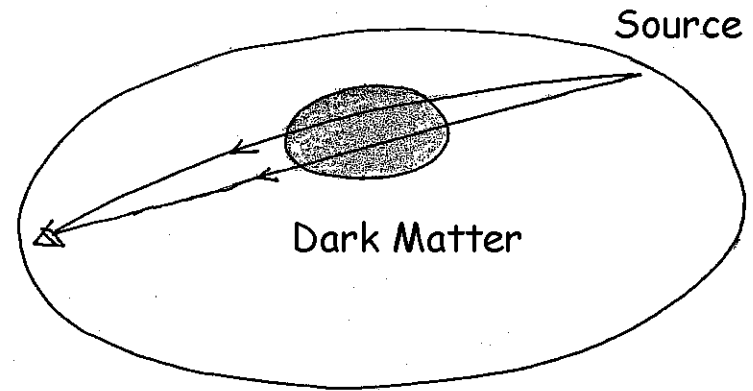
Therefore, gentlemen, we are entering a new age for astronomy. We can show, because of **GRAVITATIONAL EFFECTS**, we may never be able to observe them by optical means, whatever their wavelengths be: visible light, ultraviolet, infra-red and even X-rays.



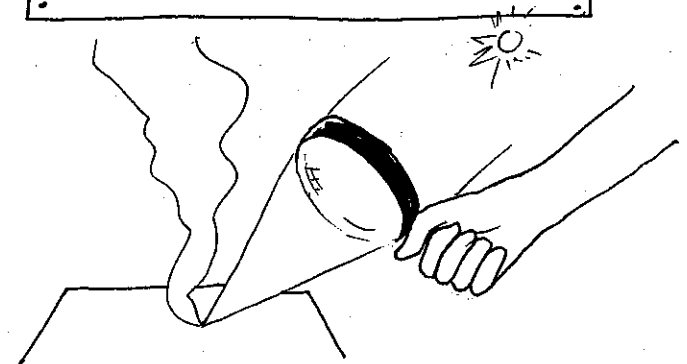
MICRO-LENSING



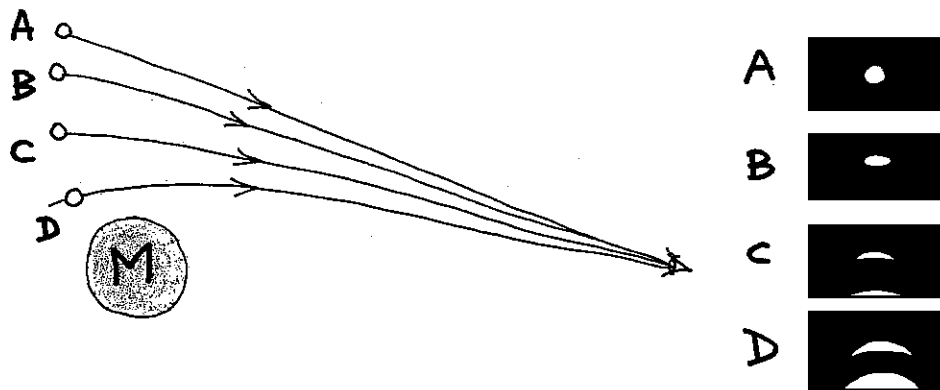
Only pessimists say that astrophysics is in a crisis. Our tools have simply developed. So, if light can cross a concentration of dark matter it will be subject to a gravitational lensing effect which will reinforce the source's luminosity just as an optical lens does.



The lens allows light to be concentrated.



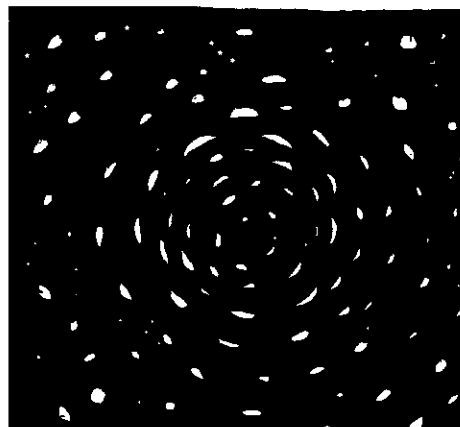
But what is even more interesting is that the gravitational lensing effect deforms the image of galaxies. This can make spheroidal galaxies seem to be elliptic.



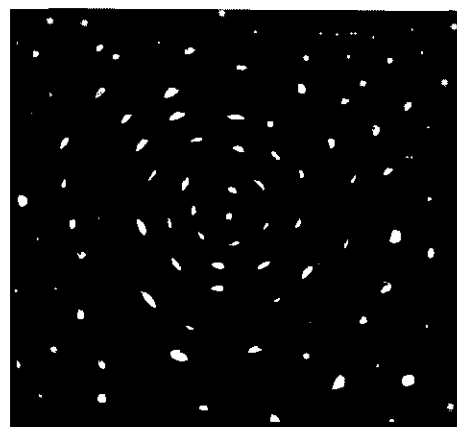
(*) VISIBLE light, which is an electromagnetic wave, interacts very little with this dark matter, if this does in fact exist, for it emits no radiation and behaves like a completely transparent milieu. Just the gravitational lensing effect remains.



A

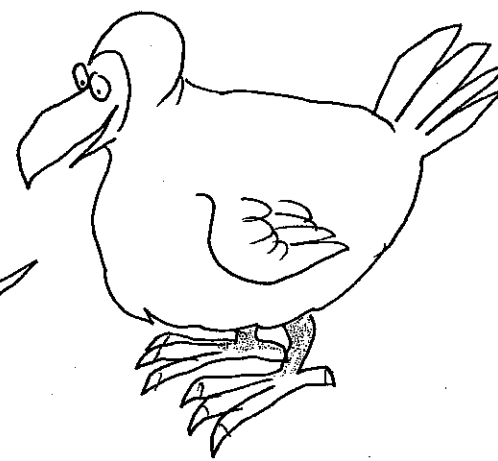


B



C

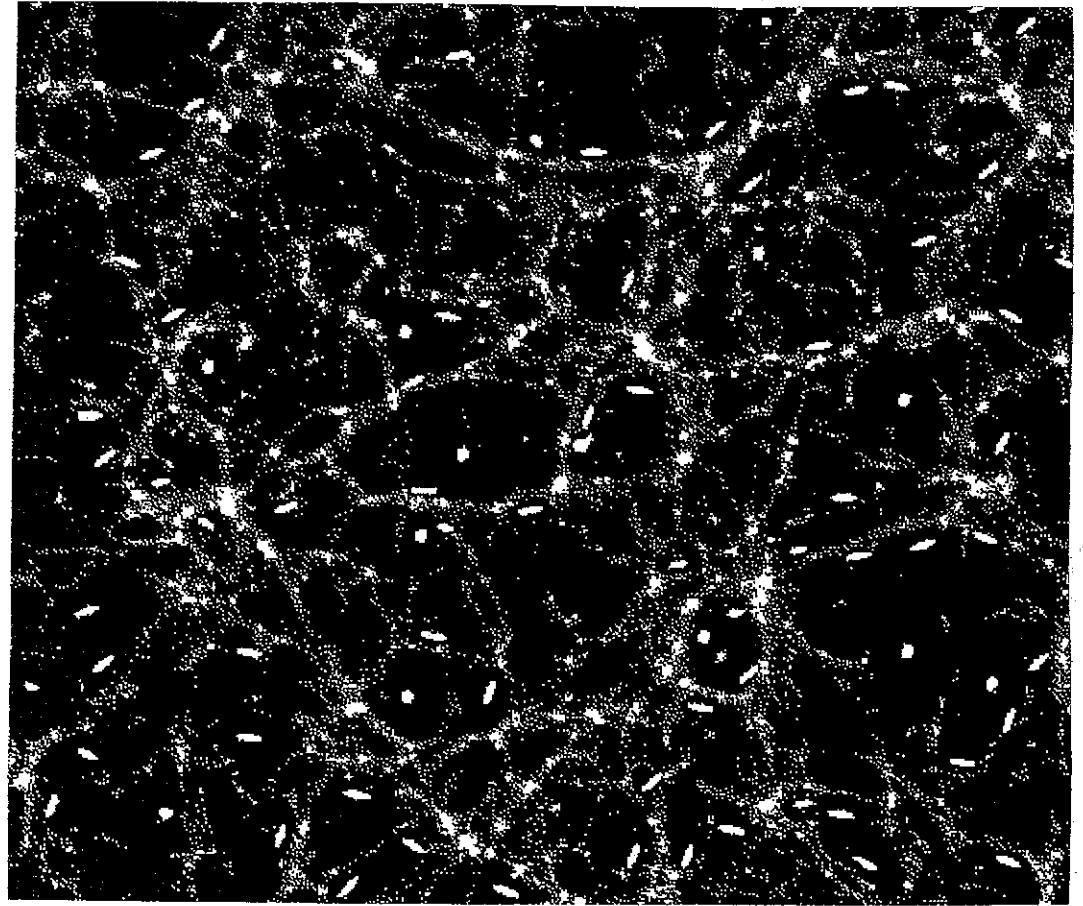
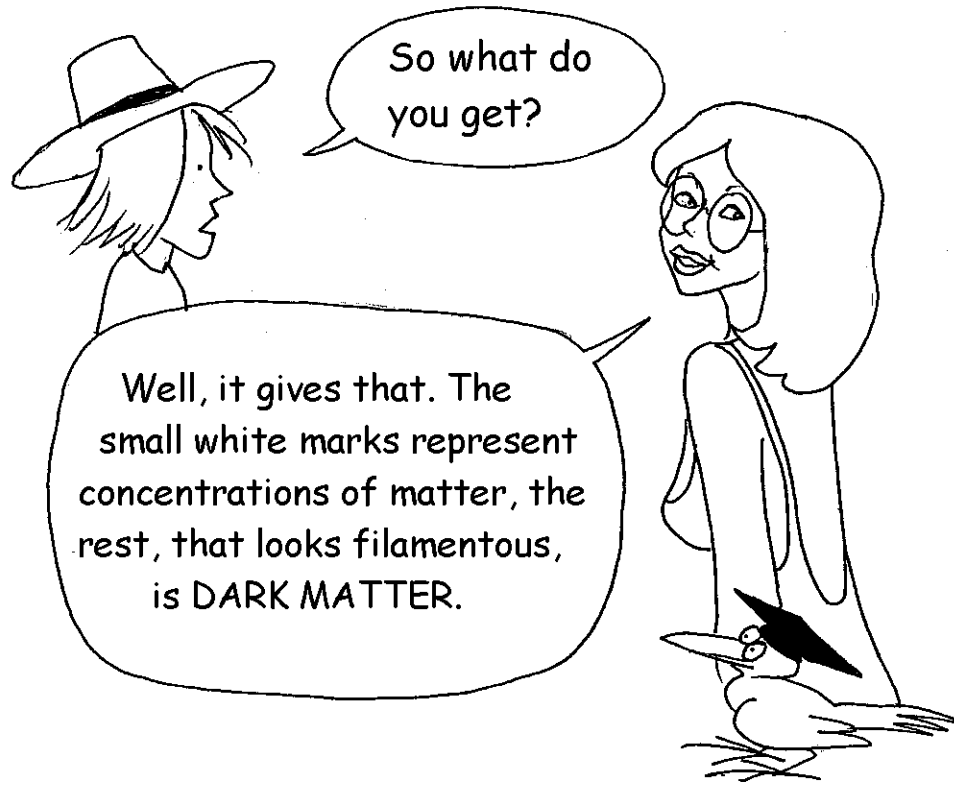
Let us look at a part of the sky sprinkled with distant galaxies - In A, a uniform sky background. In B an invisible object distorts the images of the galaxies by a gravitational lensing effect. Some appear stretched and look like ARCS. The effect is less pronounced in C but remains visible to the naked eye. The study of the image distortion of background galaxies allows the evaluation of the quantity of (dark) matter producing the effect. In the case of GALAXY CLUSTERS the mass is often 100 times superior to that measured by counting the visible objects that form the cluster, and whose distance is calculated via their redshift. However the capacity of the human eye is far less than the capacity for analysis and treatment of an image by a computer. From the tiniest (statistical) deformations in background galaxy images they can MAP the dark matter in three dimensions (*)



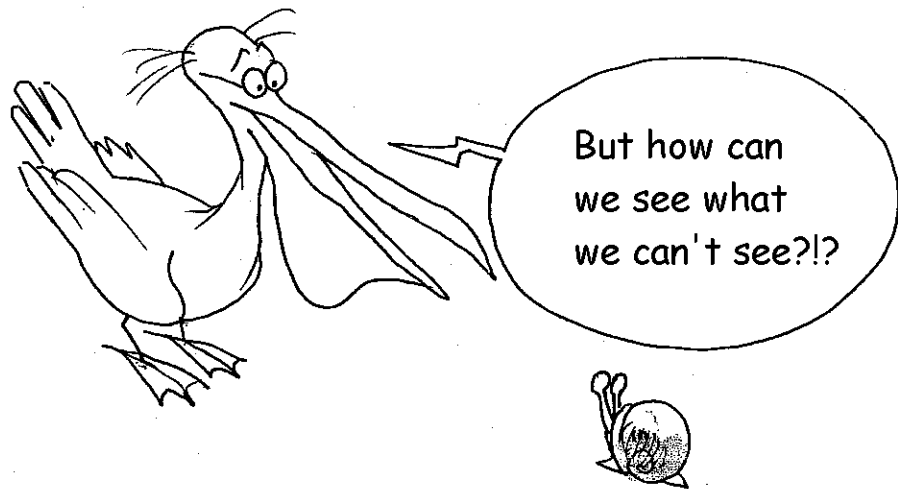
You mean that using this method we can map something we can't SEE?

(*) These techniques were first used at the beginning of the 21st century.

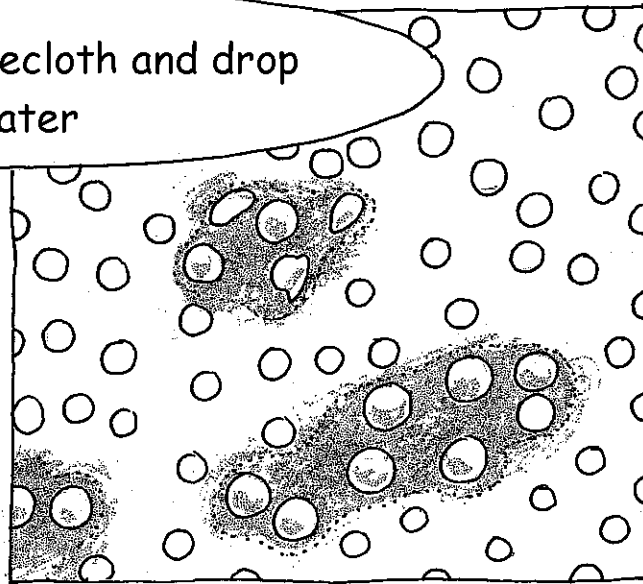
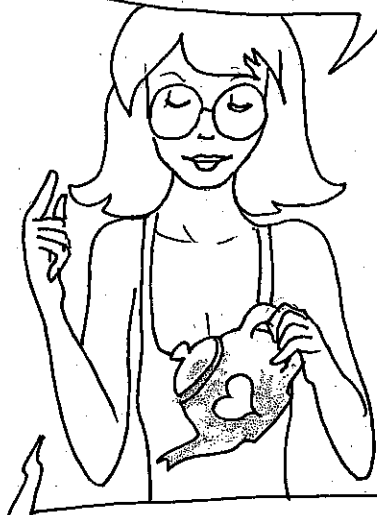
THE NEW ASTRONOMY



The first map of DARK MATTER published in 2000



Take an oilskin tablecloth and drop it onto water



Let's suppose that it is covered with white marks on a colored background.

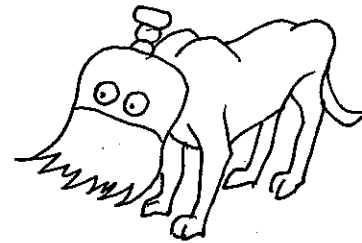
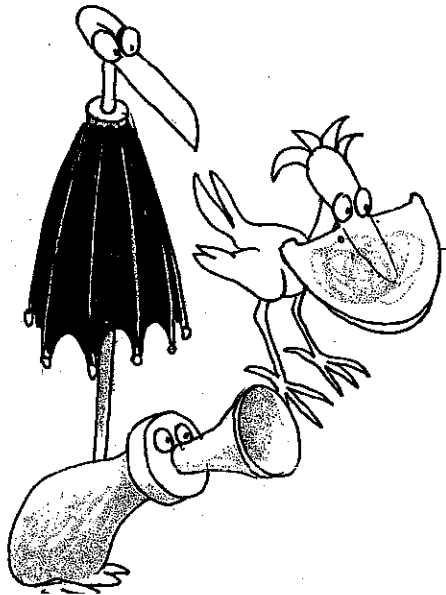
By analysing the distortions of the white marks, through a magnifying effect, a computer would be able to reconstitute the form of the water pools creating the phenomenon, even without seeing the areas of liquid.

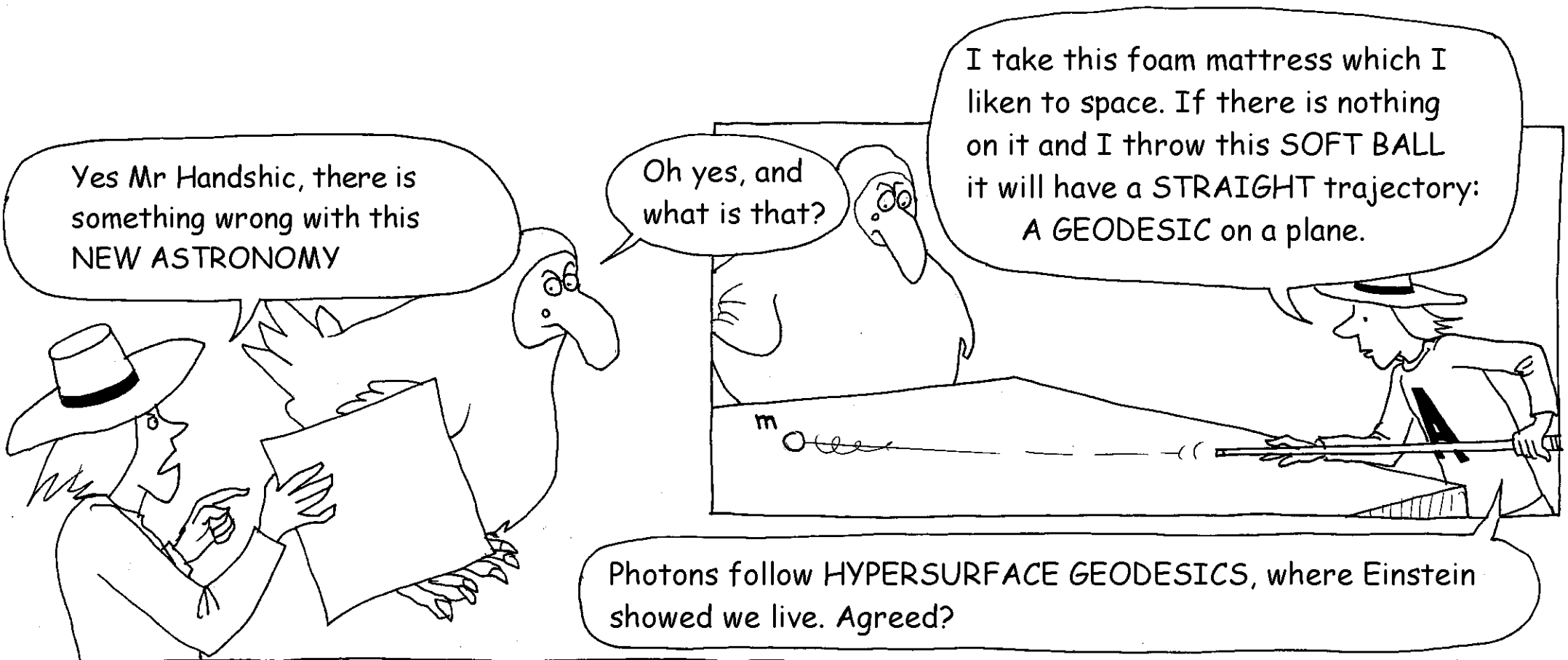


There you are, it's done.



Wait Mr dodo, there's a problem.





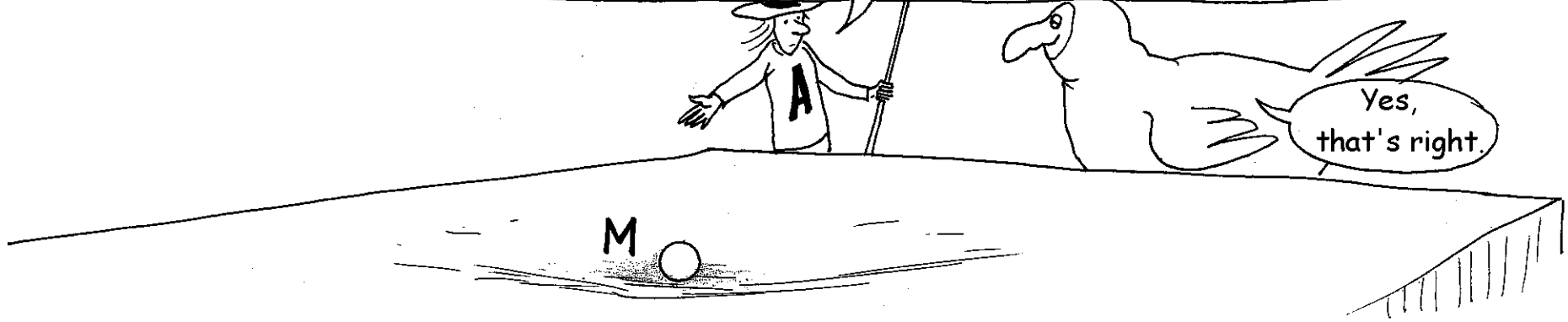
Yes Mr Handshic, there is something wrong with this NEW ASTRONOMY

Oh yes, and what is that?

I take this foam mattress which I liken to space. If there is nothing on it and I throw this SOFT BALL it will have a STRAIGHT trajectory: A GEODESIC on a plane.

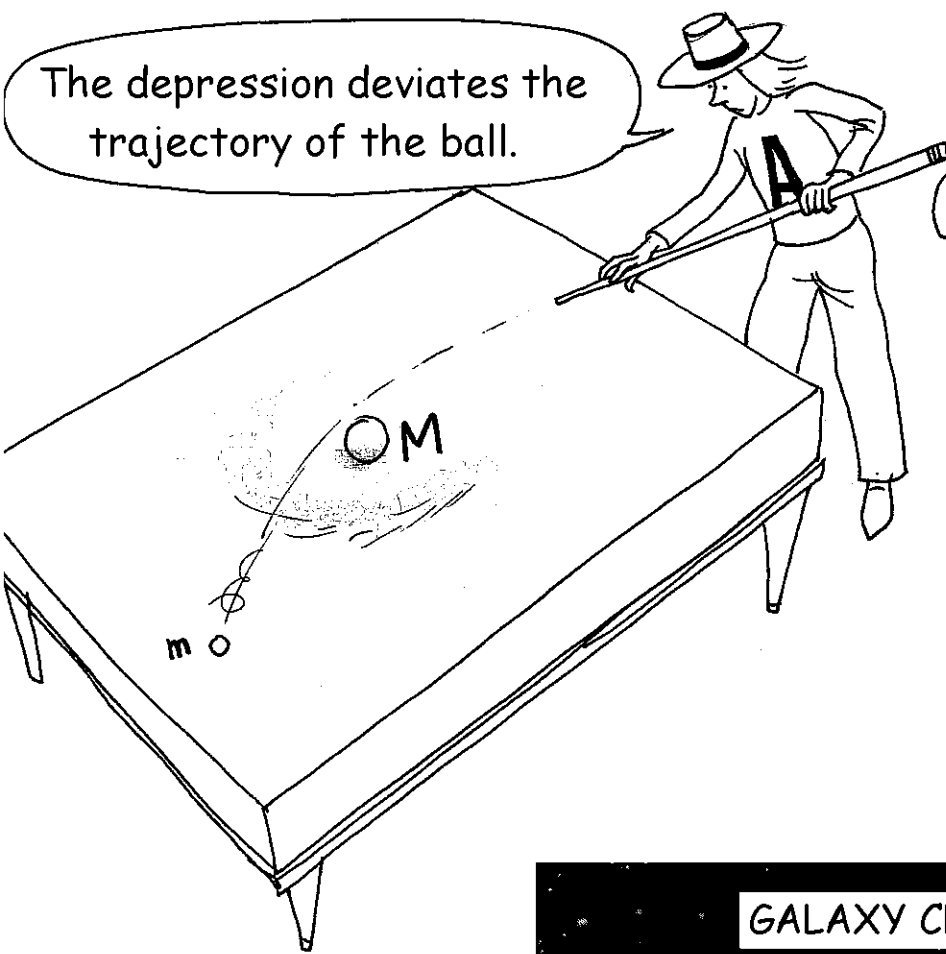
Photons follow HYPERSURFACE GEODESICS, where Einstein showed we live. Agreed?

If I put a mass M on the soft ball it will depress the surface, creating a sort of dip. Have I understood the general idea correctly?



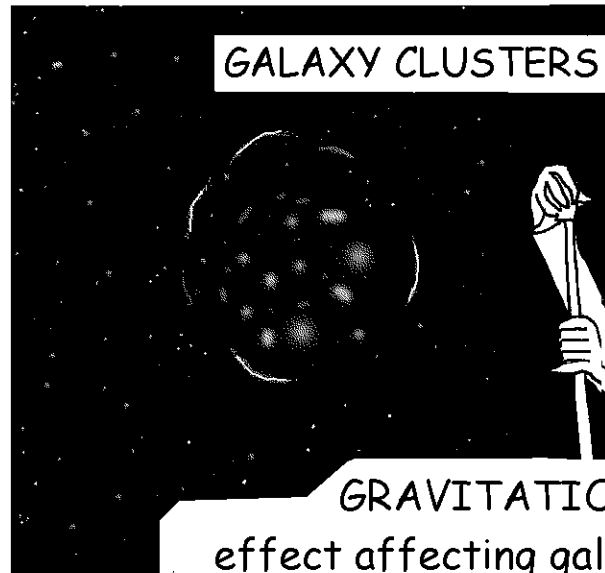
Yes, that's right.

The depression deviates the trajectory of the ball.



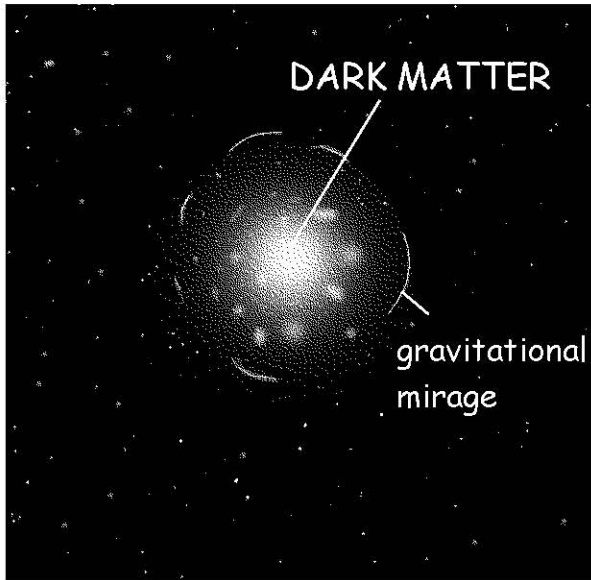
Exactly. Verified in 1919 during a total solar eclipse.

You base your PROOF OF THE EXISTENCE OF DARK MATTER on the fact that the gravitational lensing effect observed around certain galaxy clusters is a HUNDRED TIMES GREATER than that which would be due to the visible mass, after adding together all the galaxies present in the cluster.

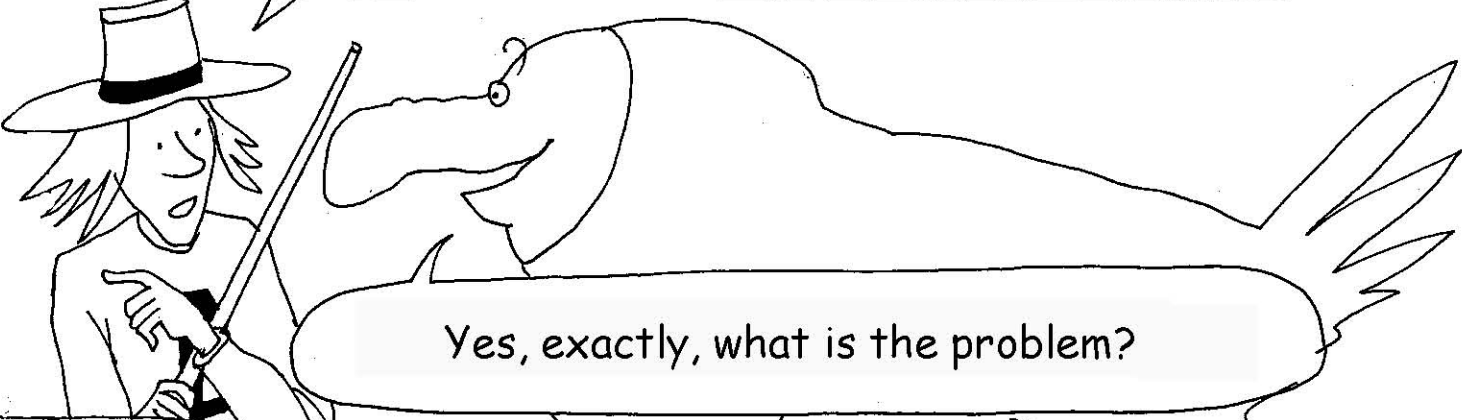


GRAVITATIONAL MIRAGE effect affecting galaxies in the background of the cluster.

Correct, and so what?



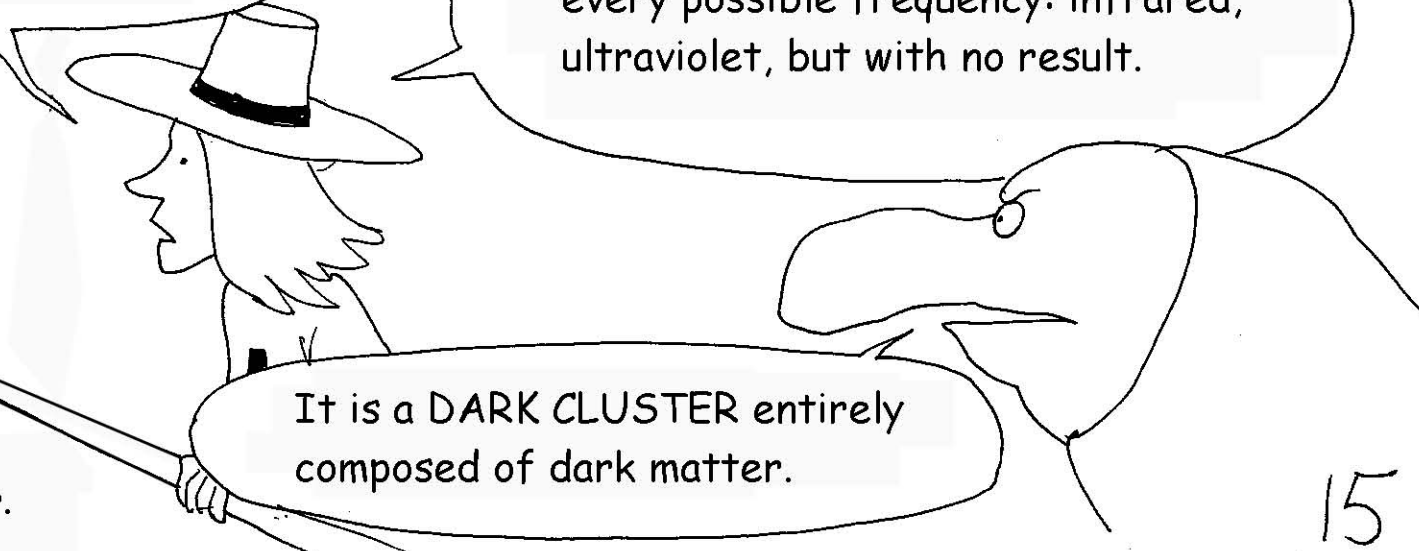
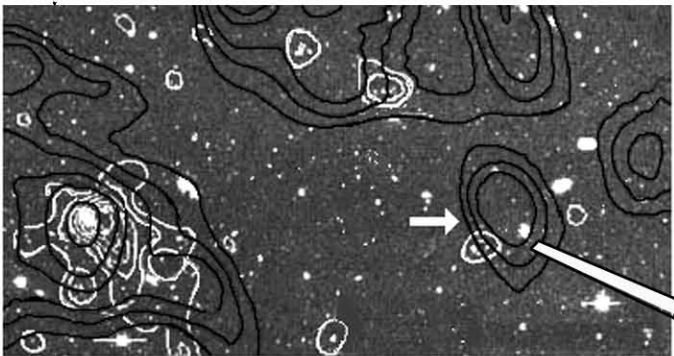
From that you deduce that the mass m_{dm} of DARK MATTER in the cluster is 100 times greater than the visible mass M_v



Yes, exactly, what is the problem?

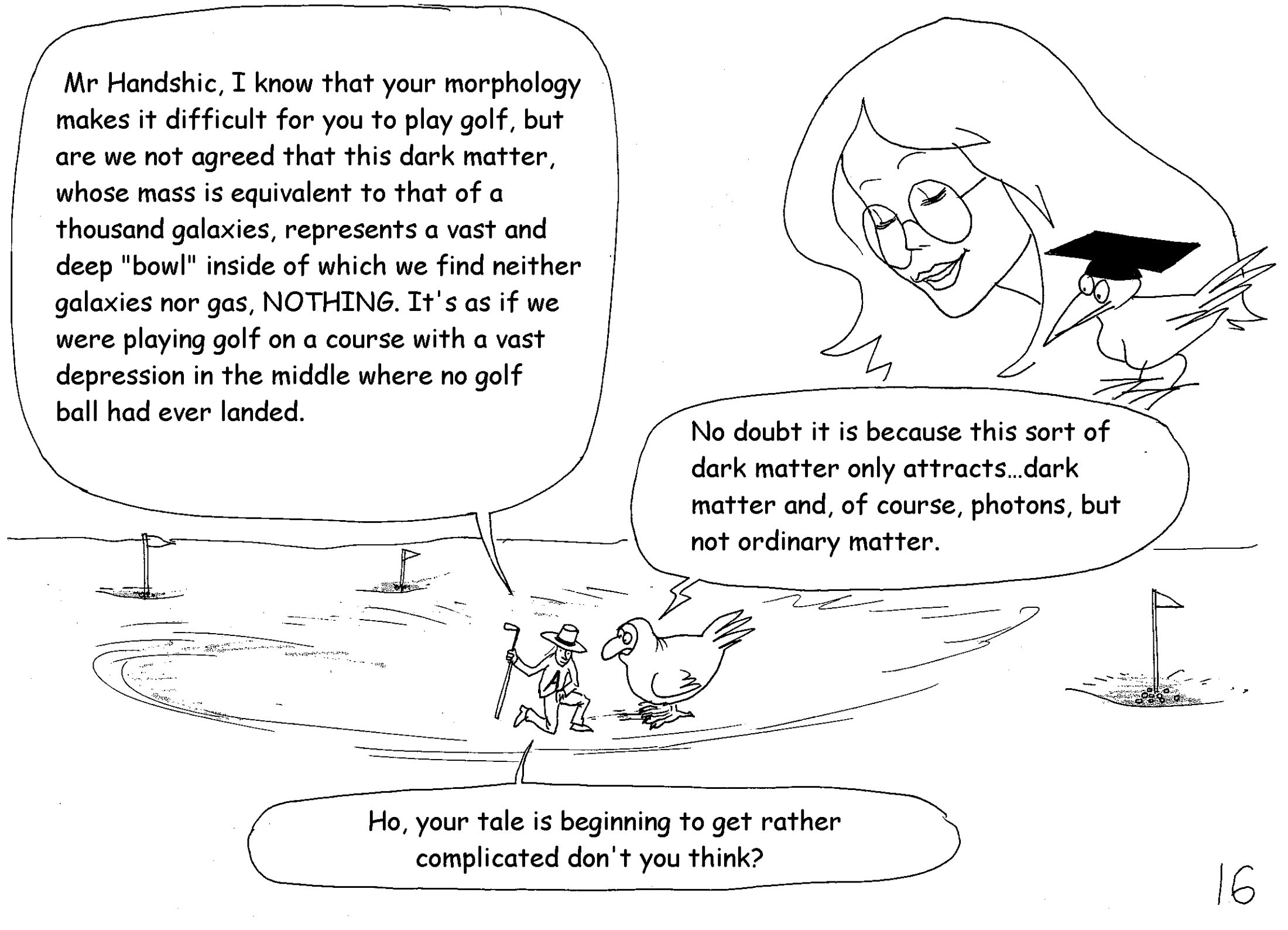
IN 1999 Meillier and Fort localised DARK MATTER CONCENTRATIONS whose mass M_{dm} was equivalent to a thousand galaxies. But the problem is that on a optical level there was nothing special about the area (*).

They hunted ordinary matter in every possible frequency: infrared, ultraviolet, but with no result.




It is a DARK CLUSTER entirely composed of dark matter.

(*) a little way from the Abell 1422 cluster. The white arrow indicates the position.



Mr Handshic, I know that your morphology makes it difficult for you to play golf, but are we not agreed that this dark matter, whose mass is equivalent to that of a thousand galaxies, represents a vast and deep "bowl" inside of which we find neither galaxies nor gas, NOTHING. It's as if we were playing golf on a course with a vast depression in the middle where no golf ball had ever landed.

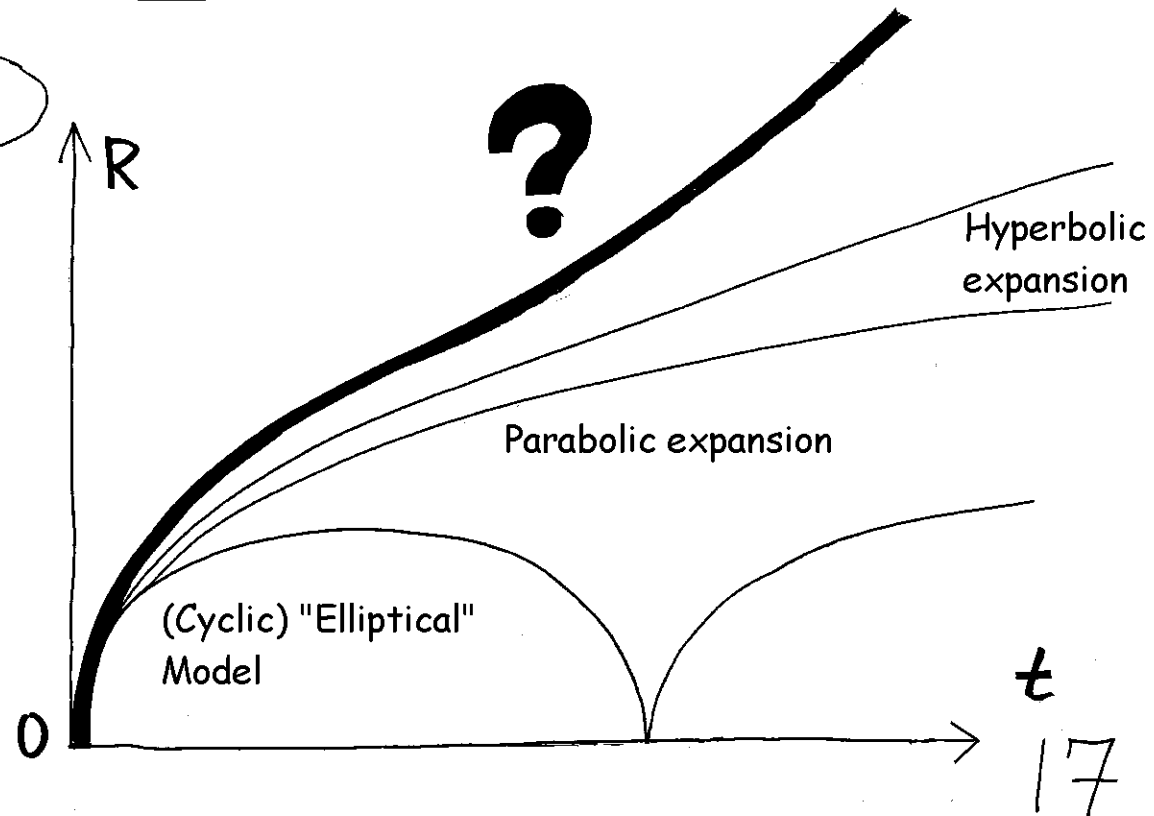


No doubt it is because this sort of dark matter only attracts...dark matter and, of course, photons, but not ordinary matter.

Ho, your tale is beginning to get rather complicated don't you think?

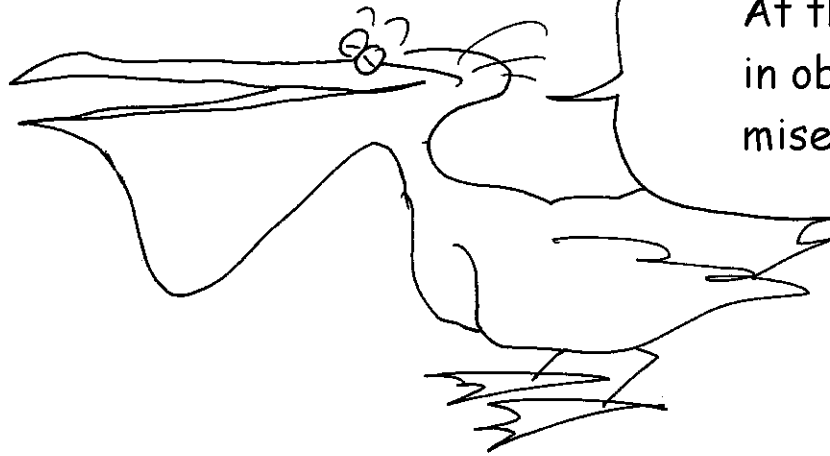
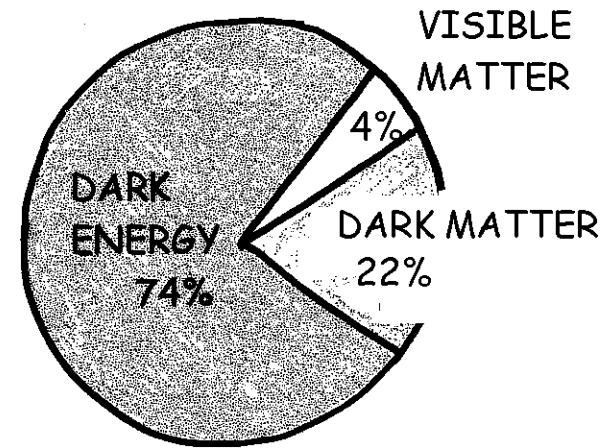
COSMIC ACCELERATION

As if things weren't bad enough already, observations made at the beginning of the 21st century on extremely distant supernovae confirmed that the cosmic expansion rather than slowing down, as had been thought for three-quarters of a century, was, in fact, accelerating with the passing of time - What could be the mysterious force responsible for such a phenomenon? We didn't know ANYTHING. So a new ingredient was invented to add to a cosmic mix which increasingly resembled the Duck Soup of the Marx Brothers - It was given a name, DARK ENERGY, and endowed with a REPULSIVE FORCE.



To fit the new observational data into the COSMOLOGICAL MODEL astrophysicists came to the conclusion that the Universe was composed of

74% DARK ENERGY,
22% DARK MATTER
and 4% VISIBLE MATTER.



At this point one could ask if there was any point in observing any more, why not simply neglect the miserable 4% that we can see.


Wait, you're forgetting string theory. Thanks to that, one day, it'll all become clear and a THEORY OF EVERYTHING will be proposed.

For the moment it is a THEORY OF NOTHING ...



PHYSICS AND ASTROPHYSICS SINK INTO AN UNPRECEDENTED HISTORICAL CRISIS

I think it would be interesting to cite a speech given by the president of a university over 20 years ago : "While the string theory has, up until now, produced no interpretation of a phenomenon, has not proposed the least experiment, nor furnished a model of any sort, we note, given the increasing numbers of articles published each year in every country, the extreme vitality of this new discipline (*)"



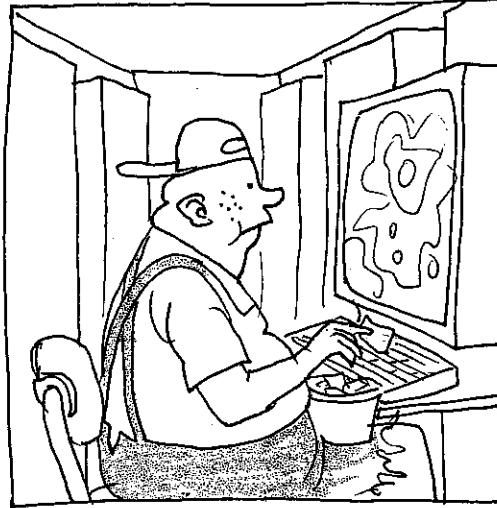
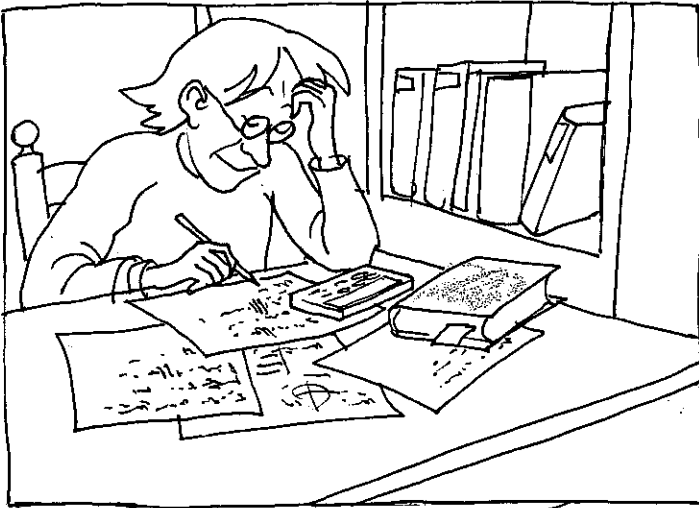
A gulf, widening every year, has been created between the spectacular progress of observational and measuring instruments and the capacity of researchers to treat and modelise the data. It is in serious deliquescence. As much as this epoch is in a technological boom, so the fundamental area seems to be in equally great freefall.

(*) In 2007 the number of articles published was beyond the astronomic figure of a hundred thousand publications and the number of doctoral theses continued to progress.

The PETER SMALL LAW is confirmed day after day. It says that the product of the imaginative and creative capacity of a researcher by the power of the computer is a constant.



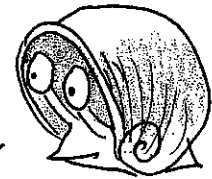
The key words of this epoch are DIGITAL SIMULATION, a theoretical astrophysicist who has spent his life, unsuccessfully, trying to pierce the mystery of GALAXY DYNAMICS is a researcher who has performed calculations a thousand times, whose theoretical basis is limited to NEWTON'S LAW, who each time changes the parameters hoping that, at last, the miracle will happen.



μερδε !

Oh dear, the spiral arms of my galaxy have evaporated again after just one revolution.

The world's most powerful computer is still no replacement for some well connected neurons.



While we model atoms and the functioning of stars (*), we have no theoretical model that can describe a galaxy. Our modern "theoreticians" are far from having the knowledge and mental tools of people such as Eddington (**) or Chandrasekhar (***)).

$$\begin{cases} \frac{\partial f}{\partial t} + v \cdot \frac{\partial f}{\partial r} - \frac{\partial \psi}{\partial r} = 0 \\ \Delta \psi = 4\pi G \rho \end{cases}$$

?

The knowledge of geometry and mathematical physics of the average astrophysicist is quite simply...non-existent.

(**) He calculated the temperature and pressure in the core of stars (1923)
(***) He calculated the limit that bears his name, characterising white dwarves. Nobel Prize in 1983, fifty years after (a record).

(*) In 1931 a mastery of theoretical calculation allowed the American of Swiss origin FRITZ ZWICKY to predict the phenomenon of supernovae and explain his scenario during a famous conference at CALTECH, long before they were observed and studied..

However, an extremely efficient career-making system has developed thanks to the INTERNET and data bases such as SPIRE which counts up the citations and downloads of articles. This allows ORGANISED GROUPS to inter-evaluate themselves in a completely artificial manner by citing each other - As these groups have also taken over the control systems of scientific journals, by benefitting from the anonymity of the REFEREE system(*), or have created their own journals, the system is now completely locked into the fields of DOMINANT IDEAS, thus excluding the emergence of any idea, any model that is really innovative. This has allowed the emergence of real SCIENTIFIC IMPOSTURES such as STRING THEORY (which doesn't even exist in the form of an explicit theory).

SOME GEMS FROM "THE ELEGANT UNIVERSE" by Brian Greene

4th paragraph cover : A scientific revolution. From the infinitely great to the infinitely small. The unification of all the theories of physics.

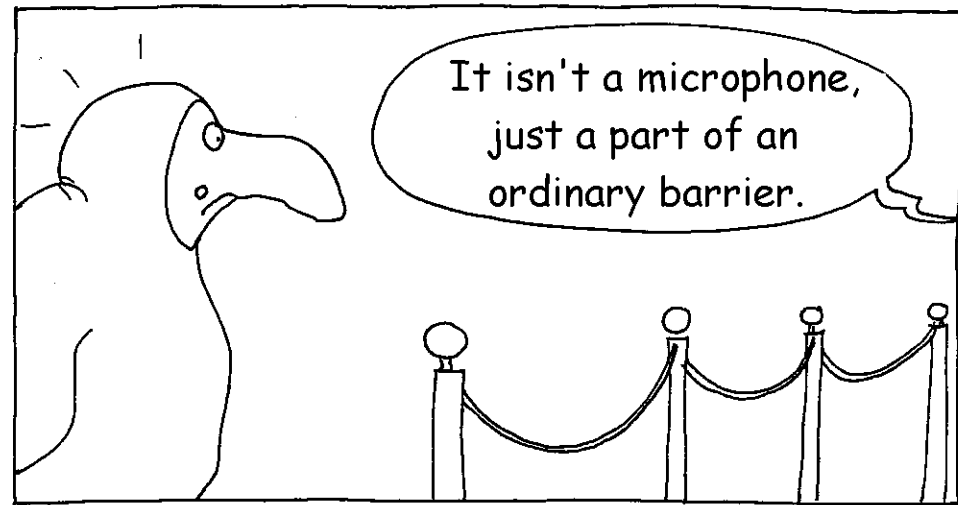
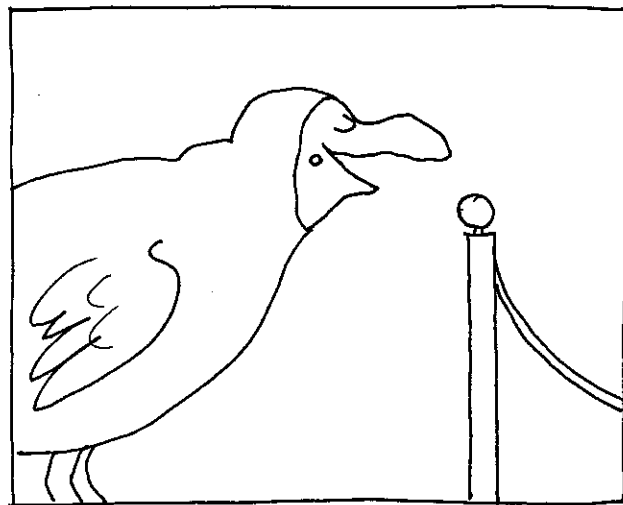
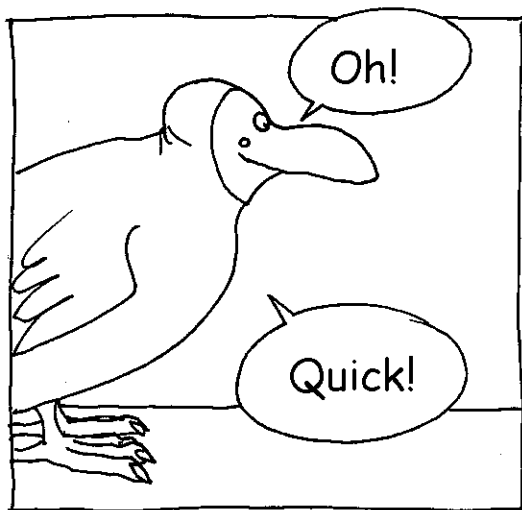
p.189 : We will see that with string theory, while it is the most predictive that physicists have ever known, we are not able to make sufficiently precise predictions to match the experimental data.

p.252 : It is perfectly imaginable that more than one generation of physicists will consecrate their lives to the study of the development of string theory without the least experimental echo.

p.300 : Edward Witten (the father of 'cosmic strings' and the mythical "M Theory") is considered the worthy successor to Einstein in the role of the greatest living physicist. Some go further and say that he is the greatest physicist in history (...)

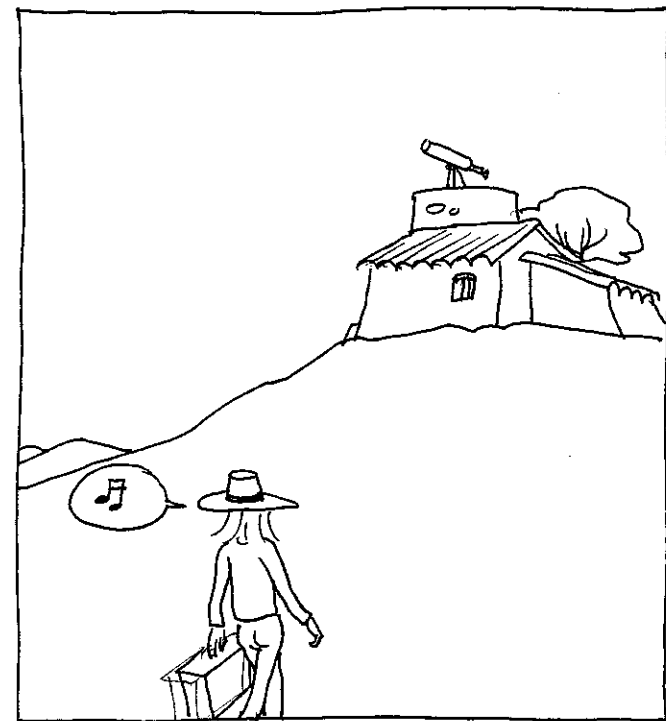


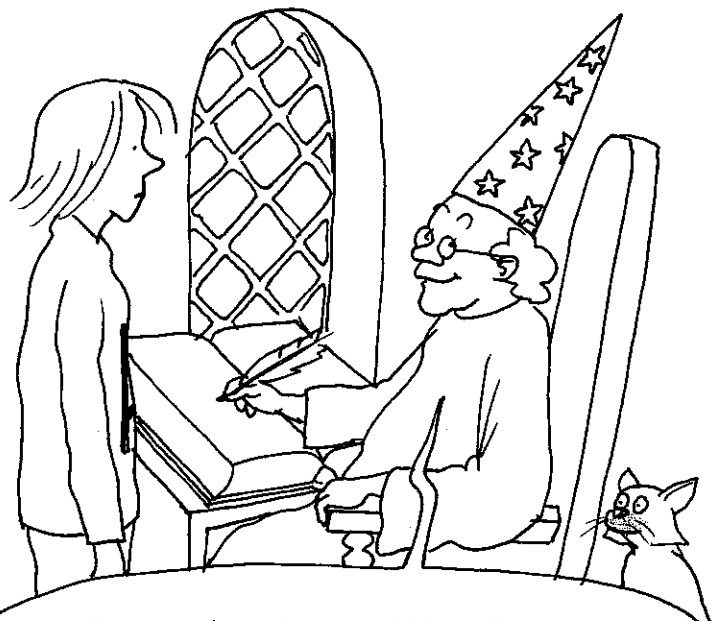
(*) A system where experts are chosen by the review's office to evaluate a submitted article.



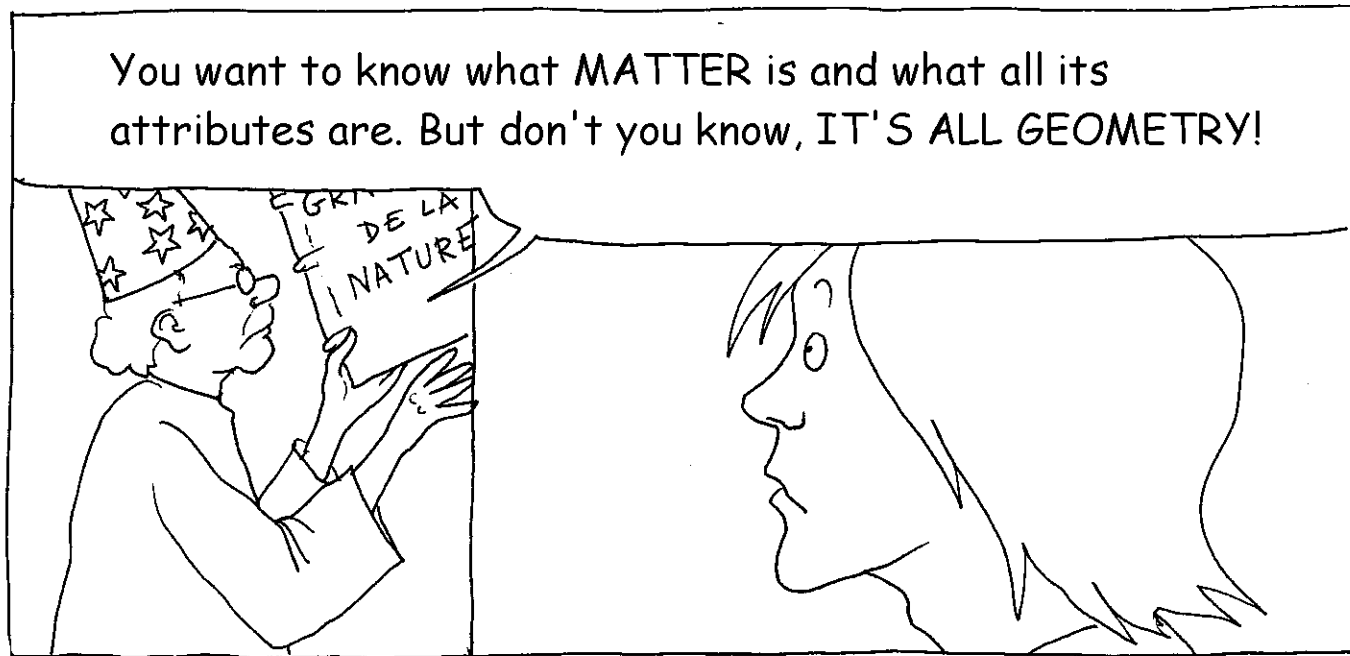
Science today is hyper-mediatised. Unmerited reputations are constructed, where mediocre scientists benefit from an aura born simply out of their vulgarising talents.

Let's return to the matter of the acceleration of the Cosmos and this repulsive dark energy. What could that correspond to?

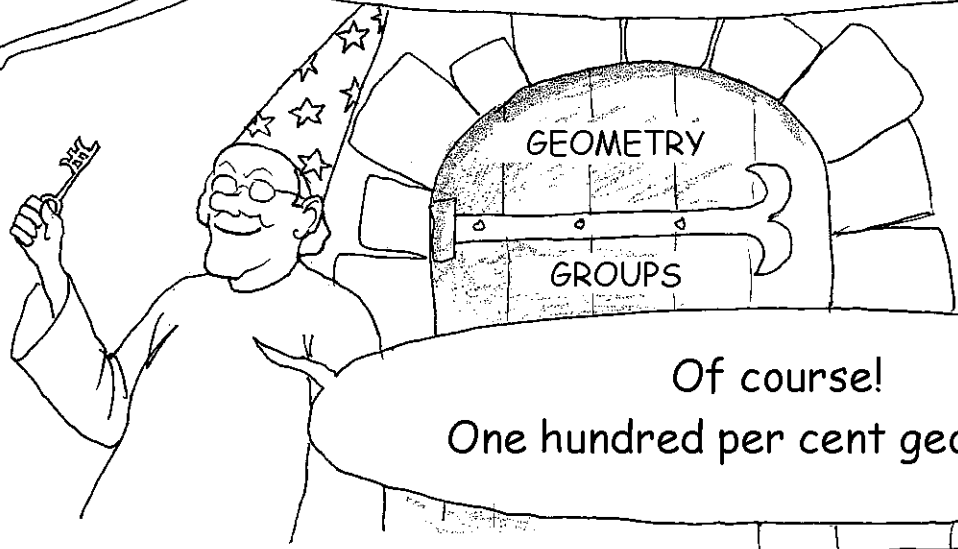
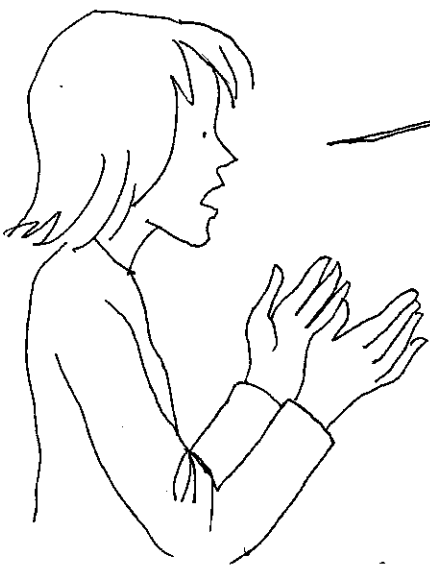




Ah, you're back (*), what brought you here this time?



Is a particle of mass m a geometric entity then?

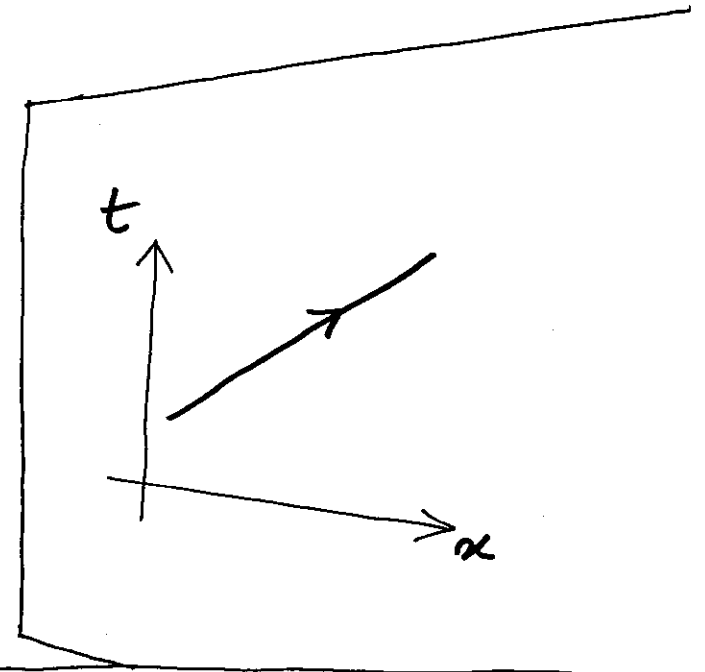


Of course!
One hundred per cent geometric.

(*) Reference to an album on GROUPS

TELL ME HOW YOU MOVE AND I'LL TELL YOU WHO YOU ARE

Take a material particle and treat it like a RELATIVISTIC MATERIAL POINT, that is, obeying the elementary rules of SPECIAL RELATIVITY. Let's consider its MOVEMENT in SPACE-TIME.



There you're showing a very rustic representation of this movement in space-time, to fit in with Special Relativity it has to be inscribed in a Minkowski space (Annex 2). But let's ignore that detail and concentrate our interest on the movement (arrow).

I feel like I'm descending into the catacombs of the Universe.

Well we can see that it's because you're a laboratory rat. It's simply MATHEMATICAL PHYSICS. We're going to get to the bottom of things.

I'm wondering if I did the right thing in coming here.

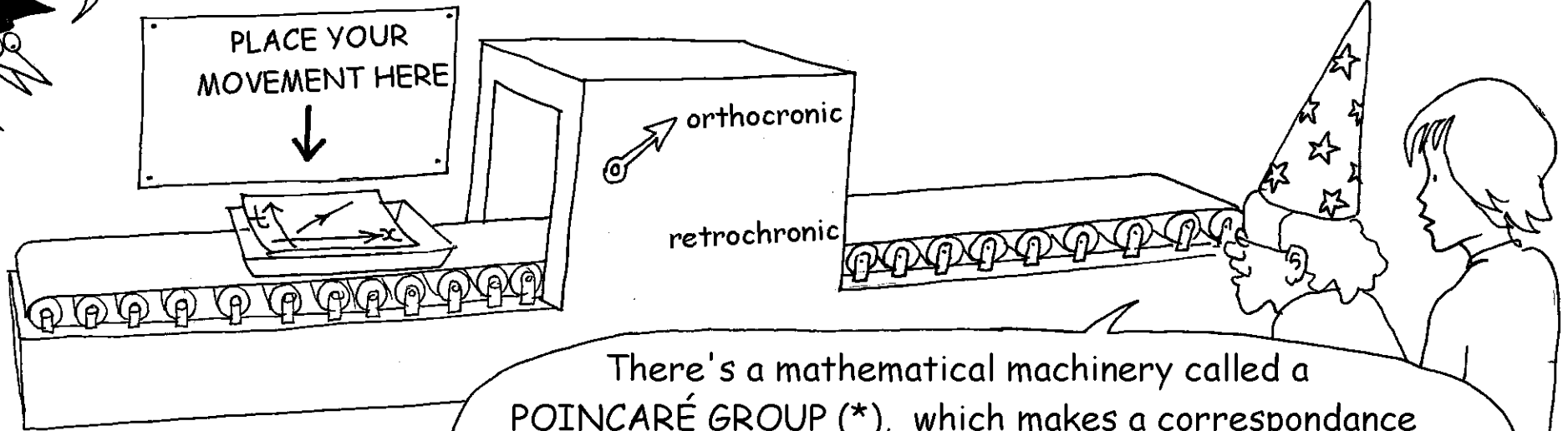
What would you prefer, visit a psychiatrist?

Have you ever held in your hands a particle of mass m ? Have you?

Er no, not really. You think you're holding something then you no longer really know what you're holding anymore.

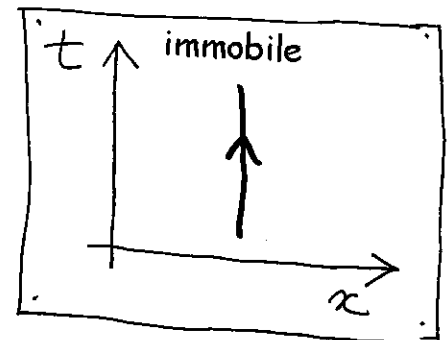
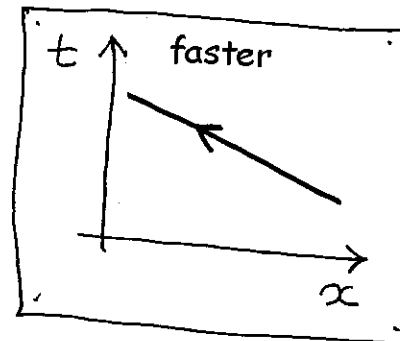
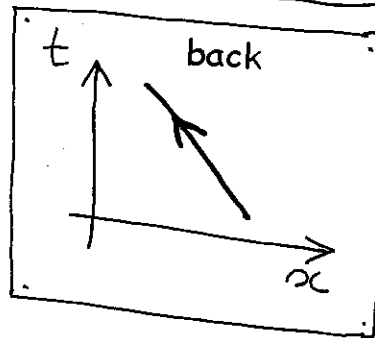
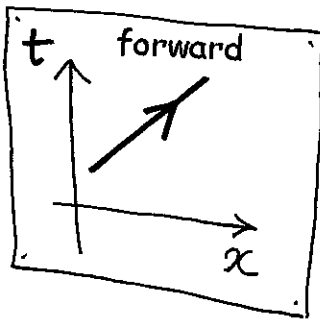
ABANDON CERTAINTY
ALL YE WHO ENTER HERE

For readers who have a (little) mathematical baggage, all these things are explained in the Annex.
For everyone else we'll make do with pictures.

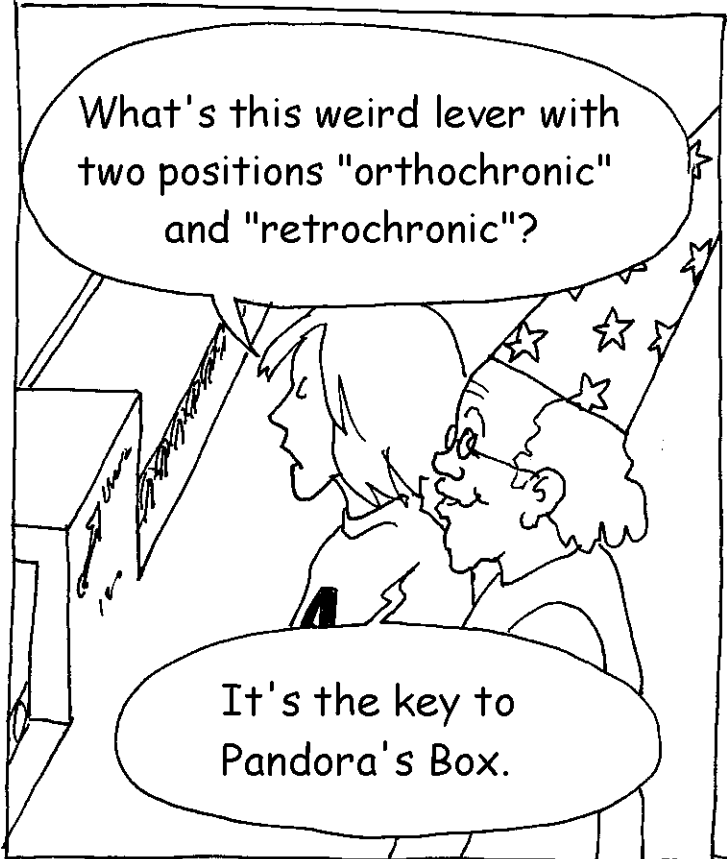


There's a mathematical machinery called a POINCARÉ GROUP (*), which makes a correspondance of any MOVEMENT with another MOVEMENT. Here the machine is set to "ORTHOCHRONIC", which means that every "past -> future" movement will correspond to another "past -> future" movement.

OK up to here.



(*) These secrets are all revealed in the annex.



What's this weird lever with two positions "orthochronic" and "retrochronic"?

It's the key to Pandora's Box.

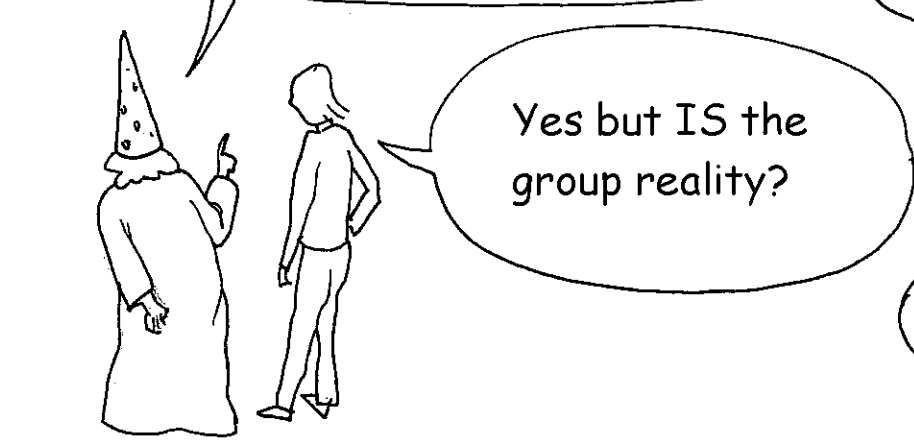
If you put MOVEMENT in space-time, orthochronic, that is, oriented in the direction past-future, half of the elements of the Poincaré group will transform themselves into another movement with the same temporal orientation, but the remaining half will transform themselves into a "future-past" movement.



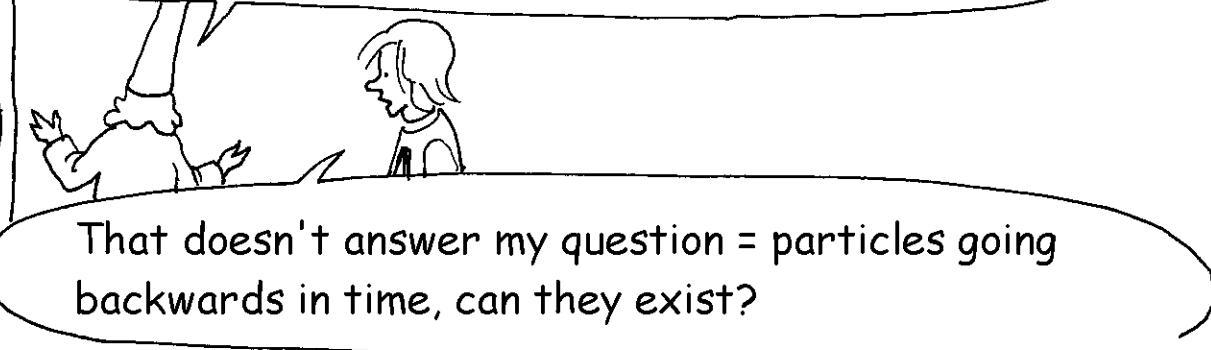
Heavens! Do you mean that there are particles going backwards in time?

The group shows it.

The group and space are closely linked. They mutually confer each other's existence.



Yes but IS the group reality?



That doesn't answer my question = particles going backwards in time, can they exist?

It seems you came because you were asking yourself questions on MATTER. Let's do an experiment then. I consider the past-future movement of a particle of mass m .

Start the machine except, this time, set it to "retrochronic".

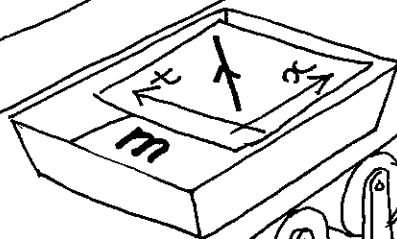
In other words I'm acting on retrochronic elements of the Poincaré Group.

Suspense: The result of this operation is on the next page.

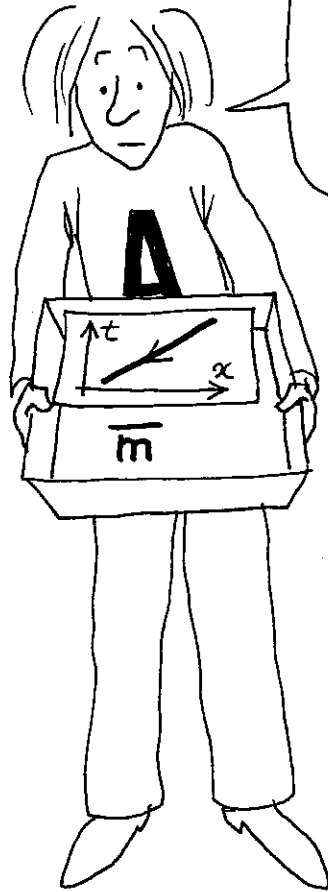
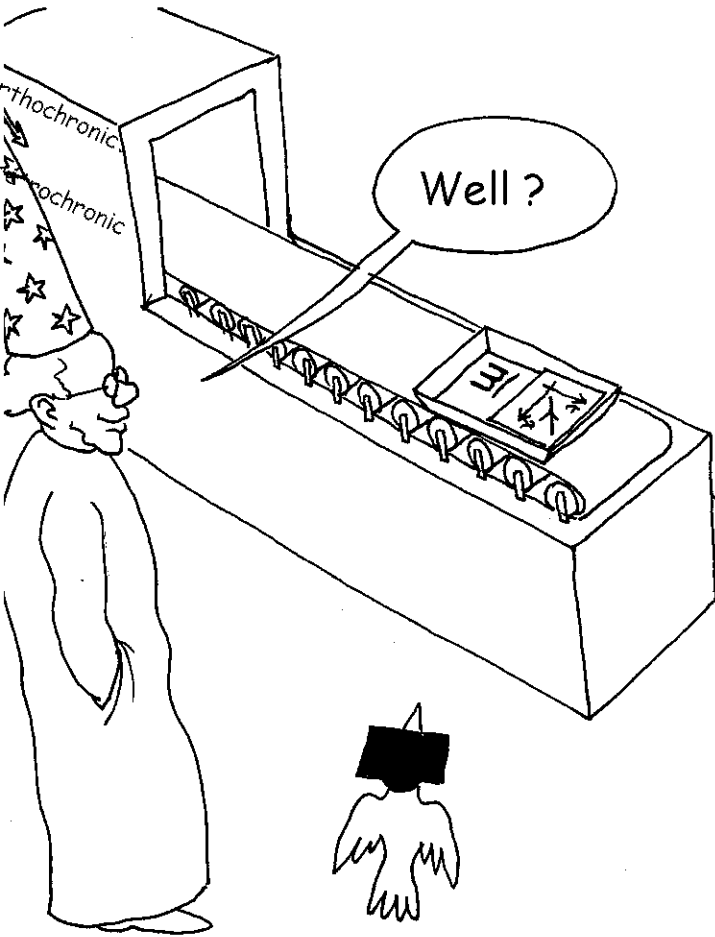
Goodness, I don't like this at all!

If you're frightened already go and see the superstring people. They won't destabilise you with unforeseen discoveries.

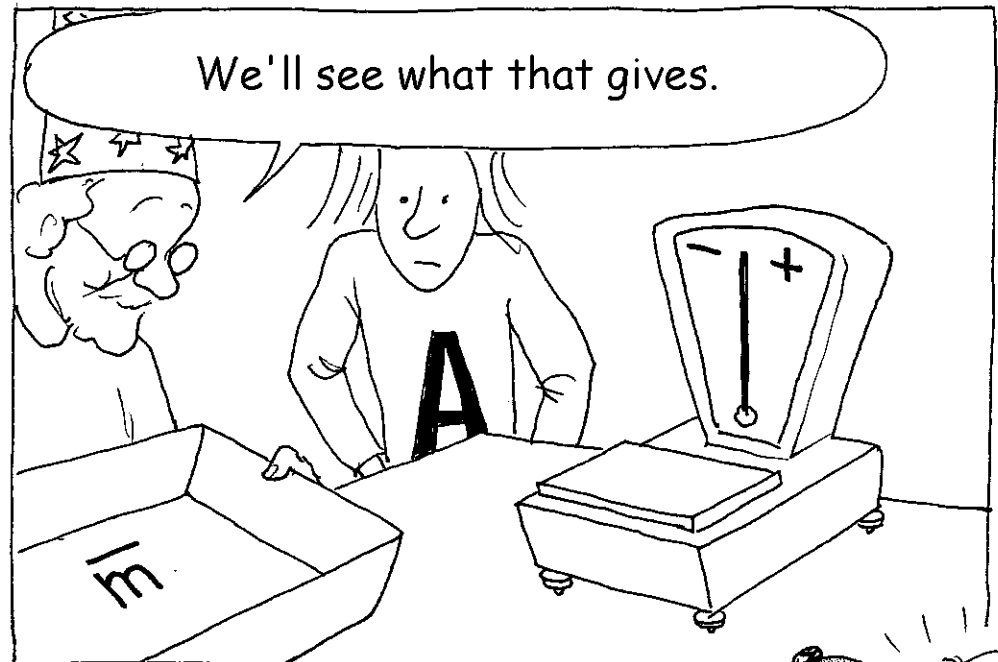
MOVEMENT
↓



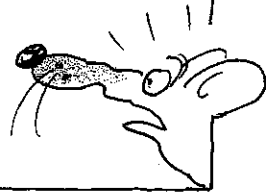
NEGATIVE MASSES AND ENERGIES

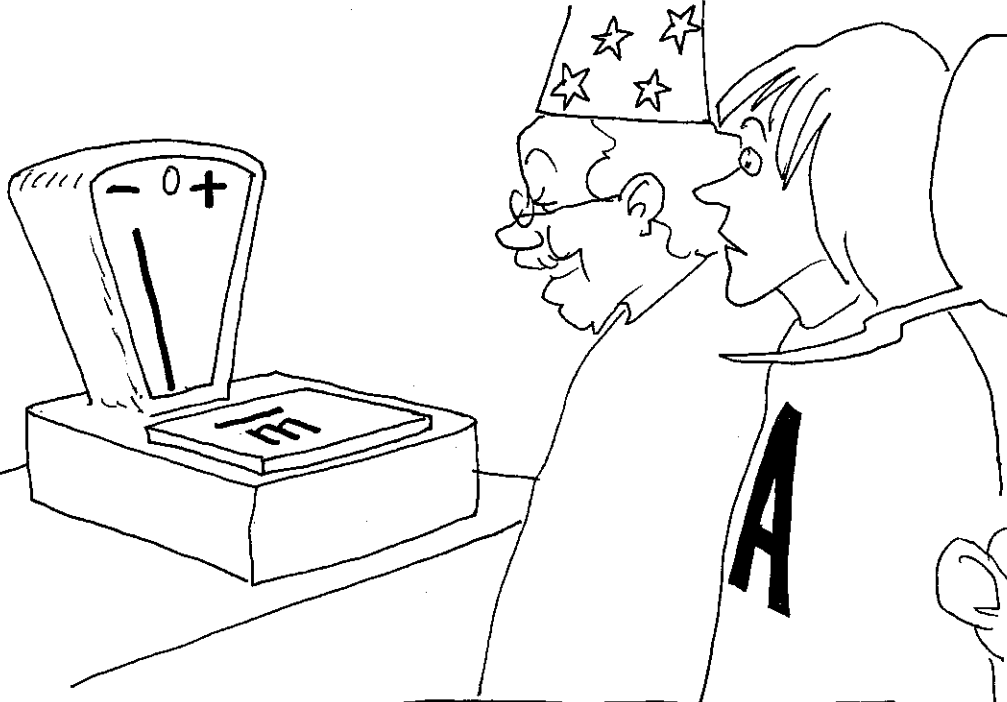


I get a RELATIVISTIC MATERIAL POINT movement which is now being effected in the direction PAST-FUTURE. My particle is GOING BACK IN TIME but it's mass has become \bar{m}



What are those weird scales?!?





Here we are now. Particles which we say "are going backwards in time" simply have **NEGATIVE MASS** and $\bar{E} = \bar{M}C^2$ **NEGATIVE** energies.

I told you that this thing was doubtful. If two particles with opposing energies meet that gives

$$E + \bar{E} = 0, \text{ that is...}$$

NOTHING (*)

Wait, what happens with photons, the have nil mass?

Do an experiment. Bring the **POINCARÉ** group into play.

Don't freak out. This is conceptual, a simple piece of paper.

(*) And not photons as in the so-called **MATTER-ANTIMATTER ANNIHILATION** where energy is conserved, which we really should qualify as **DEMATERIALISATION**.

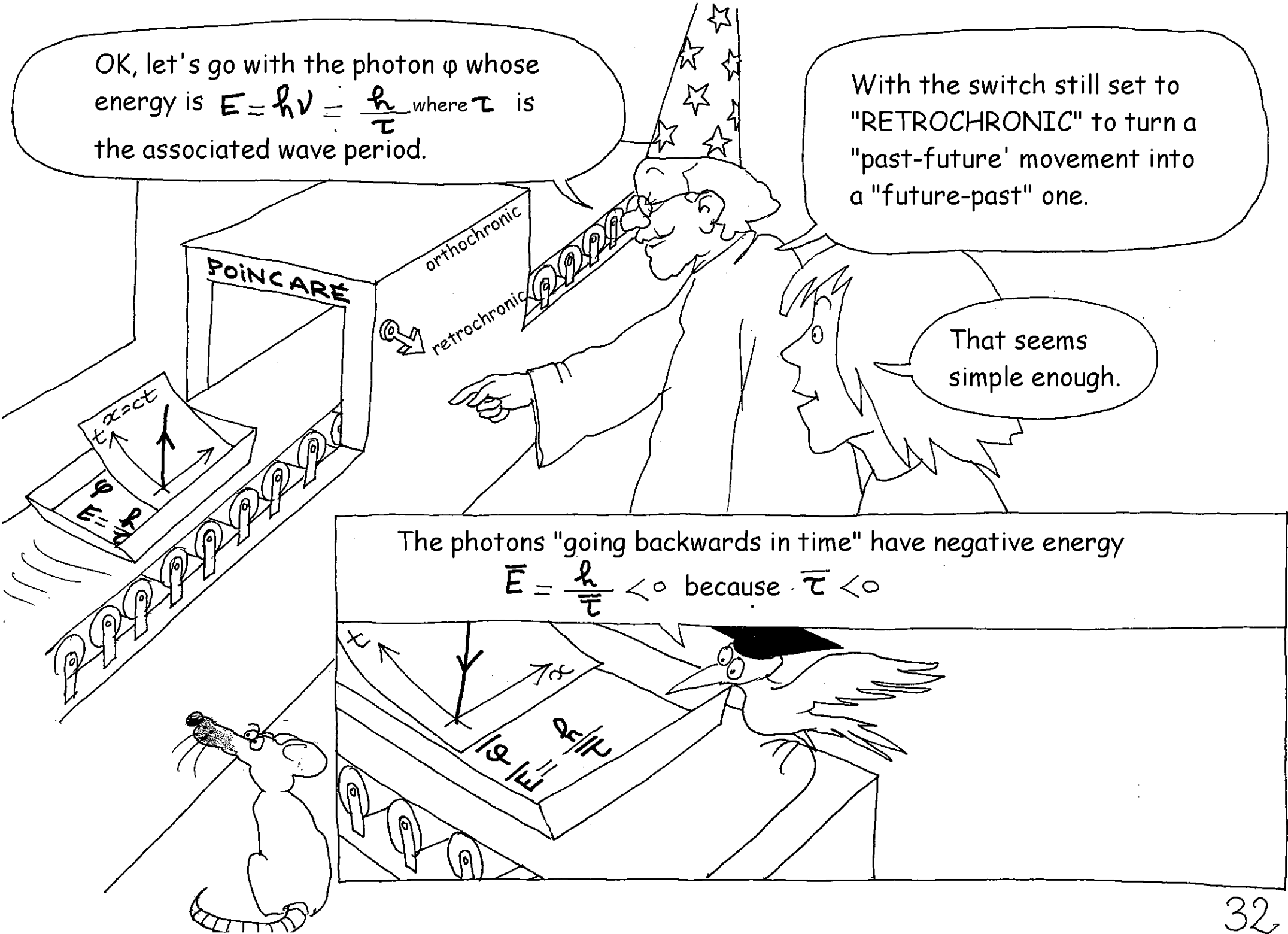
OK, let's go with the photon φ whose energy is $E = h\nu = \frac{h}{\tau}$ where τ is the associated wave period.

With the switch still set to "RETROCHRONIC" to turn a "past-future" movement into a "future-past" one.

That seems simple enough.

The photons "going backwards in time" have negative energy

$$\bar{E} = \frac{h}{\bar{\tau}} < 0 \text{ because } \bar{\tau} < 0$$



Your eyes and your measuring instruments aren't capable of capturing the photons with negative energy that are emitted and captured by particles with negative mass \bar{m}

So we can neither see nor observe these negatives masses.

Exactly.

And what about gravity?

Apply :

$$F = \frac{G m m'}{d^2}$$

m and m mutually attract each other according to **NEWTON**

\bar{m} and \bar{m} mutually attract each other according to **NEWTON**

m and \bar{m} mutually repulse each other according to **ANTI-NEWTON**

If I managed to keep a negative mass in a box it would make the box fly because the Earth repulses it.

It would pass through it and, effectively, fly.

But wouldn't it be annihilated with the positive mass particles of the box?

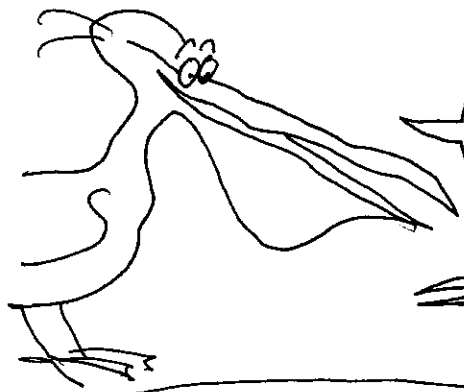
Not even.
Think about it...

GOING THROUGH WALLS

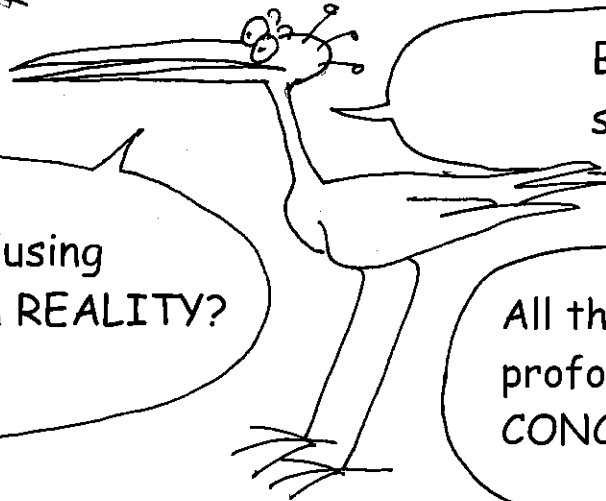
Matter, at ordinary densities, is made of tiny atoms separated by a lot of space. It all holds together because of ELECTROMAGNETIC FORCES, the same forces that stop your posterior from going through the chair on which you're seated while reading this book, even though your seat and your posterior are also made of miniscule atoms separated by a lot of space. If we suddenly suppressed the electromagnetic forces, which negotiate through the game of photon exchange (*) and which have positive energy, you'd immediately pass through your chair, then the floor and fall towards the centre of the Earth, now only influenced by the FORCE OF GRAVITY.

As these two types of matter repulse each other,, any structure made up of negative mass would be subject to an ANTIGRAVITATIONAL effect from the Earth. This structure would also be able to cross any type of barrier of matter. It would be invisible to our eyes and undetectable by our measuring and observation instruments. The opposite would also be true - Passengers on a ship made of negative masses could cross through Earth without seeing it.

The Management.



If I understand it correctly this "machinery-group" allows the prediction of new objects in physics.



But isn't that ...purely mathematical speculation, completely pointless?

Isn't it confusing mathematics with REALITY?

All the great advances in science come via a profound change in our **GEOMETRIC CONCEPTION** of the Universe, as we perceive it.



The emergence of **SPECIAL RELATIVITY** and **GENERAL RELATIVITY** was nothing other than profound **PARADIGMATIC** modifications of our conception of the **GEOMETRY OF THE UNIVERSE**. However when we consider a geometric context, the central question concerns the way that **MOVEMENTS** are described in this new space.

Special relativity has melted space and time into the same object: a HYPERSURFACE, A SPACE-TIME where movements are now inscribed according to its GEODESICS - General relativity added curvature. GROUP THEORY encompasses the different types of MOVEMENT that can be inscribed on a given hypersurface and MATHEMATICAL PHYSICS identifies the movement of the objects in this universe, according to the principle:

TELL ME HOW YOU MOVE AND
I'LL TELL YOU WHO YOU ARE.

Thus, in a given geometric context, when a possible new type of movement is identified, it suggests the existence of new OBJECTS deriving from this group thanks to the GROUP-TOOL.

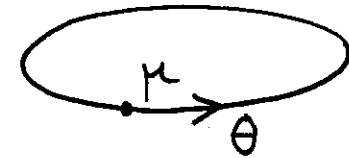
But for goodness' sake, give me a concrete example, otherwise your discourse sounds like that of the SUPERSTRING people.

Except that they have neither a geometric context, nor a group, nor movement, nor objects. In short, they don't know WHAT they are saying.

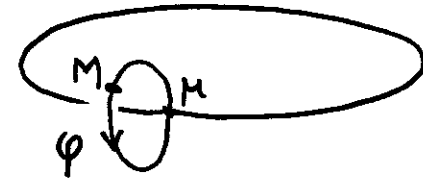
BLA BLA...

A FIFTH DIMENSION

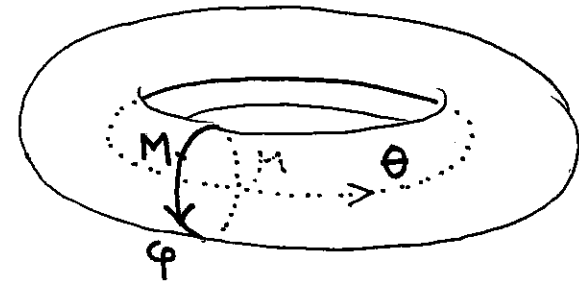
In adding an additional dimension we enrich the geometric context. Take a CLOSED unidimensional universe represented by a simple circle.



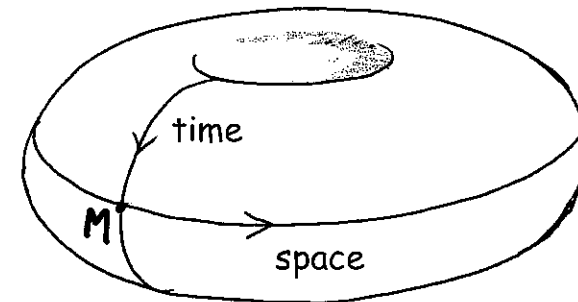
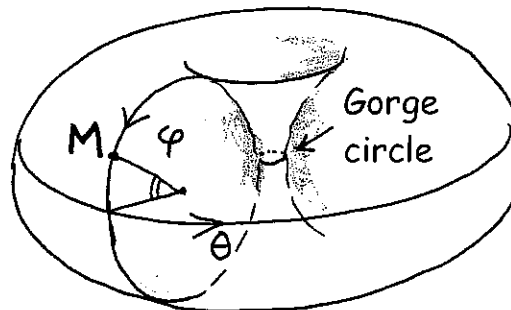
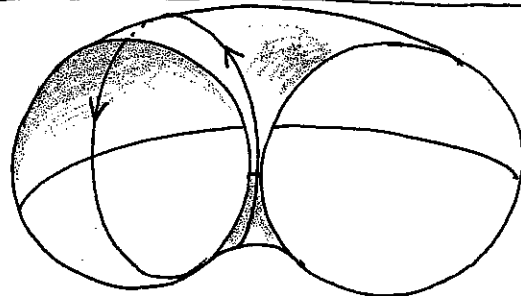
Add another dimension, also closed, on all points of the circle. We'll call it a BUNDLE.



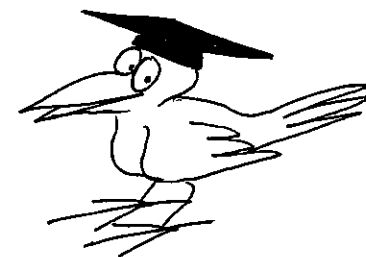
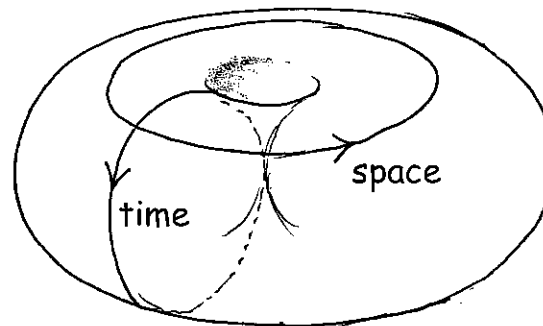
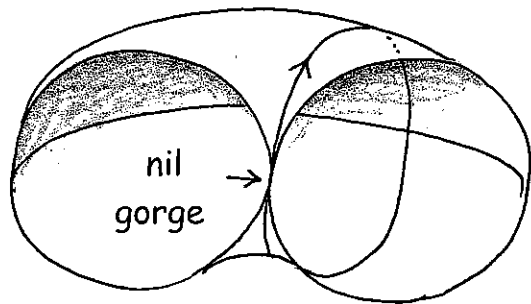
The object obtained, with two dimensions, becomes a TORUS T^2



What do we know of the TOPOLOGY (*) of the space in which we live? We don't even know if it is infinite or closed on itself - We can imagine, for example, a 2D space-time which has the topology of a TORUS T2.



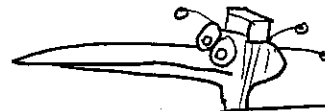
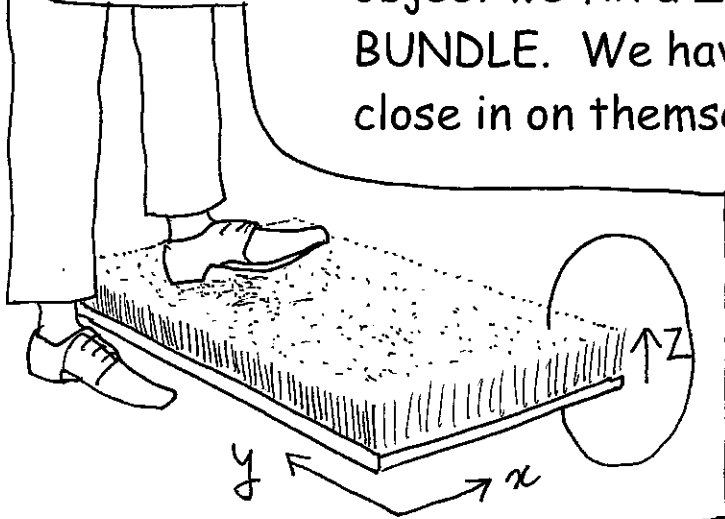
At every point of a circle representing time (x) we place another circle (O) that is supposed to represent a closed space (*). The gorge circle is supposed to represent the BIG BANG and a BIG CRUNCH together, without "initial singularity". In a case where a singularity is desired absolutely we can consider a TORUS WITH A NIL GORGE.



(*) If we had wished, we could have placed a "time circle" on every point of a "space circle".

On each point of my 2D space-time I can add a new circle and create a T3 TORUS. We then go from a 2D space to a 3D space by operating a BUNDLING . Such a transformation from a 2D to a 3D space can be represented by a doormat. At each point (x,y) of a planar object we fix a Z BUNDLE. The 3D object thus obtained is called a BUNDLE. We have to imagine a world in which the fibres of the doormat close in on themselves (which will make the doormat useless). In short, we

can imagine that our 4 dimensional space, one of time and three of space, is a T4 TORUS. We can repeat the operation and make a new fibre "grow" at each point, which closes in on itself. We obtain a T5 TORUS. And it is in this new space of 5 dimensions that we can inscribe the MOVEMENTS of our RELATIVIST MATERIAL POINTS.

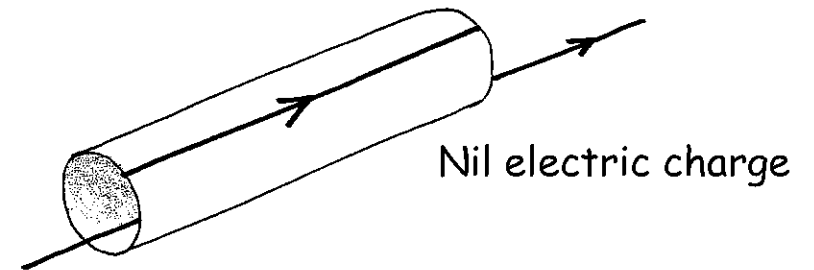
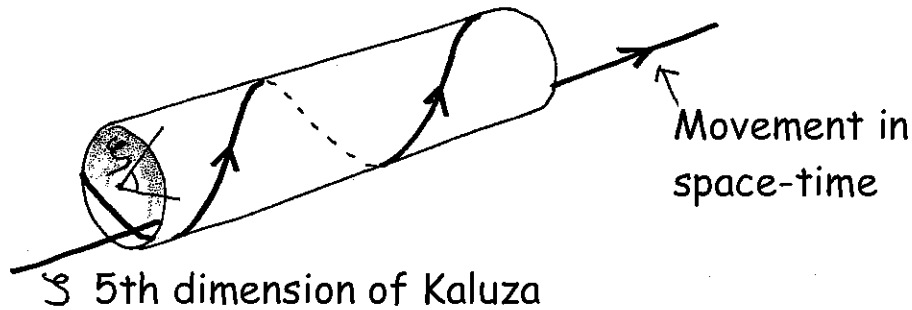


Is it absolutely necessary to do all this mathematics?
Where does it get us?

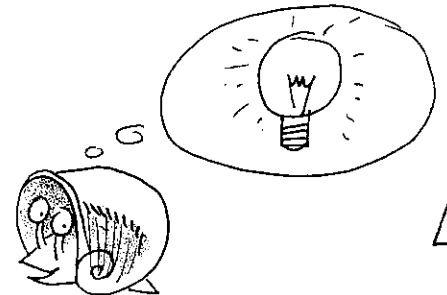
KALUZA SPACE

We've already said that PHYSICS is a GEOMETRY. Well, inscribing the movement of a particle in a five dimensional hypersurface is, in fact, equivalent to considering that the relativist material point is endowed with an ELECTRIC CHARGE e . The fact that this fifth dimension, called "Kaluza", is closed on itself means that the electric charge can only take whole values (GEOMETRIC QUANTIFICATION). We can shrink the dimension of a space to a single point. Then the movement of the electrically charged relativist material point will correspond to a spiral curve.

The Management



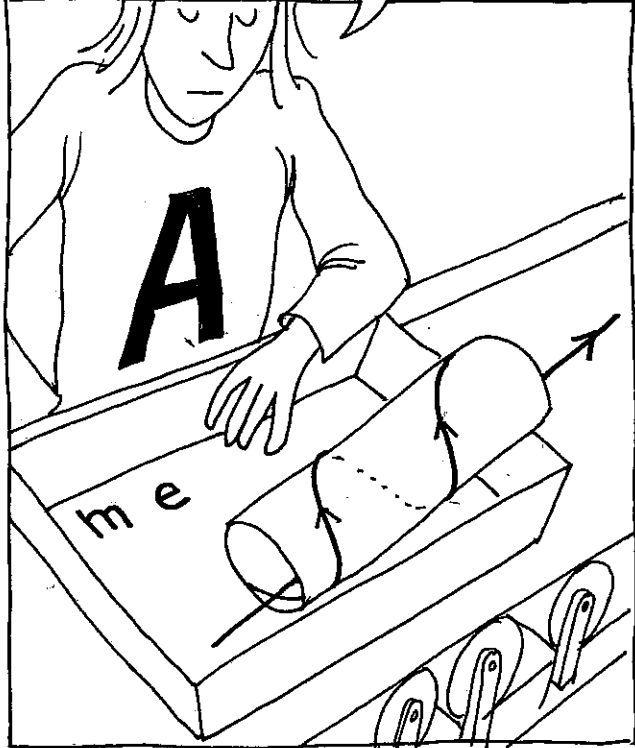
OK, I understand. The direction of the curved spiral corresponds to the sign of the ELECTRIC CHARGE.



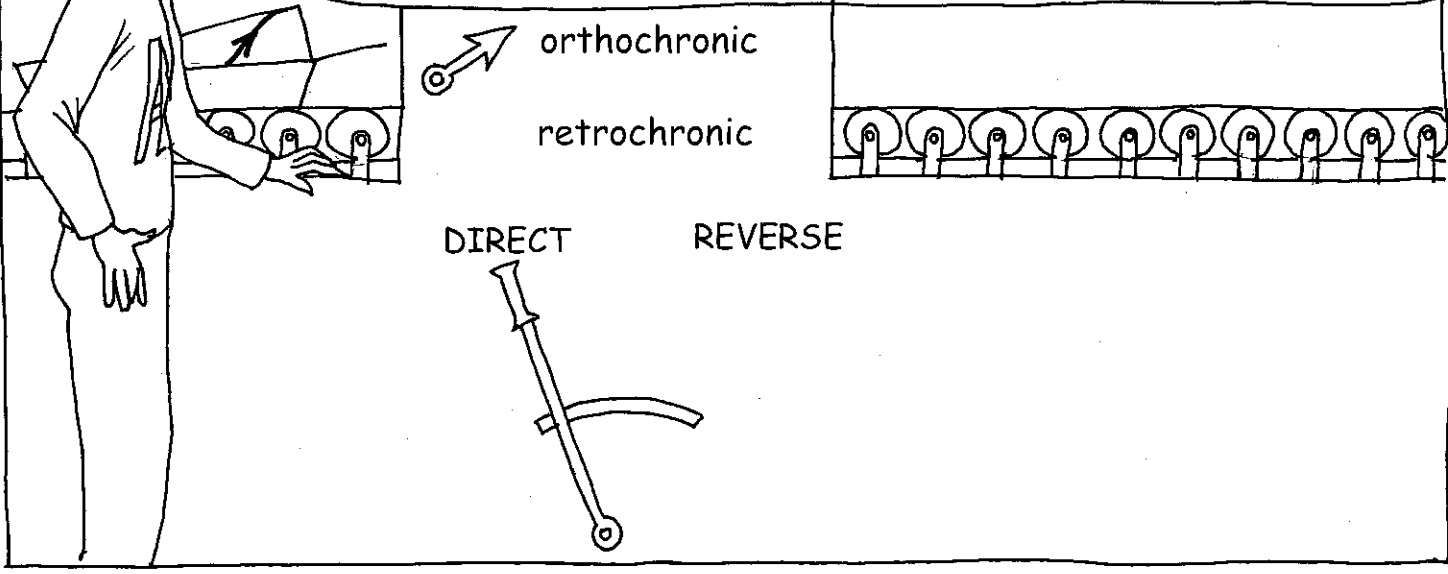
Could there be a group behind that?

Of course, where there is geometry there is an underlying group (*).

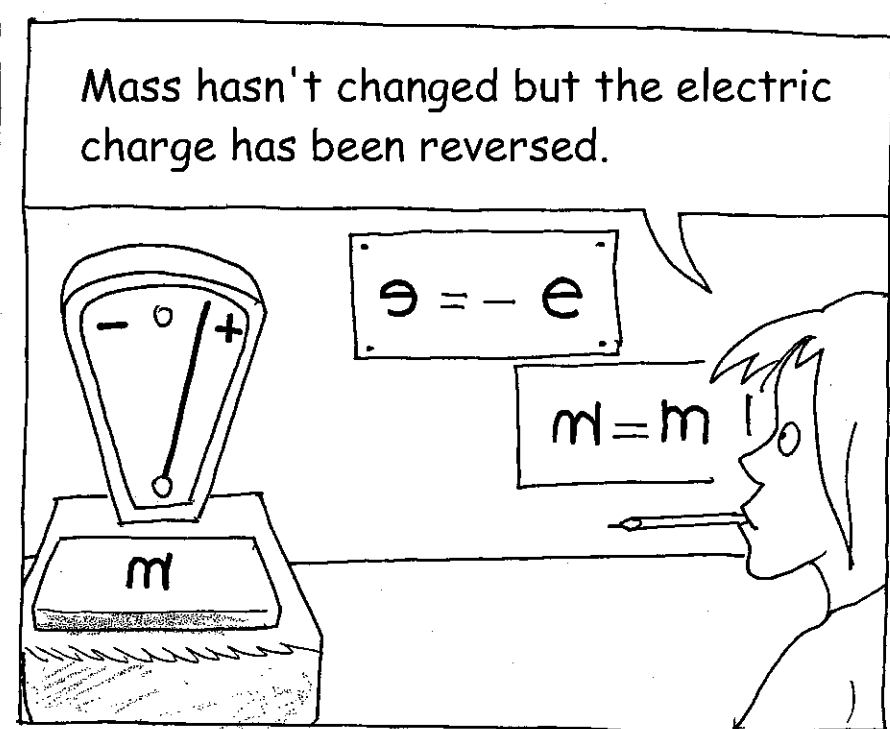
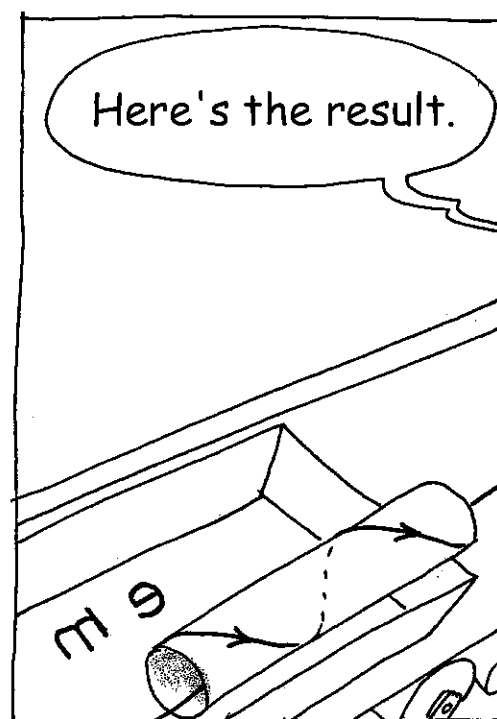
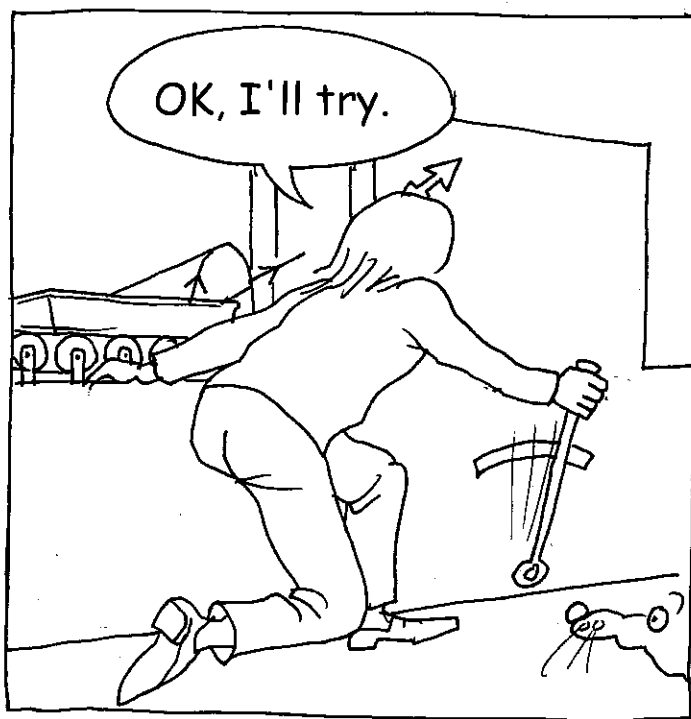
OK I start a movement, mass m and the charge e .



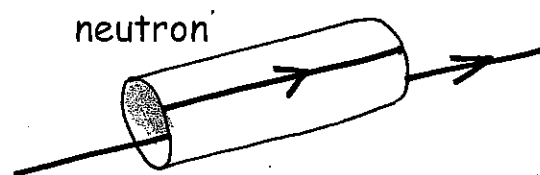
There's a lever which allows the inversion of the spiral's direction. Look at the effect on the mass and the charge.




(*) The "extended Poincaré group". See the Annex 4




This inversion of electrical charge evokes immediately the transformation matter \rightarrow antimatter. But according to this schematic model the neutron, whose electrical charge is nil, will be its own antiparticle, which isn't true. In fact particles have, on their "identity card", a certain number of "quantum charges" (hadronic, leptonic etc), the electric charge e was just one of these charges among all the others. The transformation of a particle of matter into its antiparticle consists of inverting all its quantum charges (*), including its electric charge if it isn't zero. It should be remembered that if the charges change, the mass isn't modified.



(*) Charge union or C - SYMMETRY




In short, antimatter has positive mass.



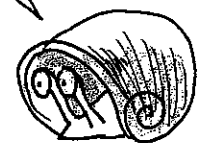
Why not add some more dimensions in order to make every aspect of the particles appear?

Easier said than done, the superstring people know something about that. It's only with the fifth dimension, electromagnetism and electric charge that it really works. But as the fifth dimension inverts itself automatically as soon as we start a C -Symmetry, we can think of it as a useful geometric image of this matter-antimatter symmetry.

So all particles possess their anti-particle because even when their electric charge is nil, other QUANTUM CHARGES remain that the C -Symmetry can invert.



The exception is the PHOTON.



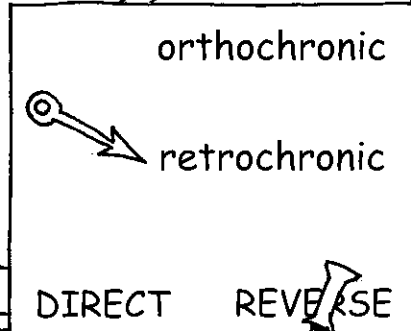
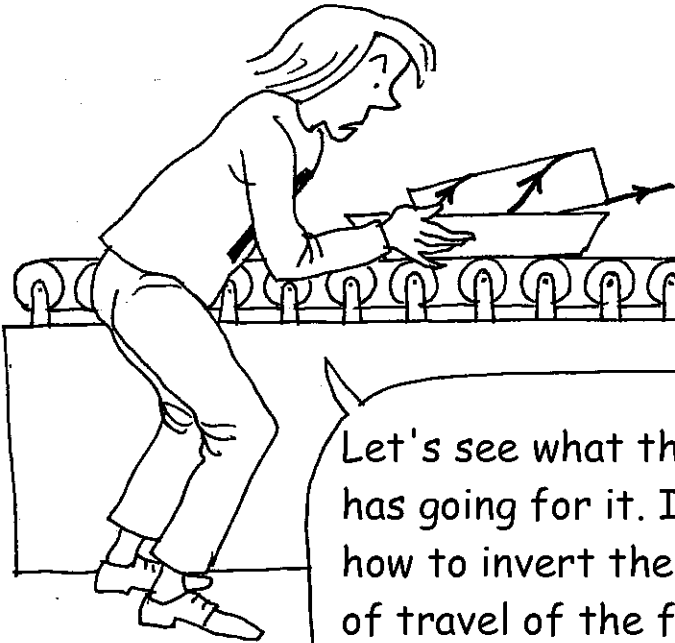
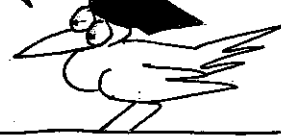
Why?

Because all its quantum charges are nil.

So what remains? Nothing?

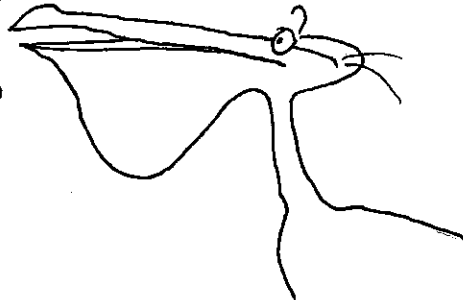


No, its energy $E = h\nu = \frac{h}{\lambda} (*)$
remains

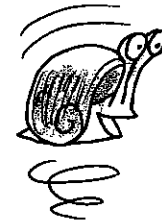


Let's see what this group has going for it. I know how to invert the direction of travel of the fifth dimension and of travel through time.

Doesn't this lad ever stop?



And what does that give?



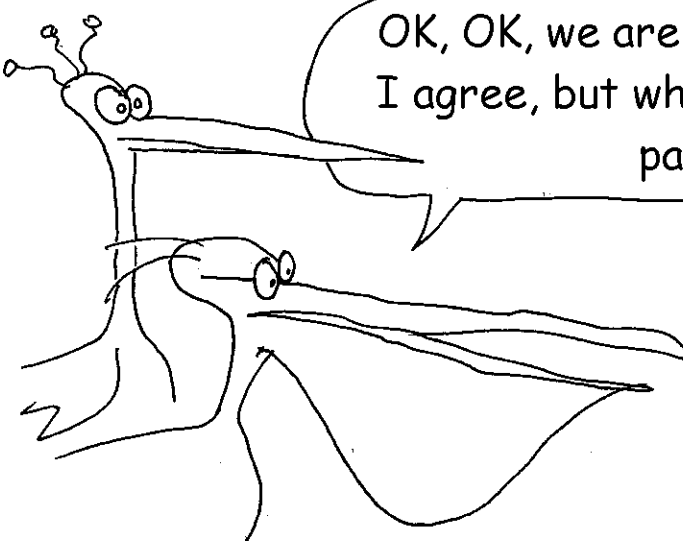
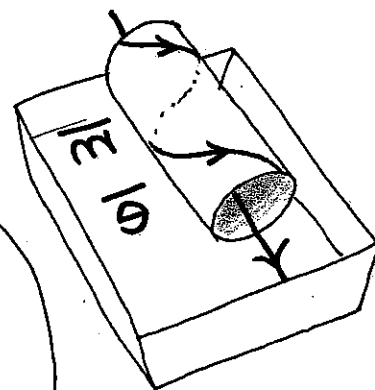
(*) and its spin, see the Annex.

Electric charge \bar{e} inverted and mass \bar{m} inverted. That means that I obtain anti-matter with negative mass and energy. In other words, the matter-anti-matter symmetry also exists in this world of negative masses. But ignoring the fact that masses and energies are inverted, this other matter, what could it look like?

Conclusion: The MATTER-ANTIMATTER DUALITY can also be found in this WORLD OF NEGATIVE ENERGIES where a particle of negative mass can "annihilate itself" with its antiparticle, also of negative mass, giving $\bar{\varphi}$ photons of negative energy.

OK, OK, we are wading through real fiction here I agree, but what do these negative energy particles look like?

We find \bar{p} protons, \bar{e} electrons, \bar{n} neutrons, $\bar{\nu}$ neutrinos etc, all endowed with negative energy.



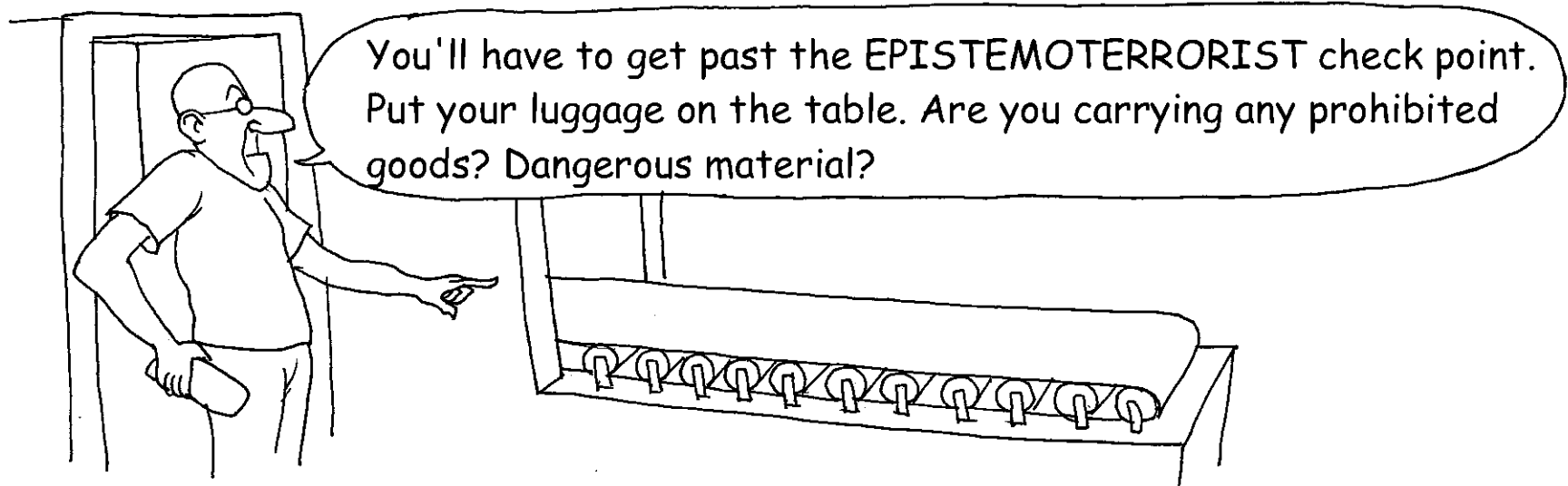


Hey, you there, stop!

OK, now what are we going to do with all that?

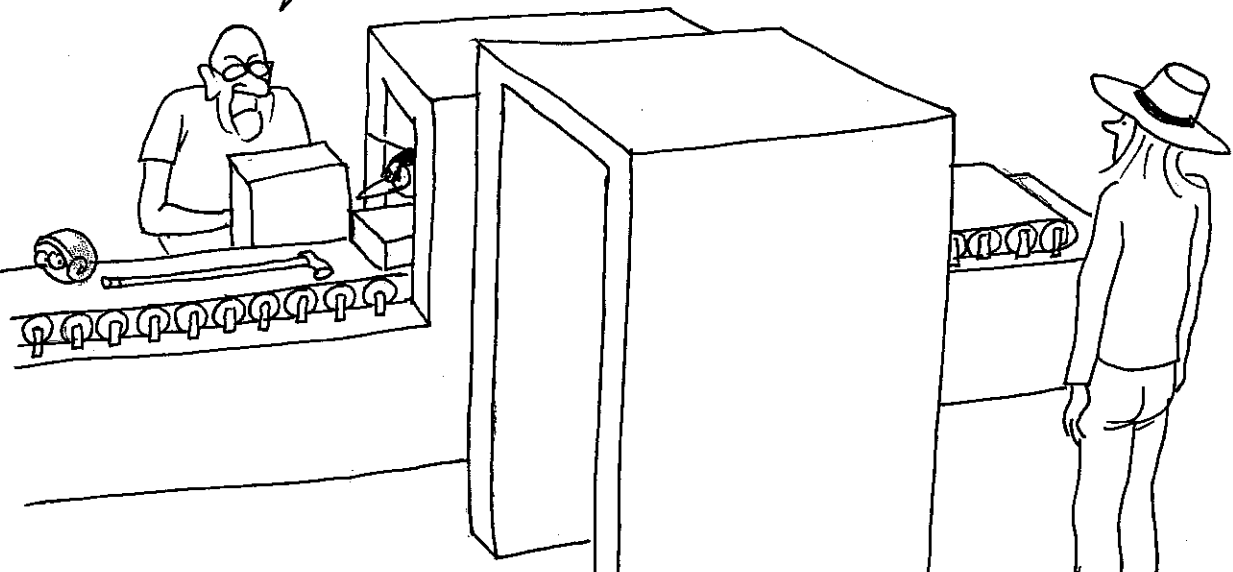
I was wondering myself.

Pah! Theoretical physicists...



You'll have to get past the EPISTEMOTERRORIST check point. Put your luggage on the table. Are you carrying any prohibited goods? Dangerous material?

No negative energy particles?

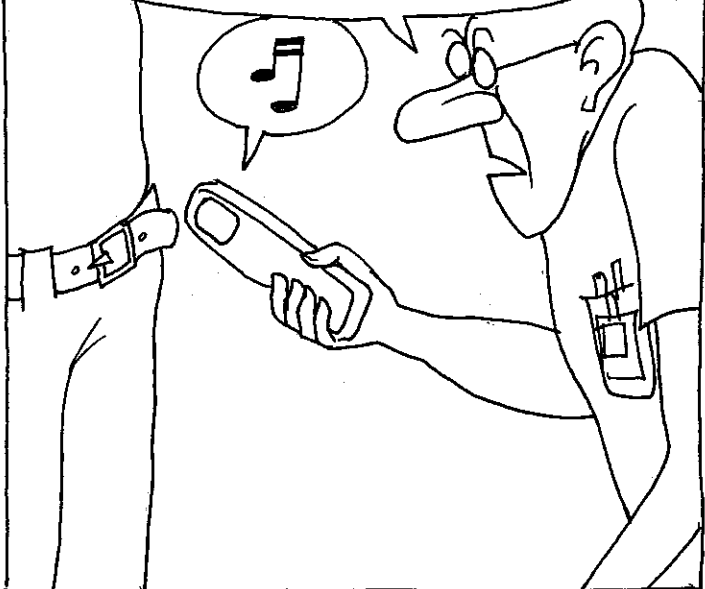


OK. Now go through the scanner.



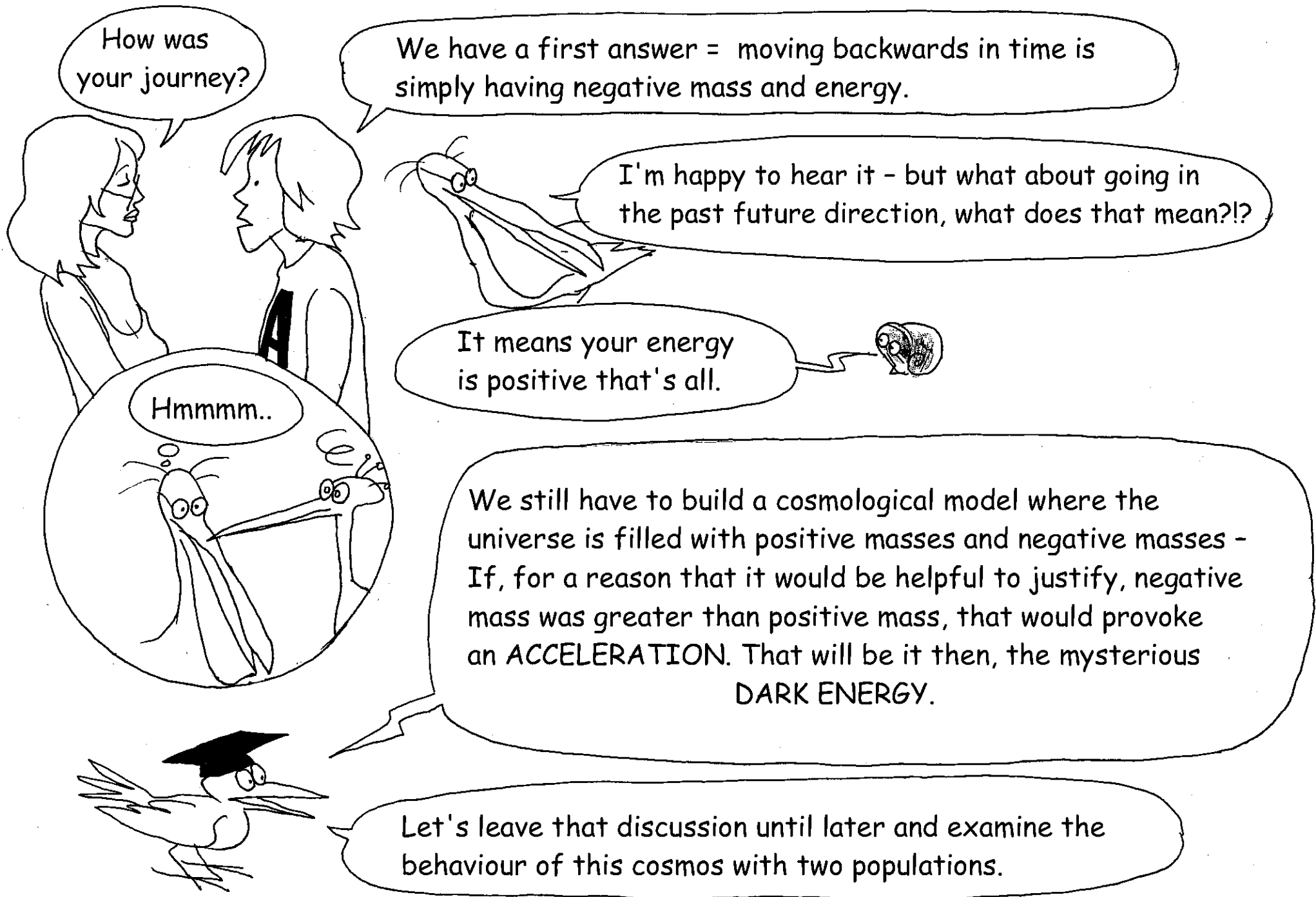
!!!!

That's probably your belt.



I had a job putting it on this morning, it's half-twisted.

Put it on properly. You know full well that transporting single sided objects is forbidden.



How was your journey?

We have a first answer = moving backwards in time is simply having negative mass and energy.

I'm happy to hear it - but what about going in the past future direction, what does that mean?!?

It means your energy is positive that's all.

Hmmm..

We still have to build a cosmological model where the universe is filled with positive masses and negative masses - If, for a reason that it would be helpful to justify, negative mass was greater than positive mass, that would provoke an ACCELERATION. That will be it then, the mysterious DARK ENERGY.

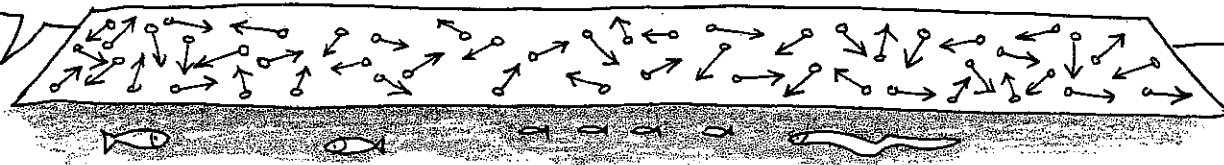


Let's leave that discussion until later and examine the behaviour of this cosmos with two populations.

(*) The existence of negative masses and energies: "Structure des systèmes dynamiques" 1972, downloadable at www.jmsouriau.com, more precisely page 198, equation 17.67

THE LARGE SCALE STRUCTURE : EXPLAINED

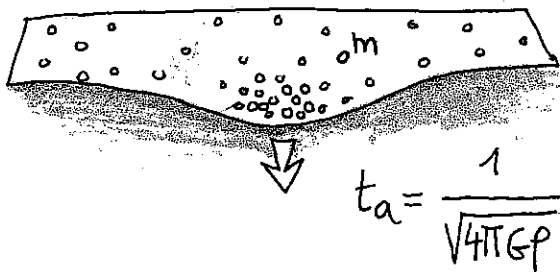
In the album A THOUSAND MILLION SUNS (1986) we presented a fundamental problem in astrophysics: GRAVITATIONAL INSTABILITY or JEANS' INSTABILITY (pages 12 to 23). We'll return to this idea while modifying the model a little. Matter will be represented by lead shot spread over a big, flexible rubber mat covering an area of water. The lead shot can move freely on the surface with a random speed representing the THERMAL AGITATION RATE (*) of this 2D milieu.



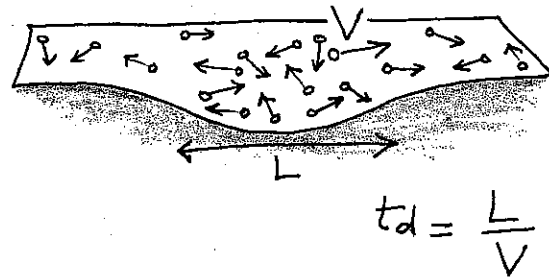
When chance causes an assembly, a local superdensity of matter, this attracts the matter around it (the ACCRETION phenomenon). The characteristic growth time t_a of this perturbation is in $\frac{1}{\sqrt{\rho}}$ where ρ is density.

Inversely this "lump" will tend to disperse in a time

$$t_d = \frac{L}{V}$$



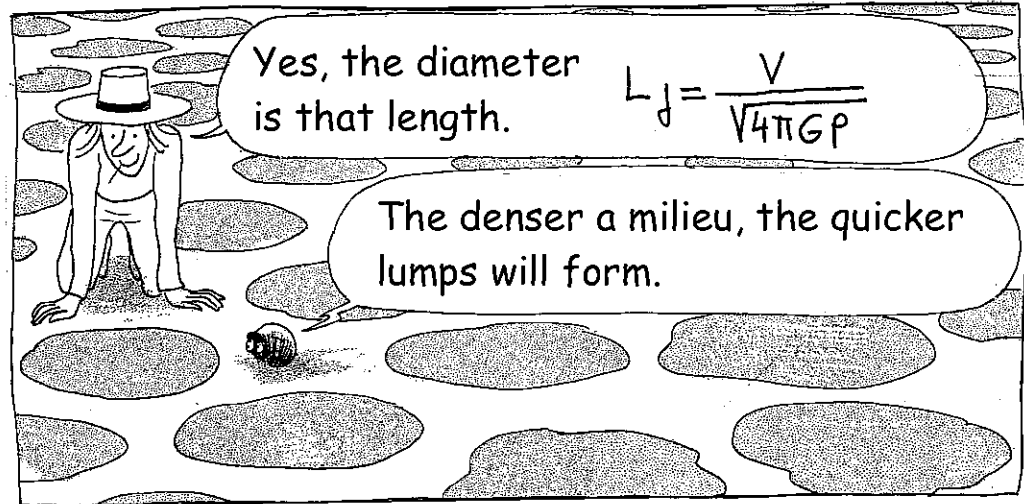
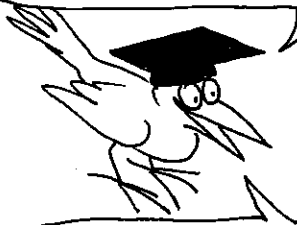
$$t_a = \frac{1}{\sqrt{4\pi G \rho}}$$



$$t_d = \frac{L}{V}$$

(*) ABSOLUTE TEMPERATURE is defined as $\frac{3}{2}kT = \frac{1}{2}mV^2$ where k is Boltzman's Constant (1.3810⁻²³ MKSA)

The lumps that will appear will be those whose diameter is equal to the Jeans' (*) distance which, statistically, have more chance of appearing than bigger ones.



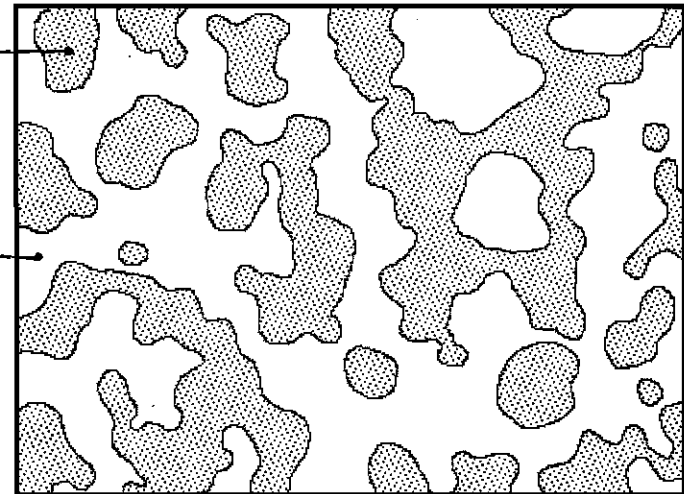
As negative masses attract each other they will also form their own "lumps". If we start with a milieu where negative and positive masses have the same densities and the same thermal agitation rate, they will simply share the available space because they repulse each other.

Like people who can't bear to be near each other.

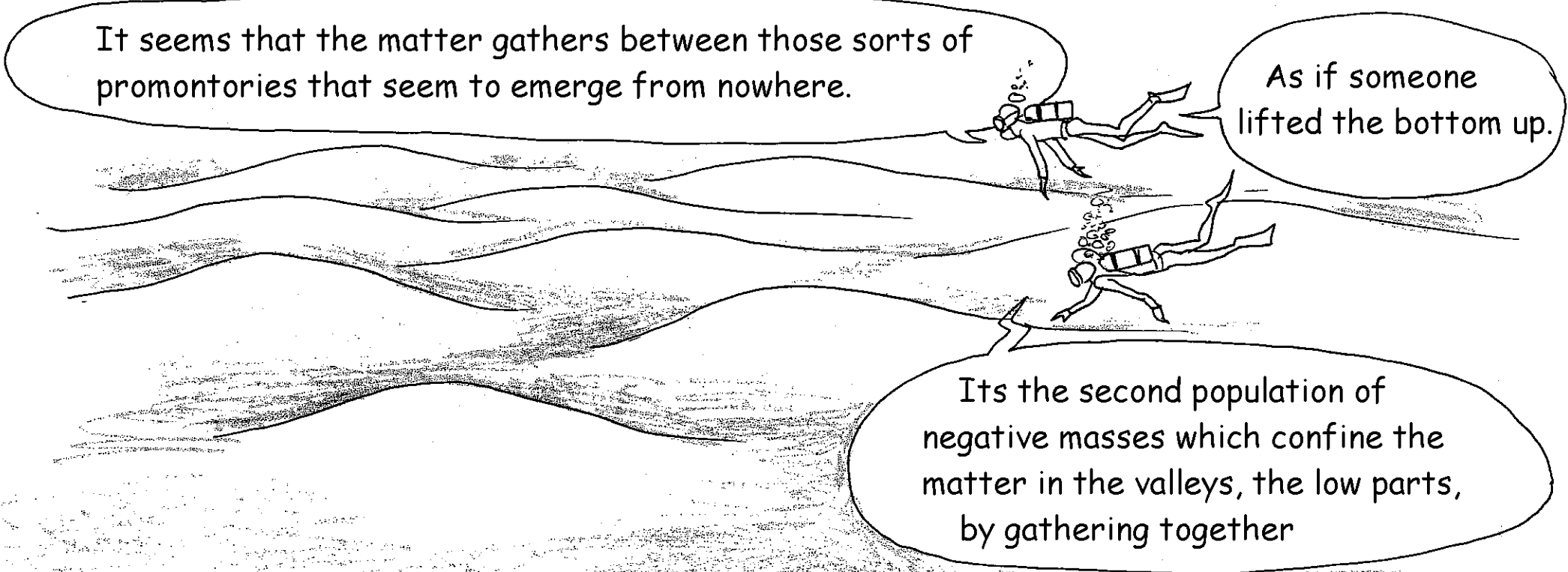
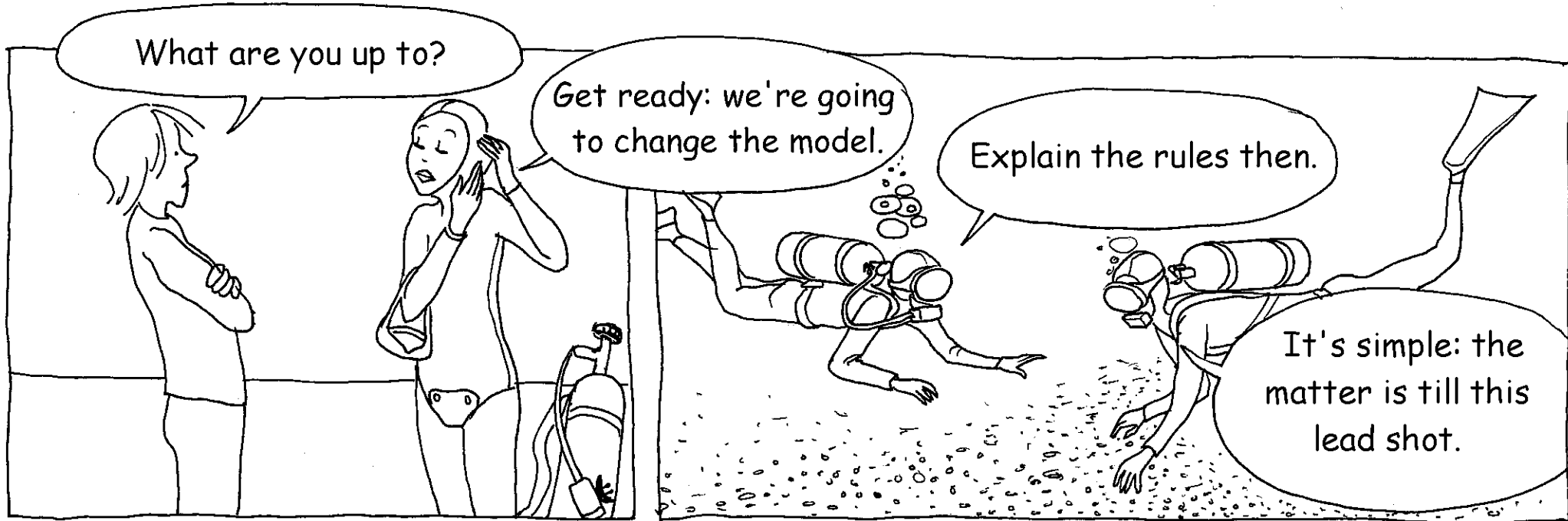


matter of positive mass

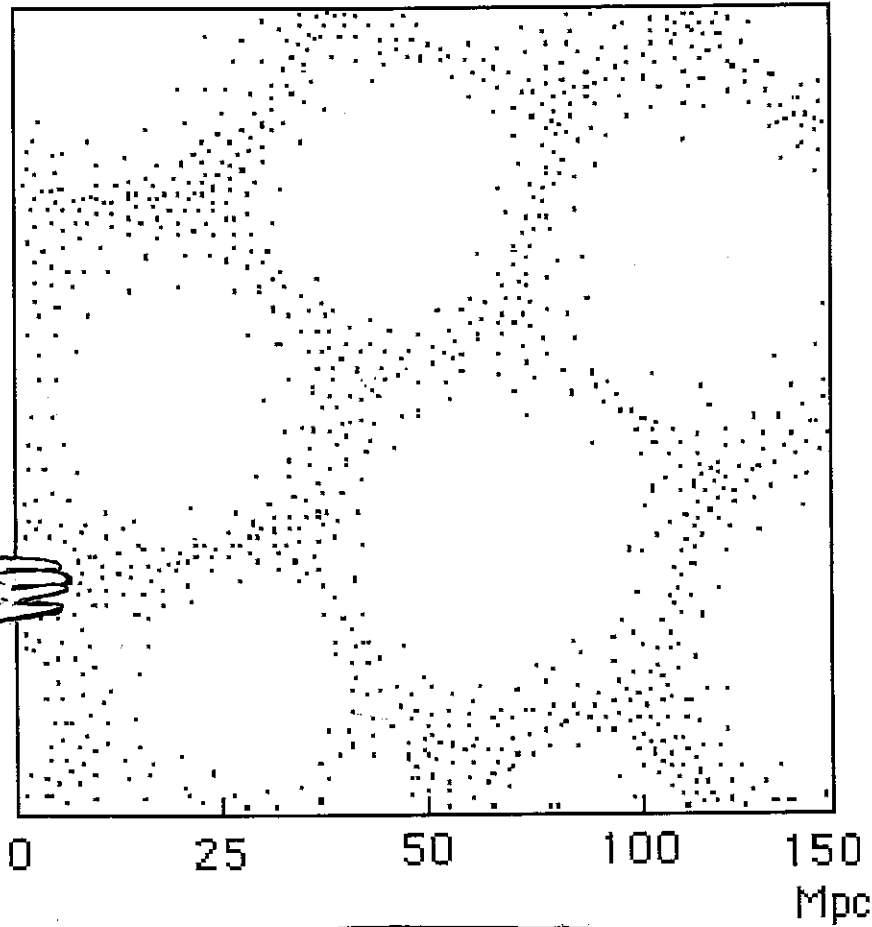
matter of negative mass



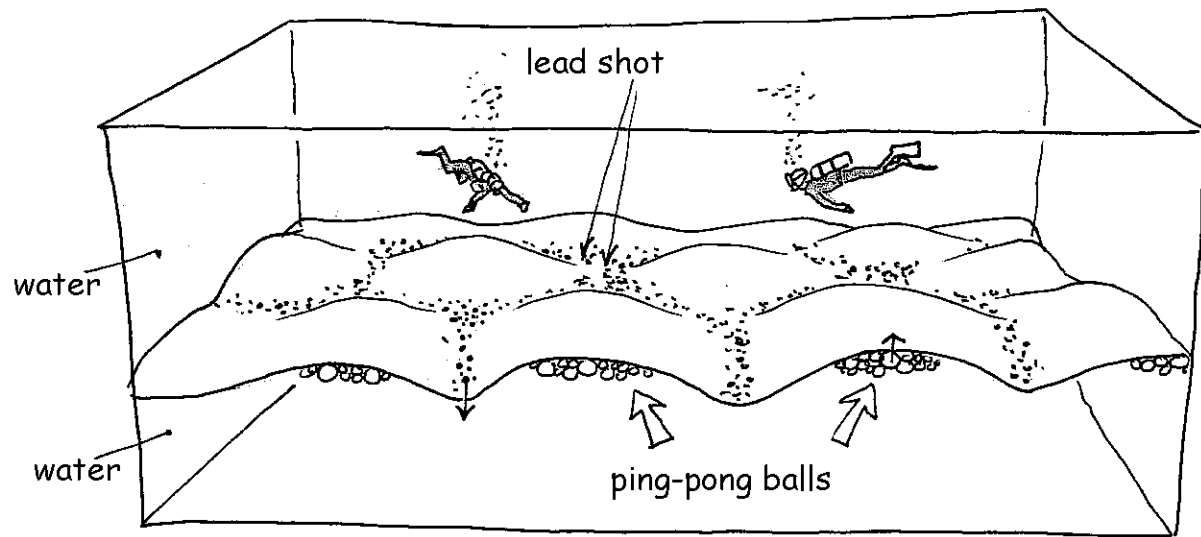
(*) Sir James Jeans, English astronomer (1877-1946)



A nice rundown

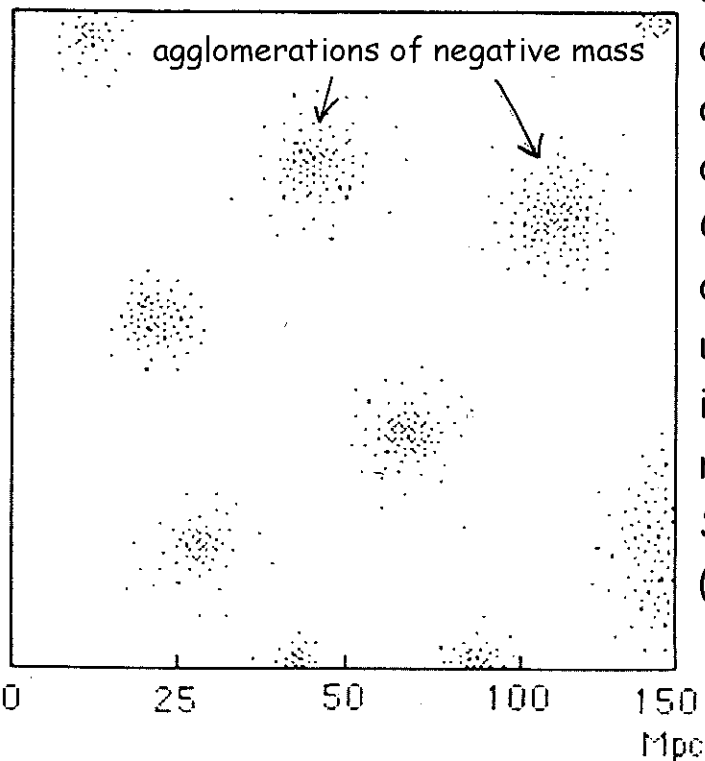


Each of these "links" is about a hundred million light years in diameter.



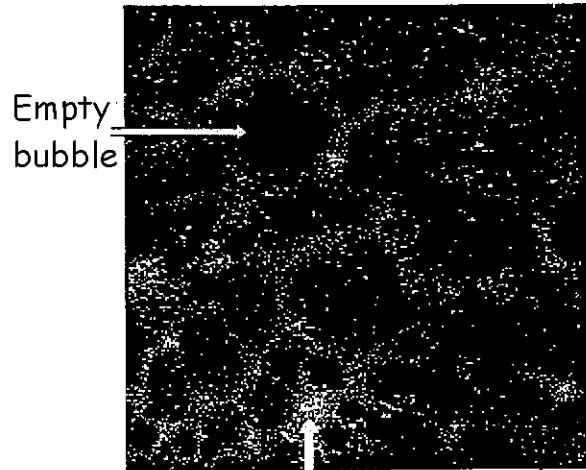
This model is there to illustrate the idea of **CONJOINED GRAVITATIONAL INSTABILITY** which will affect a mixture of positive and negative masses if the density ρ of the negative mass is the greater.

It will form agglomerations more rapidly by imposing its structure on the large scale universe.



The rubber membrane evokes their invisibility for an observer made of positive mass. - In case, on the left, here is what an observer made of negative mass would see. He wouldn't see our own matter, which is distributed in a **LACUNAR** manner, a **PROVEN OBSERVATIONAL** fact, like "jointing soap bubbles" around "voids" of hundreds of million light years diameter. - Numerical simulations undertaken in 1992 with a mixture of the two matters led to images in conformity with observations while the classical model, even if resorting to **COLD DARK MATTER** gives a **FILAMENTAL STRUCTURE WHICH DOESN'T AGREE WITH OBSERVATION** (following page).

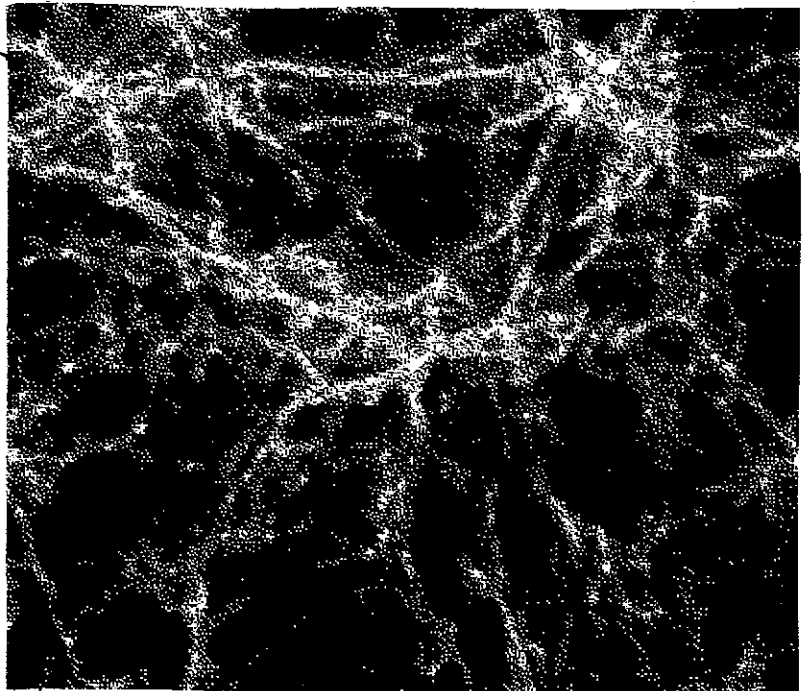
SCIENTIFIC SURREALISM



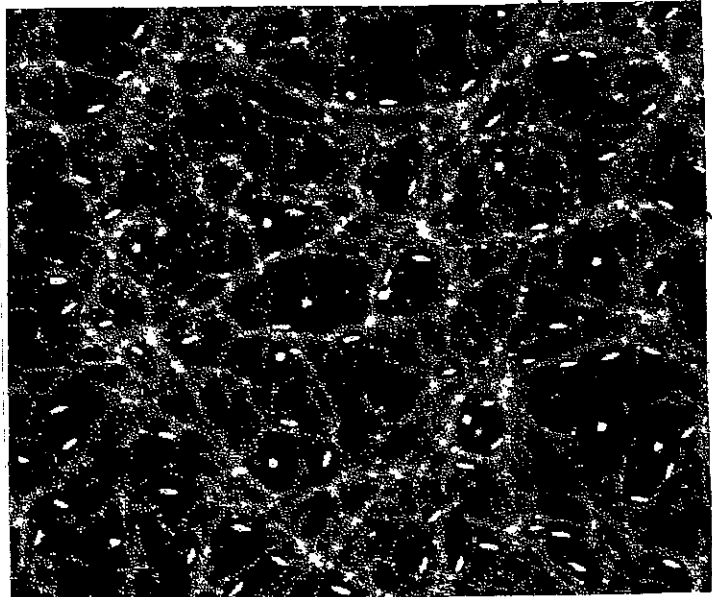
Empty bubble

Galaxy cluster

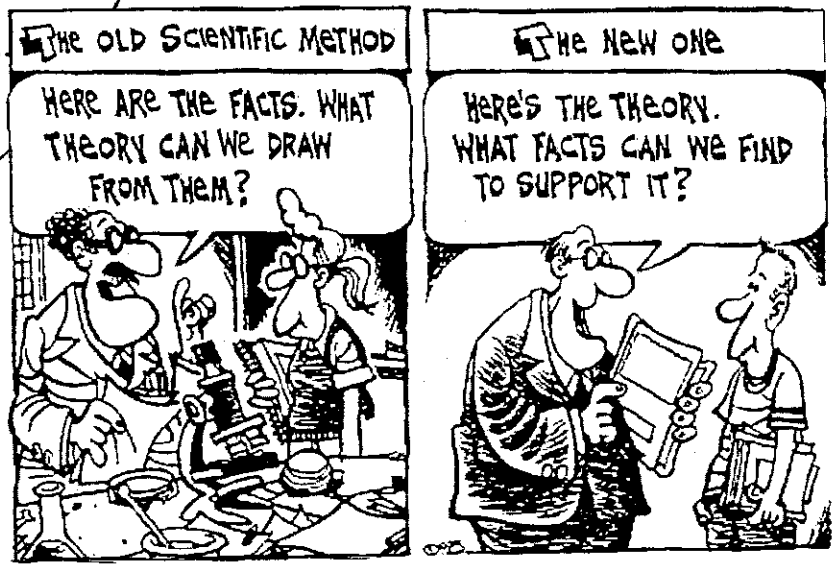
On the top left the **VISIBLE PART** of the Universe, whose resolutely **LACUNAR** aspect is confirmed from year to year. On the bottom left, the **INVISIBLE PART** deduced from the decoding of micro-effects of the gravitational lens. On the top right the result of simulations using **COLD DARK MATTER**, which agree with the second "observations". All that remains is to map **DARK ENERGY**...

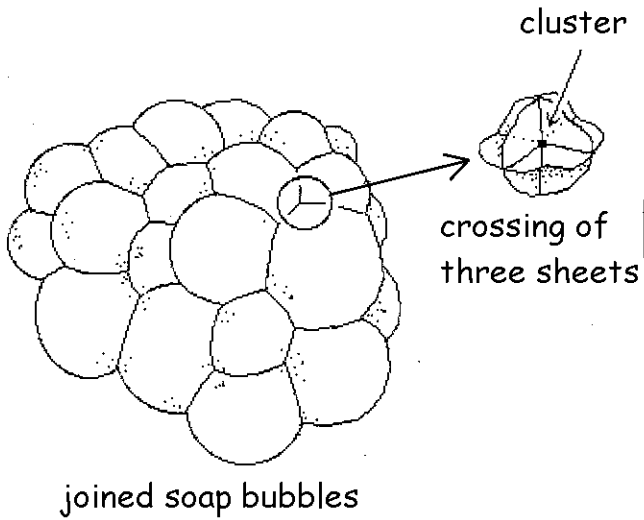


Simulation: The Universe at 2 million years old



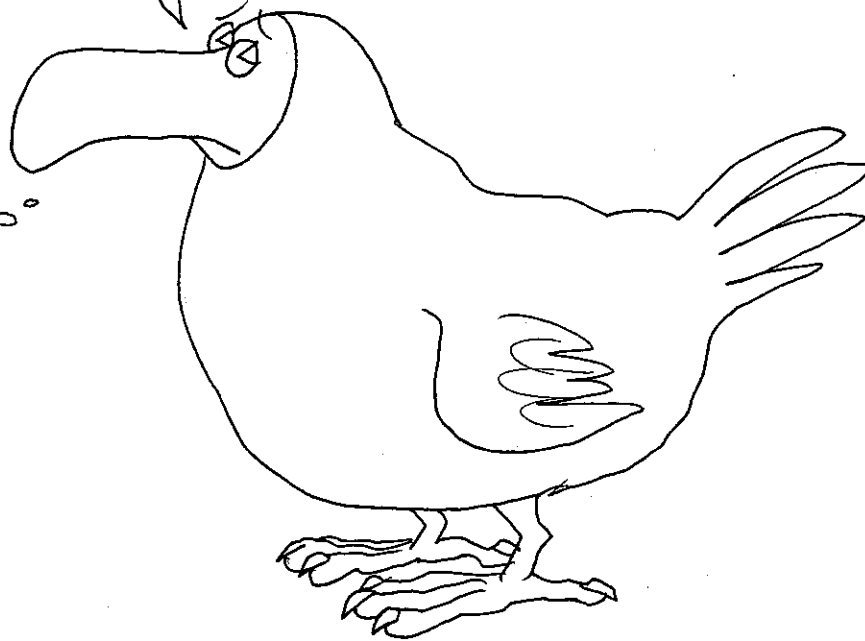
Map of dark matter





You are hanging on desperately to the miserable 4% of the universe that we see. Be modern for goodness' sake! Look at the fantastic advances that this NEW ASTRONOMY has brought. In any case, you won't get away from an inescapable **FACT**: the strong effects of the gravitational lens which **PROVE THE EXISTENCE OF DARK MATTER.**

Joined soap bubbles!



Ah, I think that Higgins brings a new element!



THE NEGATIVE GRAVITATIONAL LENS EFFECT (*)

What new element?!?
I just bought some crisps.
I was a bit hungry.

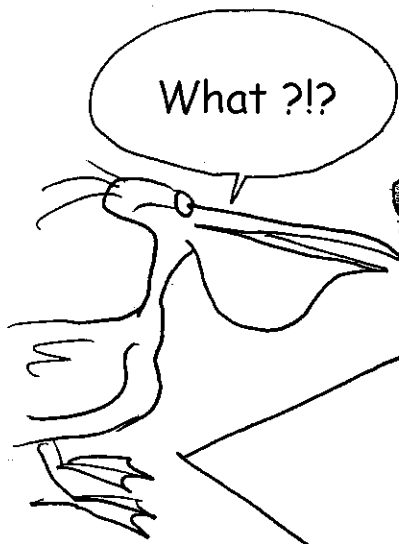
Yes but they're NEGACRISPS

What's all this nonsense
about...negacrisps?!

They're crisps with
a negative curve.

(*) For the specialist : the negative gravitational lensing effect is an exact solution to Einstein's equation, which nobody had thought about until now. This will be brought up schematically in the annex, for the details see

Jean-Pierre Petit : Twin Universe Cosmology : Astronomy and Space Science 226 : 273-307, 1995 et <http://arxiv.org/abs/0801.1477>

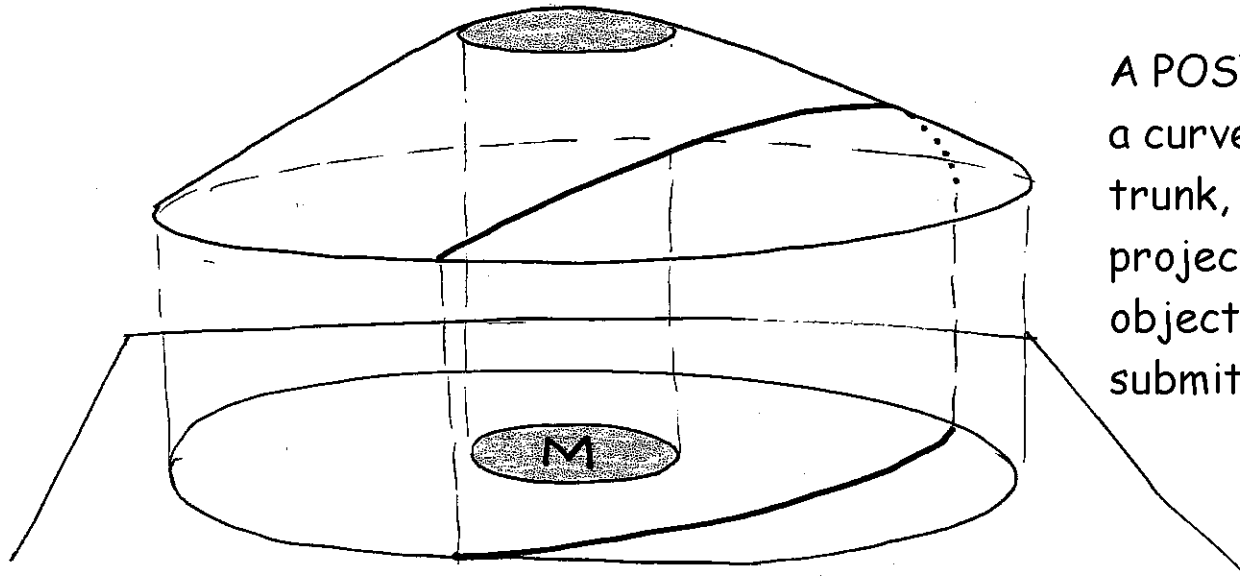


What?!?

I think a businessman suddenly had the idea of making crisps in the shape of a HORSE SADDLE. No doubt a mathematician who went into the agri-food business.



When we trace a geodesic on a negatively curved surface its planar projection evokes a REPULSIVE FORCE. Remember the thing about the BLUNTED CONE.



A POSICONE TRUNK is a spherical cap, a curved surface, completed by a cone trunk, a Euclidian surface. The planar projection gives the impression that an object, on its trajectory, would be submitted to the attraction of a mass M .

What am I hearing? You want to do some horseriding on a crisp?

How can we make it that the plane tangent to the trunk of the cone joins that of the spherical cap exactly?

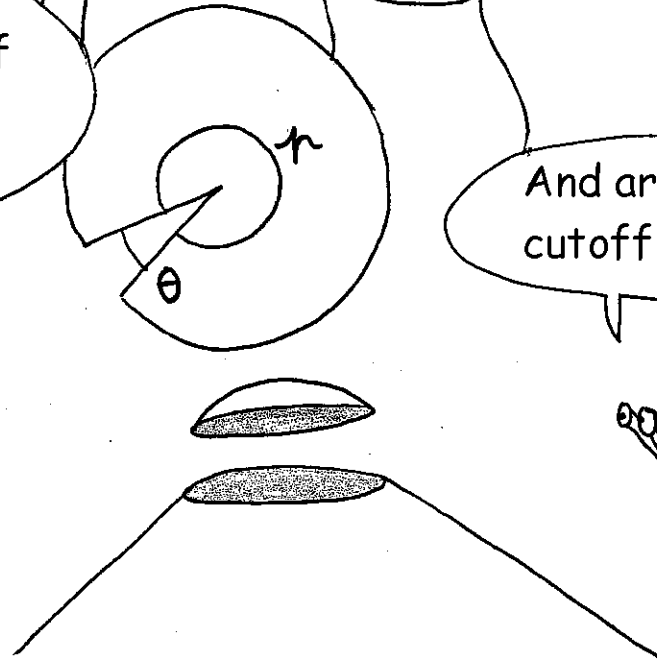
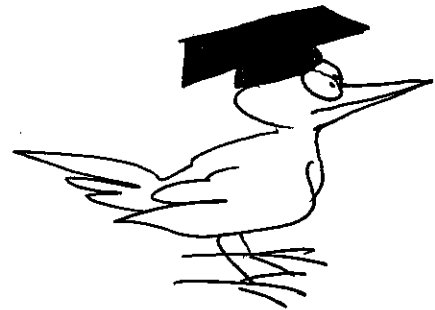
Dead easy. The sphere's TOTAL CURVATURE equals 4π (*). The quantity of angular curvature contained in the spherical cap of surface s , taken from a sphere of surface S is

$$\theta = 4\pi \times \frac{s}{S}$$

For the tangent planes to meet it just requires that the trunk of the cone be taken from a cone with a cutoff θ

And arranging it so that the cutoff has the same perimeter

We're GE-NIUSES!



Can we imagine a
BLUNTED NEGAcone?

Of course. You just need
to stick a negachip from
edge to edge to a negacone.

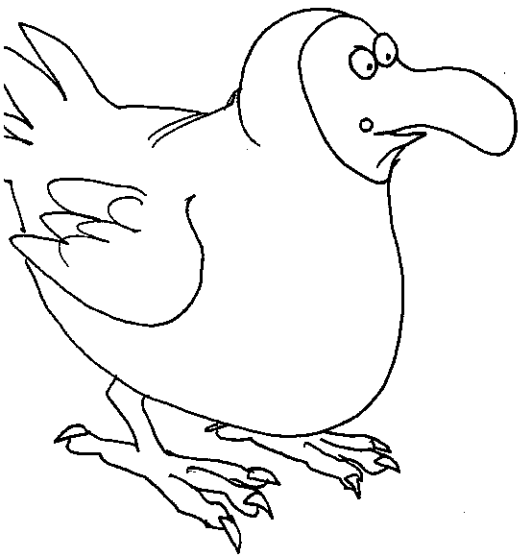
oh la.

And how do we ensure the
continuity of the tangent plane?

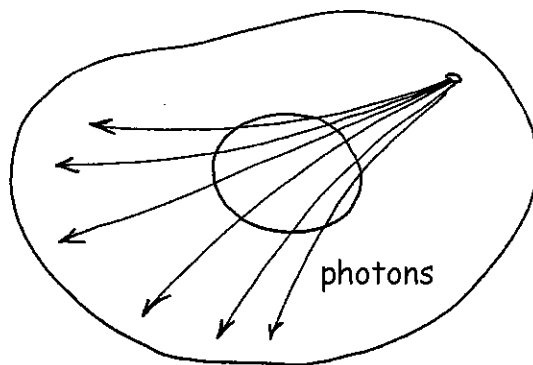
A negacone is a disc
into which we insert
an angle θ

Ah, there there isn't a rule as simple as that for the blunted posicone. We've measured the curvatures of the negacrisps and found 11° . It's going to be delicate because we haven't found any glue for negacrisps.

I think that negacrisp makers should print this curvature
on the packet so that we know what we're eating.

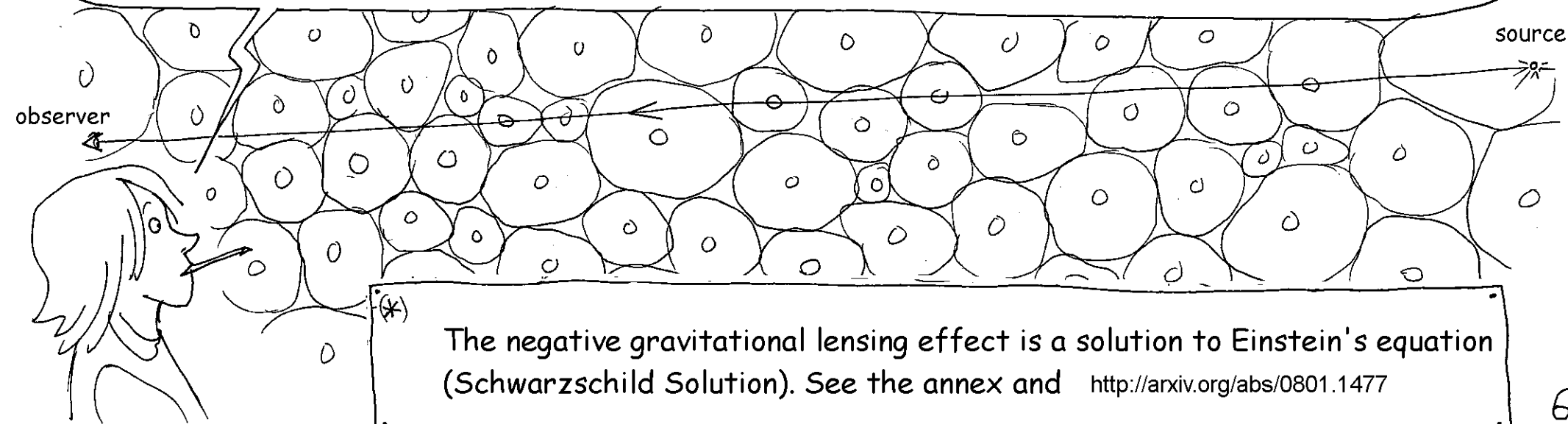


What are you trying to show with your ... negacones ?



It's a 2D picture of the INVERSE GRAVITATIONAL LENSING EFFECT (*) which will submit, without any other interaction, every photon of positive energy crossing "without seeing it" to the effect of an agglomeration of negative mass.

Which means that if, in any direction, we observe objects situated at very great distances, at the extremities of the observable Universe, there are good chances that the light rays cross several agglomerations of negative mass on their way and that this attenuates their luminosity. Thus, logically, images of far distant galaxies with a pronounced redshift should make them appear as dwarves.



(*)

The negative gravitational lensing effect is a solution to Einstein's equation (Schwarzschild Solution). See the annex and <http://arxiv.org/abs/0801.1477>

Well Mr Handshic ?

Well... the first galaxies that formed are effectively... dwarves. That is what we observe at high redshifts. Then we suppose that they assemble to form more massive objects.

It seems to me that we are progressing, no?

That is the accepted thesis

And these galaxies, in general, how do they form ?

We're working on it dear lady, we're working on it.

For three quarters of a century now.

HOW STARS ARE FORMED

You've scored a point but don't forget, band of imps, that your tale of negative masses does not explain in any way the strong effects of gravitational lensing near galaxies, and especially galaxy clusters.

For the moment he's right.

Before asking how galaxies are formed, we might reflect on the way stars are formed.

Stars: We know more or less how they function. In relation to our ephemeral human lives, and even our civilisations, their development extends over an immeasurably longer time. The key progress, at the beginning of the 20th century, when it was understood that there wasn't an infinity of possible stars but that we were in fact seeing different types of star which could be classified according to mass and which appeared to us at different evolutionary stages.

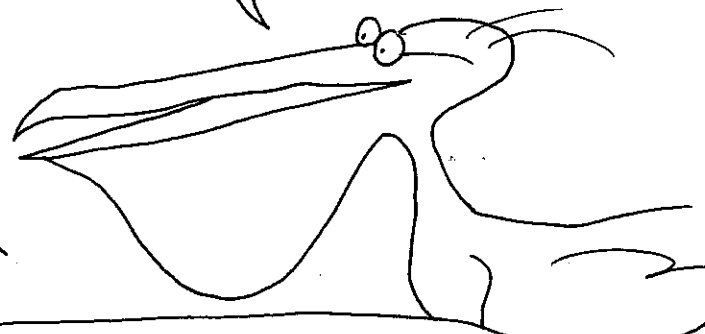
Ah, those massive stars, they burn their hydrogen at both ends

Stars form in gas clouds. Later we will see why and how "lumps" form: PROTO STARS. When FUSION begins, when the star starts to burn its "fuel", hydrogen. The greater the star's mass, the faster it will "burn" and the shorter its existence.

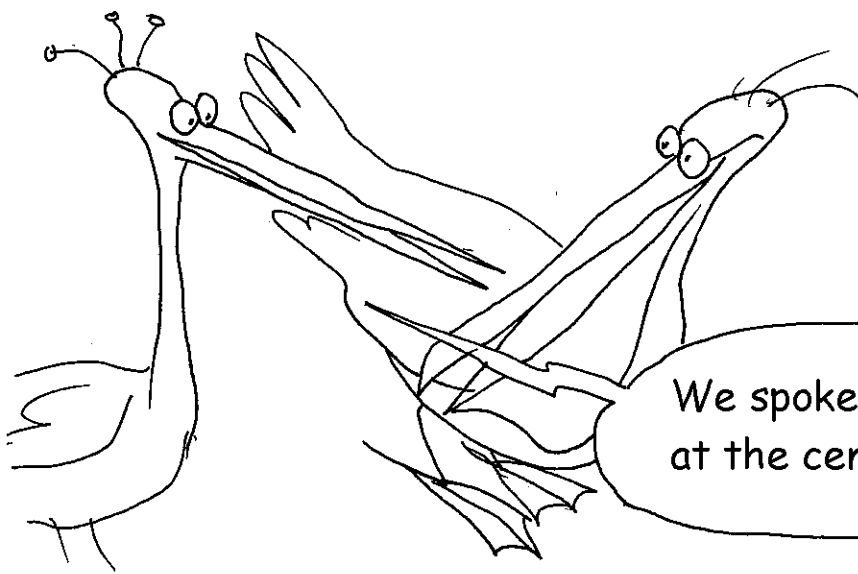
Jupiter is a "failed star" which radiates and contracts, but never light up. When there is sufficient mass, say ten times that of Jupiter, the star experiences a period of latency before the fusion reactions start.




How long does it take?




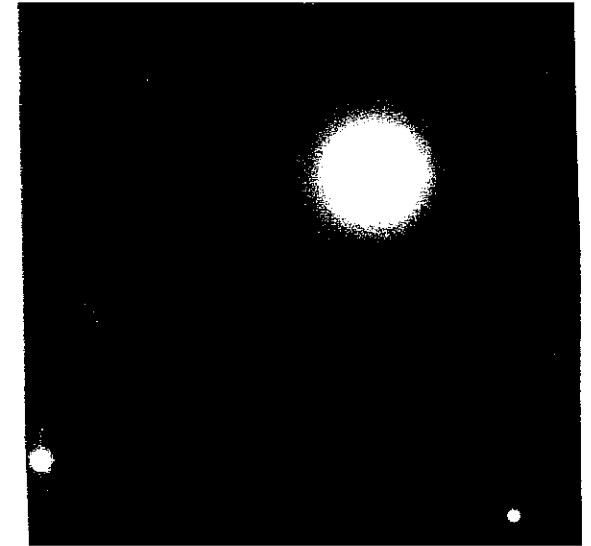
Let R be the star's radius. The lump contracts until its temperature reaches 3000° . The lump then ionises and pressure forces oppose the continuation of contraction. The amount of heat that needs to be evacuated, by radiation, is as the volume of the star, as the cube of it's radius - the "radiator" is its surface $4\pi R^2$. The time taken for the dissipation of this heat, which allows contraction to begin again and results in fusion, varies therefore as the cube root of the stars mass, as its radius R .




We spoke of spheroidal agglomerations with negative mass situated at the centre of these great voids. How do these objects evolve?




You'd need to be made of negative mass to be able to see these enormous proto-stars, radiating in the red and infrared, whose contraction time exceeds the Age of the Universe. Which means that they'll never light up!



So if I understand correctly, in this negaworld there are no real stars, no fusion, so therefore no planets and no LIFE?

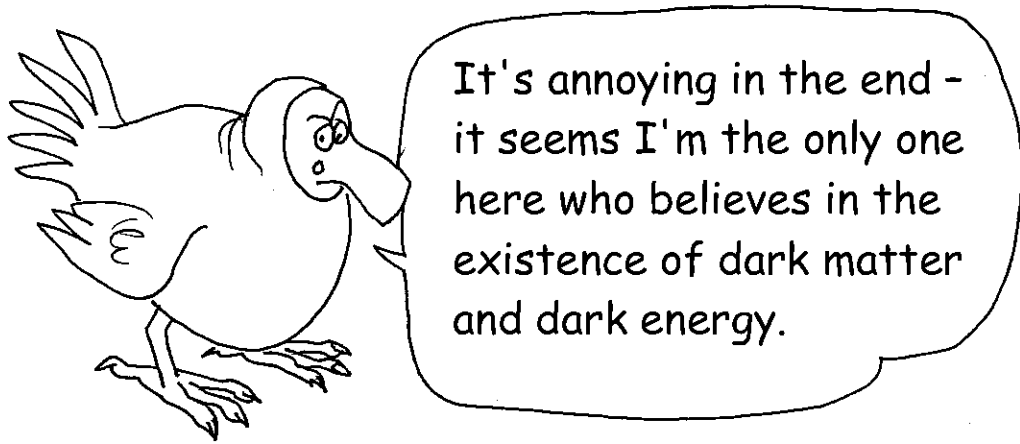


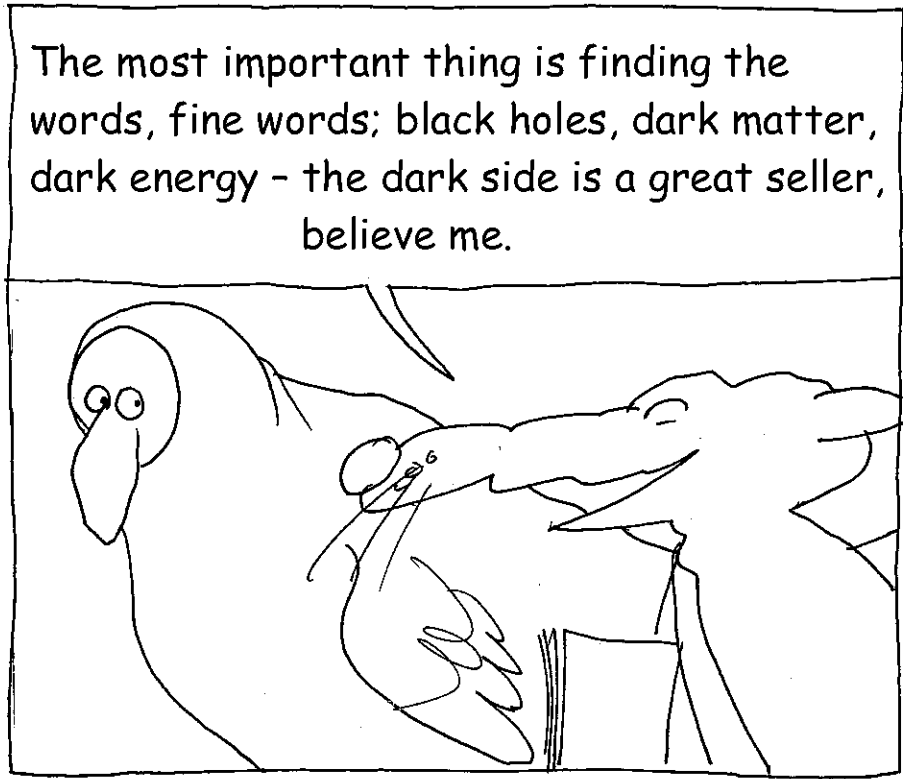
These objects are only the framework of our universe of positive mass.



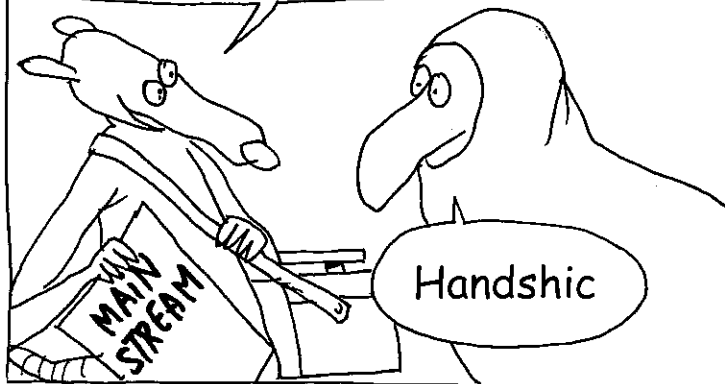
Ridiculous, phantasmagoric! You can invent this sort of thing until the cows come home but **DARK MATTER** and **DARK ENERGY**, they are real!

THE PROBLEM OF GALAXY FORMATION





That is the only way to progress in science sir.



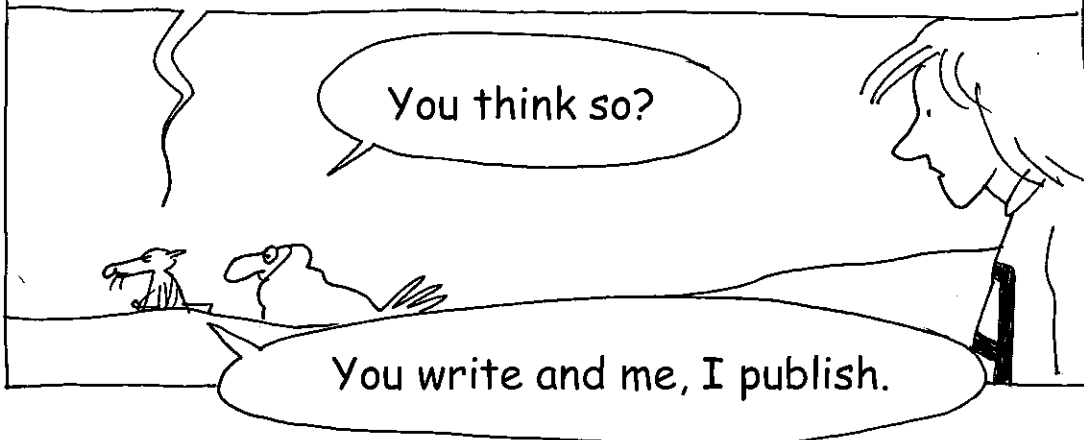
Handshic

We are looking for an article on the formation of galaxies - What is your opinion on the question?



Well, we haven't found a plan of the way they form. And as to observation, we won't find anything.

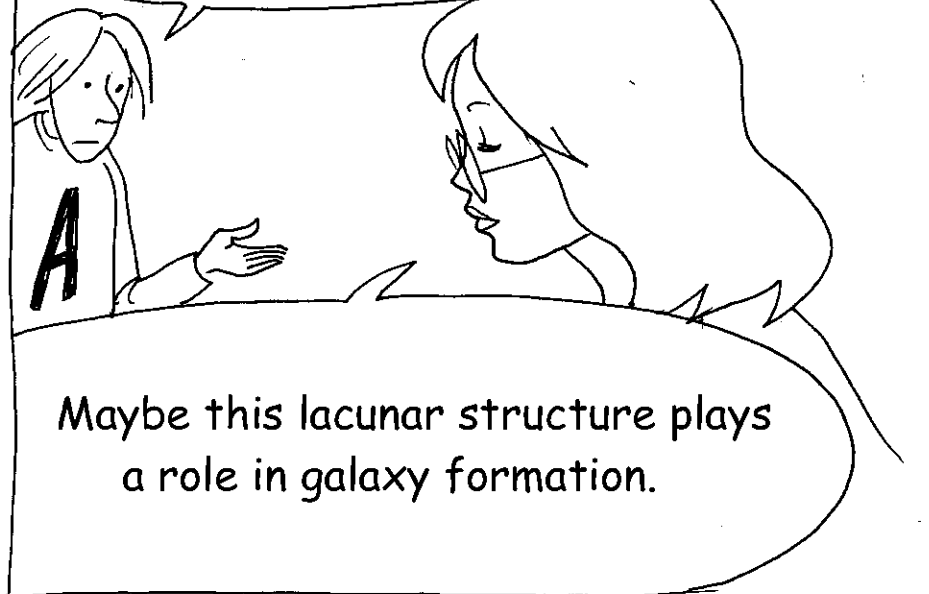
Tsss...science, it's cooking - you put in a packet of cosmic strings, a few magnetic monopoles, cold or warm dark matter, and maybe, to spice the whole thing up, a few mini black holes. No?



You think so?

You write and me, I publish.

What do you think Sophie?



Maybe this lacunar structure plays a role in galaxy formation.

When we start from a mix of positive masses and negative masses, with a large superiority of the second over the first, this forms agglomerations through gravitational instability. In doing so matter of positive mass, ours, is repulsed into the residual space. But this happens quite violently and the matter, in the form of hydrogen and helium, is compressed as PLATES (*)

While matter with negative mass assembles in the form of spheres and so is unable to evacuate heat by radiation, a PLATE CONFIGURATION, however, represents the optimal radiator for matter, which can then cool by radiation after a strong temperature excursion. This destabilises the gas and the sudden cooling sets off gravitational instability and the formation of galaxies, ALL AT THE SAME TIME. That's why we never find young galaxies.

