THE SLOTH OF THE UNIVERSE

Timoteo Briet Blanes

ABSTRACT

The fact of call one event as unpredictable, is to assume ignorance. Our goal so, is know the evolution (temporal or spatial) of any object or event from similarities.

About the phenomenon prediction, if there are few laws which define him, it will be more complicated know the evolution (chaos essence).

From all that, is necessary to ask us, if there some think common for all these cases, some law able to means these examples.

That is the objective for me and this article: know how the nature think and decides, and create language mathematics, pretty and simple, in order to explain any event, as a fluid.

There is a special relation between sloth or minimum energy principle and fluid dynamics: the geometric shape as a explanation or representation of any think dynamic evolution, is a wave. Even, a dynamic fluid, is possible to simulate as a lot particles (Lattice methods).

I apply this article-idea-method, in some fields as a Dark Matter, Galaxies formation, evolution and collide, Economy, etc….

Richard Feymann: "MATHEMATICS. To those who do not know mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty, of nature. If you want to learn about nature, to appreciate nature, it is necessary to understand the language that she speaks in."

Albert Einstein: "Look deep into nature, and then you will understand everything better."

Others articles, of different area:

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https://drive.google.com/open?id=1NNqhGJF6mLLht01DZMhLsBpMJsh_4Rt9

.Linkedin Pag: -- https://www.linkedin.com/in/timoteobriet/

1. INTRODUCTION

The main goal for any mathematician is create numeric models about nature phenomenon. For that, is necessary discovery (or create) patterns, and if is possible lineally, but that, is not easy, and normally not real.

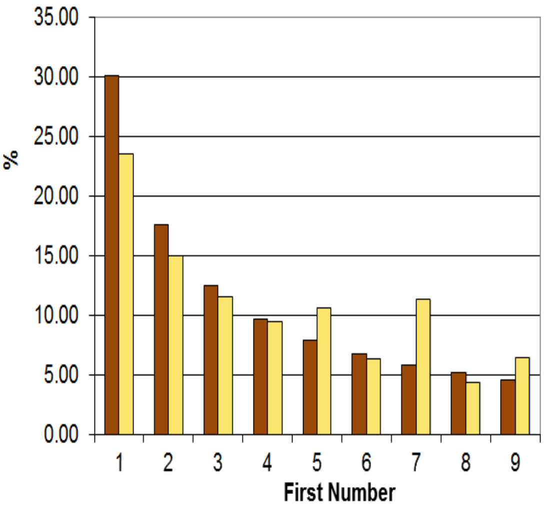
As a writer, a mathematician thinks with a language and as all language have their rules, their pretty rules….

Is very nice is front a white paper and write ideas and translating dreams….

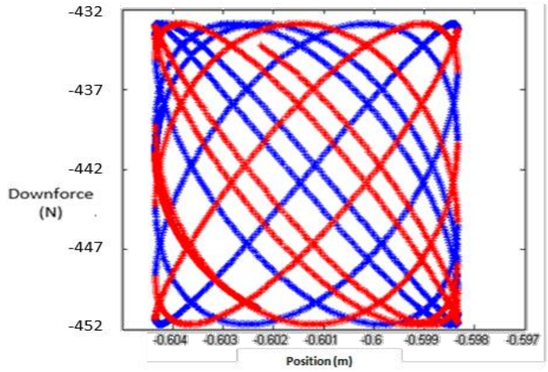
The fact of call one event as unpredictable is to assume ignorance. Our goal so, is know the evolution (temporal or spatial) of any object or event, from similarities.

In the nature, there are a lot of think very estranges, about patterns:

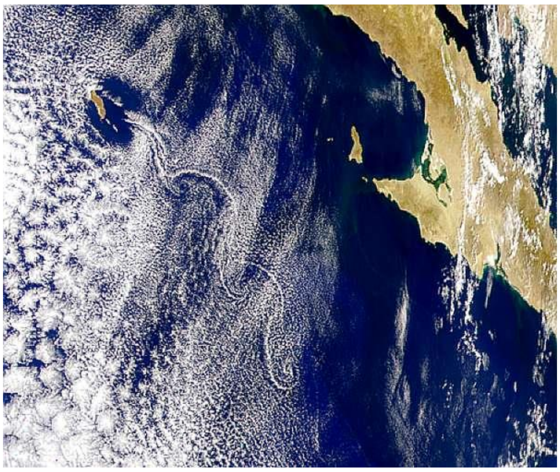
- Benford law, applied for example, in distances of galaxies (distribution in space) (Timoteo Briet Blanes – 2017): (brown=Benford, yellow=data 4.000 galaxies):

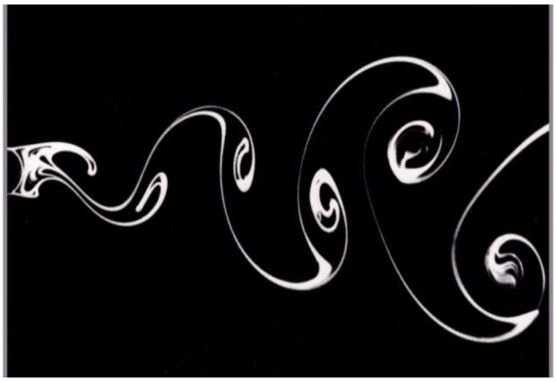


- Generation on Lissajous curves from different cases: electronic control, lift or downforce against position in a vibrating wing, etc… (Timoteo Briet Blanes – -- https://drive.google.com/open?id=1juTqJlAoKinDr5tbMUke81hxC47cfFJ0 , https://drive.google.com/open?id=1NNqhGJF6mLLht01DZMhLsBpMJsh_4Rt9):



- Vortex Karman street, in different scales as a atmospherics events, turbulences from a cylinders, etc….:





Also, in a lot cases, is not possible to see some pattern or some think as that, but is possible analyze the phenomenon in order to find a pattern. For example, in a Meteorites rain (Quadrantides - Josep Maria Trigo - temporal data January 1992), is possible to create a graphic, with "d_i" the detection instant of meteorite "i", $d_i - d_{i-1}$ against $d_{i-1} - d_{i-2}$. Is possible detect and analyze one geometry multifractal (may be because there is a random variable….) (Vicent Martínez García - University Valencia - Spain) on this graphic (Timoteo Briet Blanes - 1993).

And more: is possible to see some phenomenon or properties about fluid mechanic, in objects or particles dynamic. For example, Bernouilli principle in accumulation or exit of people from sport stadium, also sheep out of a stable, even is possible apply fluids theories in vehicles traffic in cities, etc….

About the phenomenon prediction, if there are few laws which define him, it will be more complicated know the evolution (chaos essence).

From all that is necessary to ask us, if there some think common for all these cases, some law able to means these examples.

That is the main goal for me and this article: know how the nature think and decides, and create language mathematics, pretty and simple, in order to explain any event, as a fluid. For example, get a fluid with density "ρ" constant; get a space in 2D and get $u_{i,j}$ velocity horizontal in point (i,j) and $v_{i,j}$ vertical velocity in the same point:

$$A = u_{i+1,j} - u_{i,j} + v_{i,j+1} - v_{i,j}$$

So A=0, or the same: variation zero of the mass:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

: Continuity equation or divergence zero; that is, with language mathematic is possible explain the nature.

To know the evolution of any event means the introduction may be of a probability of to be or not to be (Multifractal geometry in meteorites rain). That is very important.

Can you fight the flow of a brave river trying to reach the edge? Surely it will be useless, but you can try .... Every person has his own will and is able to choose his destiny or movement as a decision or choice, but the group dilutes that will; It might even alter your environment, but only the environment .... A person solitary, is unlikely to originate or produce a "different" evolution of the whole; but it will be able to do so, only in the case of being able to generate a great impact that affects many people: the union, it makes force.

When one speaks of "power," power is the ability to influence large numbers of people. The birds, don't know what is the geometry of a flock, but hi flights and moves....

Who, when a very dear one has died, has not thought that the world is going to stop, that the sun will not come out any more, or that everything will change, or that he will telephone on your birthday to congratulate you. Really the sun does not come out the same way and with the same beauty, but the world follows, and despite what happened, everything remains the same .... and never phone ....

I need understand the cosmos, but I and my actions, are very and quite insignificants….

There is a special relation between sloth or minimum energy principle and fluid dynamics.

- ➔ If I must to go from here to there, yes; I will go. But, with the minimum energy,,,,

If I ask question about universe, I able to understand it….

2. EVENT

Any concept, dependent of time; that is: dynamic. For example: ball position, aircraft, economics values, petroleum price, etc….

3. DEPENDENCE OR NOT, BETWEEN EVENTS

A coin is thrown: what is the probability that it comes out face? The answer seems pretty obvious. But, and if it is known that previously the same coin has been launched 50 times and has always has face? The answer is no longer so simple, besides that there are some explanations mathematically (Markov chain, etc….).

Does it therefore influence what is known a priori of an event in order to predict it? Does knowledge influence? Yes that influences, indeed: if you ask us if it's going to rain an hour, just look at the sky and know if there are many clouds ....

Be 2 events; it is assumed that one of them varies and it is observed that the other event also varies or responds to the variation of the first. Are both events therefore dependents?

One could say yes, as long as these mutual variations are known over a suitably long time, since, perhaps, the second event varies "coincidentally" ....

4. EVENTS REPRESENTATION

An event or a group of events, can be represented between them in the following ways:

- Through springs, dampers or shock absorbers and bars:

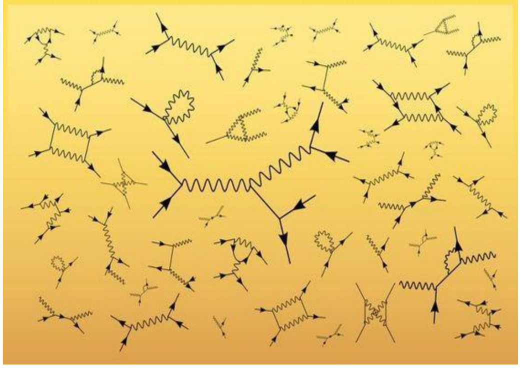
• Fixed bar (positive or negative): one event moves in the same proportion as another to the same direction.

• Spring: it is defined analogously to the bar, but with a force of repulsion or attraction, as a spring.

• Damper: it is a displacement damper, applicable to bars and springs. Is a try to enter the variable "time".

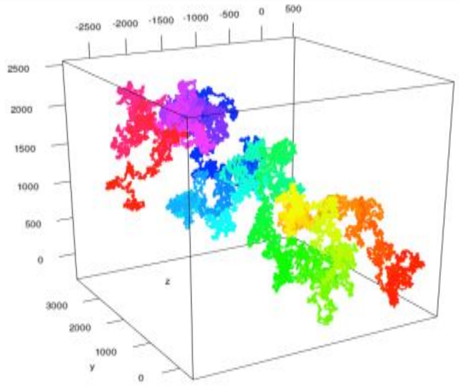
It is possible to apply "mass" to the event, in the form of "importance" or "transcendence", and others systems as imerters.

The options, therefore, of connections between events, are endless:

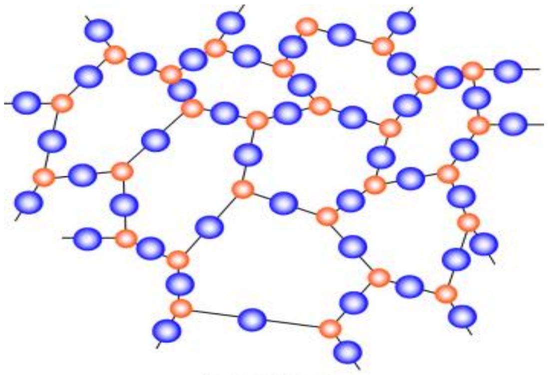


All these relationships can work under linear and non-linear functions.

- An event is represented according to different "Coordinates", which are the variables on which the Event depends. The "Dimension" of the event is defined as the number of variables on which it is possible to represent it:



➔ The glass, is a material called "Amorphous":



Amorphous

This material have the property of not transmit normally, a vibration. In fact, is possible think about the glass, as a material with a viscosity very high.

5. DENSITY

Density "ρ" is defined (definition traditional) as the number of events per unit volume or time interval. Be an event; density is defined as the quotient between the number of events enclosed in a ball of determined radius and center of event, and the volume of the ball.

This definition is extended to "n" dimensions, defining the volume of a ball of "n" dimensions as:

$$\frac{\pi^{n/2} R^n}{\Gamma(n/2+1)}$$

"z" is an integer and "Γ" being the Gamma function:

$$\Gamma(z) = \int_0^\infty t^{z-1} e^{-t}\, dt$$

Also is possible to define this value, as an average density.

6. PRESSURE

Is a concept, very similar to Density, or better, is a consequence of her. Obviously, if the density is greater, the pressure also. First, we can think about pressure as a definition in Kinetic theory of gases ("m" total mass particles, "N" particles number, "V" volume and "u" average velocity of particles), (cte1 is a constant):

$$P = cte1 * \frac{m u^2}{V} = cte1 * \rho * u^2 \approx \rho * u^2$$

This concept, is very important in galaxies formation and evolution or in general in cosmology. In this case, is called "Ram Pressure":

$$P \approx \rho * u^2$$

"u" is a velocity vector; "ρ" is a local value, that is: around a point.

We can have a fluid with compressibility but is necessary to know the velocity for this compression or expansion. This factor numeric, depend of velocity of volume variation; that is, in 3D ("V" is velocity vector):

$$\nabla \vec{V} = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z}$$

The expression is the divergence of "V"; that is: the variation of volume, and may be positive (universe in expansion) or negative (universe in compression).

Density Energy:

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7. TEMPERATURE

In a volume "V" with "N" particles and velocity "u", we can calculate the frequency of collision between particles:

$$freq_{col} \propto N * u * \frac{1}{V}$$

This value is the temperature ”T” (cte2 is a constant):

$$T = cte2\frac{N*u}{V} \approx \rho * u$$

So: $$T \approx P*u \approx \rho * u^3$$

About the Brownian movement, the particles vibrating (Temperature), produce a variation of position, and this position unpredictable, produce an evolution unpredictable.

8. VISCOSITY

When starting a car when the traffic lights turn green, it does so after some time after the car that precedes it moves (this causes a wave that is called Soliton). It also happens when the price of oil changes due to the index variation of the New York Stock Exchange; it does not do it immediately. This time delay is defined as Viscosity "μ". In fact, Viscosity is defined, as said delay time.

If μ = 0, if and only if, ρ = Constant.

The density of a fluid formed by particles depends directly on the compressibility and vice versa; Compressibility is defined as the force applied to 2 particles to bring them closer together.

Be a closed box full of billiard balls; If you try to move the balls, it will be absolutely impossible.

But if there is some kind of compressibility, the balls will tend to move and pass one another.... (Tennis ball, for example).

This Viscosity, seem the "Friction", which in my opinion, is the mother of all properties.

Viscosity = delay time between molecules (event) in a fluid, in order to transmit the sound.

It is a way to classify different fluids.

"C" is the speed of sound, "P" is the pressure, "T" is the temperature, "R" is the gas constant, "NA" is the number of Avogadro, “x” is the average displacement of molecules, and “t” is time: the gas viscosity:

$$\mu_G = \frac{1/C}{number - molecules - in - meter - lineal} =$$

$$= \frac{1}{C\sqrt[3]{\frac{P}{RT}NA}} = \frac{1}{C\sqrt[3]{\rho * NA}}$$

Einstein viscosity value is:

$$\mu_E = \frac{R*T}{NA}\frac{1}{6\pi Dr} / x^2 \propto D*t$$

, with “D” is Diffusivity and “r” radio molecules or particles. So:

$$\mu_G = \sqrt[3]{\frac{\mu_E 6\pi Dr}{PC^3}}$$

From another point of view, we are a particles group and between them, there is a spring with a constant “K”; from Hookes law, we are:

$$F = Kx \rightarrow m\frac{u}{t} = Kx$$

$$K = \frac{M*C^2}{NA*\mu_G}$$

With “C” sound speed, “M” molecular mass particle, “NA” Avogadro number and “μ” viscosity.

In space, the viscosity is easier:

$\mu_s = ligth - time$ And this value, is a local property (one for every relation between two objects).

- ➔ Also, is possible think about the viscosity, as a damper or even, cohesion force.

In gasses, if the temperature is greater, the viscosity is greater and sound speed is less, but in liquids, the viscosity is less. That is because the gasses, are more compressible.

If “vvf” is the factor of volume variation (see pressure chapter), we can define the viscosity by volume variation as:

$$vv = vvf * \left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} \right)$$

This expression is the same than a “bulk or volume viscosity”. In fact even, this expression corresponds to an “inerter” damper:

$$Force = vvf * \frac{d(velocity)}{d(space)}$$

9. TURBULENCE

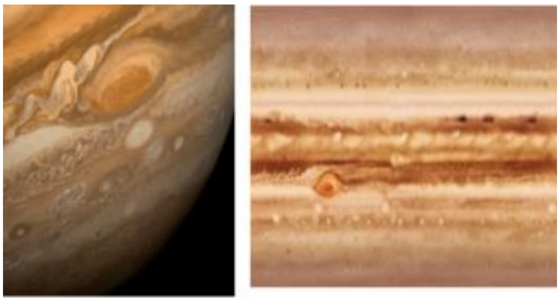
There are 3 explanations, for the turbulence origin:

- Boltzmann perturbation.
- Gap or delay time.
- Depression Path.

The Boltzmann effect, cause a little variation between different layers of fluid. These variations change in time, producing turbulences. The variation may be caused by gravity or random movement of molecules. On a moving surface, the boundary layer produces a fluid brake, because there are different velocities.

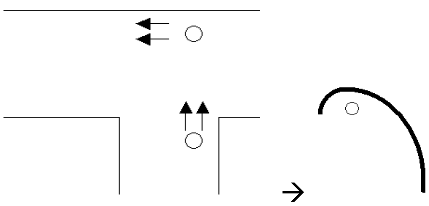
Considering the origin of turbulence in terms of small initial disturbances, one case where we can see and observe the creation of turbulences is the curtains of most rural houses. We all have seen this curtains which are placed on the door to prevent the entry of mosquitoes. If it’s windy, we will see that the curtain starts to ripple. Originally, the curtain doesn’t move, but with a slight alteration, the wave starts:

In fact, this conception of the origin of the turbulence can create Jupiter’s cloud bands and its storms or whirlwinds.

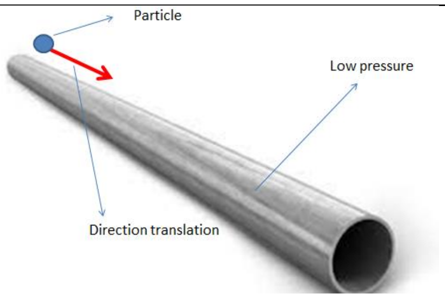


➔ If there are 2 fluids or 2 molecules groups or a fluid over surface, always is possible generate the Turbulence (speeds different).

As a Viscosity before, there are time gap between 2 particles. This gap can produce vortex as geometry: 1 particle want follow other particle with different directions; the geometry path, can be a Vortex or turbulence:



Finally, the why of the origin of the turbulence, it is basically the reason for its permanence. When a particle move, his path is a depression path; all particles behind or around her, rotate around the depression tube, producing vortices:



- ➔ Density water < Density oil.

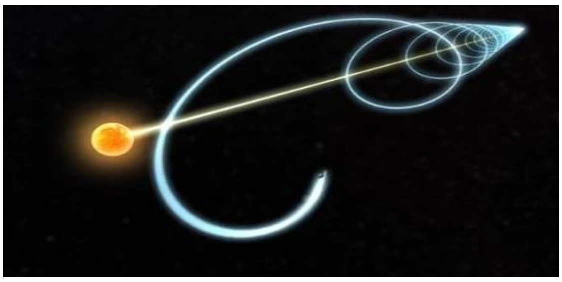
Viscosity oil < Viscosity water
20º C more or less and usual dimensions:
Viscosity kinematic water = 1.007*10^-6
Viscosity dynamic water = 1.007*10^-3
Viscosity kinematic oil = 2.8*10^-5
Viscosity dynamic oil = 0.025
Sound speed in water = 1435
Sound speed in oil = 1700

The Reynolds number, in water, is greater so.

10. VORTEX: CREATION, EVOLUTION AND COMBINATION: PATHS IN THE UNIVERSE

We can think about a vortex, thinking in gravitation theory; that is:

The path or depression tube can be the path created by a planet, and galaxies, origin the vortex. The path-orbit, may be a way with less energy for a planet: as a low pressure….:

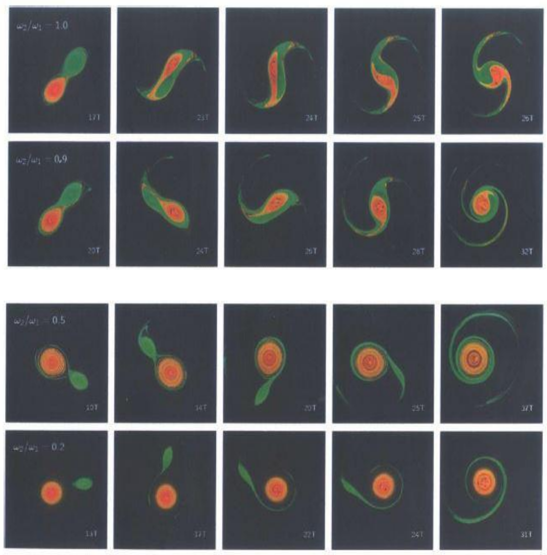


Is very important to know two parameters about any vortex (is very simple that and it is known):

- Vortex center.
- Circulation value.

The interaction between vortexes, is some think very important and complicate:

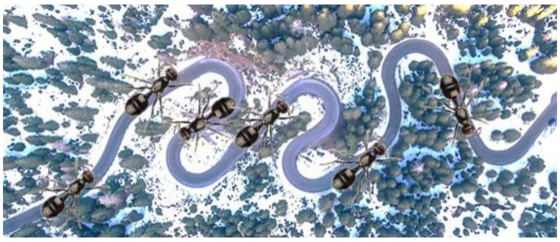
These unions or alteration, depending of intensity (vorticity) of vortex; if there is one vortex, bigger than other vortex (red and green), can produce that: (each horizontal line correspond one context or size):



These geometrics structures seem to be also galaxies or combination of galaxies....

As an ant, she creates a ways:

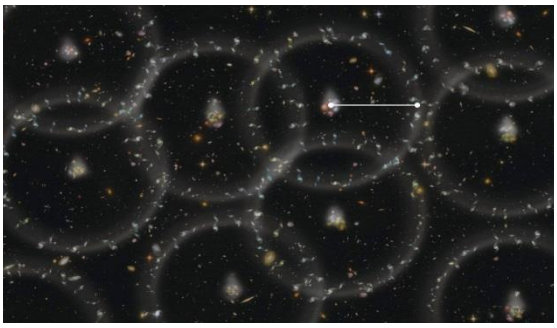
But, is possible to see stranger's ways creates by ants; but these ways are also creates by the environmental:



What is the path to follow every galaxy for example?

The galaxies need:

- Find a variation density zone; that is: Baryon acoustic oscillations.



- Find variation density tubes, created by others galaxies paths.

These 2 thinks, produce density and viscosity variation (so paths).

8. MATTER DISTRIBUTION IN THE UNIVERSE

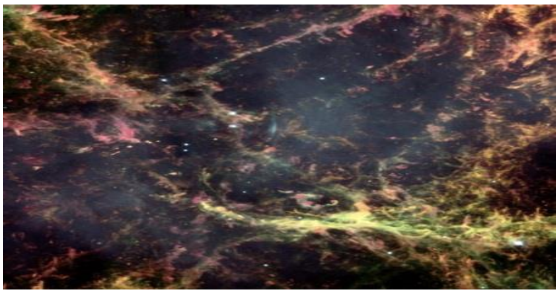
This point, obviously, is related with the last point (paths in the universe).

We can see the accumulation of dust and lint in a house or in a dispersion of tree leaf by the wind or in an accumulation of drop water in a flat plate or in clouds or seeds in garden:

➔ The friction between particles is the responsible of these accumulations.

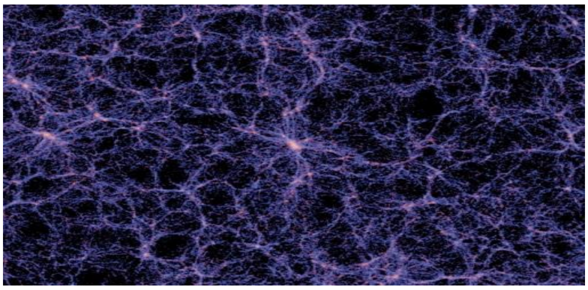
Sample in a fall water (filaments and other structures):

We can see also, the same in nebulas, as a in Crank Nebula:



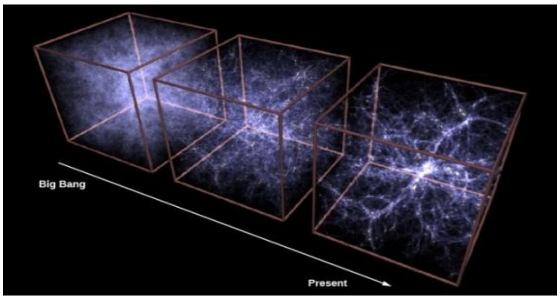
About the galaxies distribution in the Universe, he has a Multifractal structure (Vicent Martínez, Silvestre Paredes and Enn Saar, in 1992). Have may be, the same geometry distribution, a flock bird or the mixture of fluids or clumped of seed in garden? Good question…. I know works about clouds geometries, or rivers net for example, and in these cases, is possible see a multifractal structure.

In the following image we can observe the distribution of galaxies in the universe:

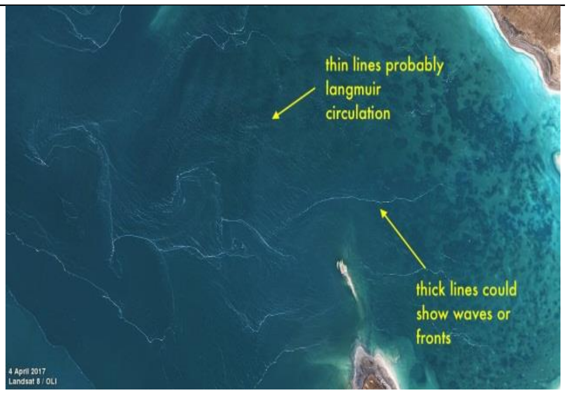


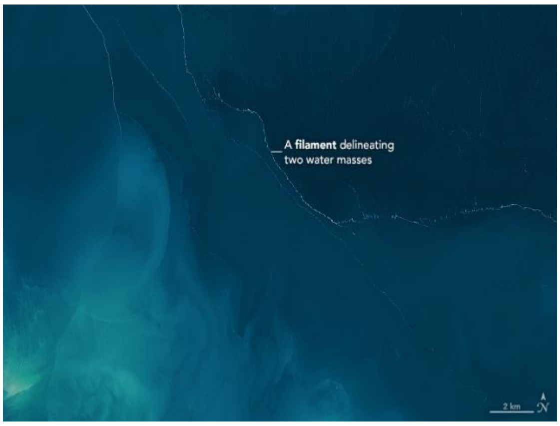
It can see that formation or geometry by the form of filaments, so characteristic.

The viscosity between “objects” in Universe, is the responsible of the particular galaxies distribution in filaments; the distance between them, is the viscosity.



Also, we can show the next images, about interfaces between fluids of different viscosity (sea water):





Conclusion:

➔ The particles with the same or similar viscosity, tend to join: that occur also in persons?....

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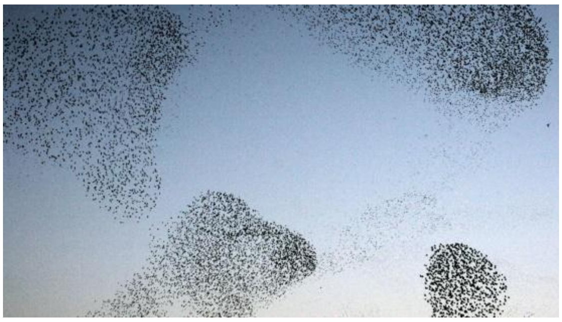
The following experiment is defined as: an enclosure with 2 fluids with different viscosities.

The mixture is moved and allowed to stabilize. We know the figures create (experiment using CFD techniques); a fluid into other fluid, ONLY with different viscosities:

- ➔ The path in galaxies dynamic, work as a depression tube into a matter.

In the case of flock´s birds, the friction force work as a feelings:



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9. *GALAXIES: ORIGIN, EVOLUTION AND COMBINATION*

About the origin, I have some theories:

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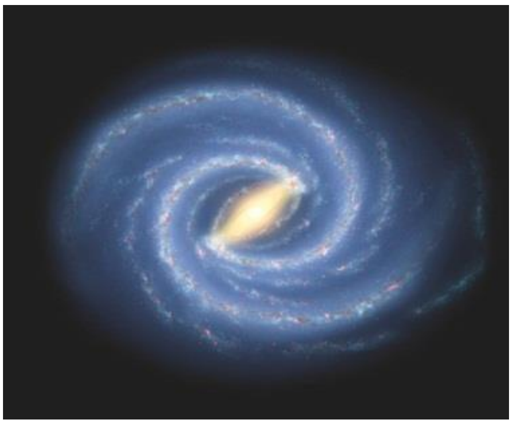
We know that the velocity radial in a galaxy is different if we suppose the rotation with the Kepler laws; the velocity “real” is greater. So the existence of dark matter becomes necessary:



The velocity in a point with “r” distance to galaxy center is (“G” gravitational constant, “m” mass of particle-point):

$$V = \frac{Gm}{r}$$

The variation of velocity “real” with the Kepler hypothesis, is suppose that m/r, change in a special form (if is equal 1 for example, the velocity is the same); so:

$$\partial v\, r^2 = G\left(r\partial m - m\partial r\right)$$

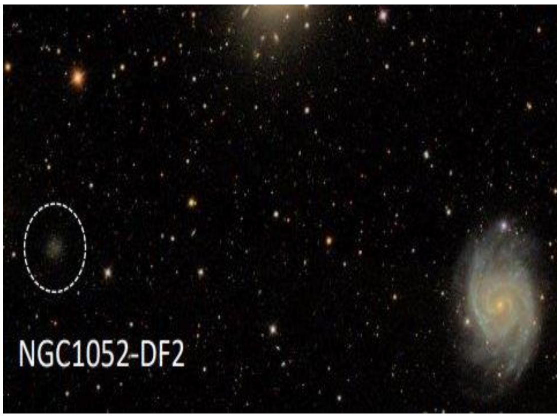
But, the velocity tangential of every point in a galaxy, depend of “r” but also of Viscosity.

That is very important (“γ” kinematic viscosity, “ω” angular velocity), (Burger model):

$$v_t(r) = \left(1 - e^{\frac{-r^2}{4\gamma}}\right)\omega r$$

From this expression, is possible to calculate the Viscosity, against angular velocity and position (“r”). After that, we calculate the profile (against “r”) of viscosity.

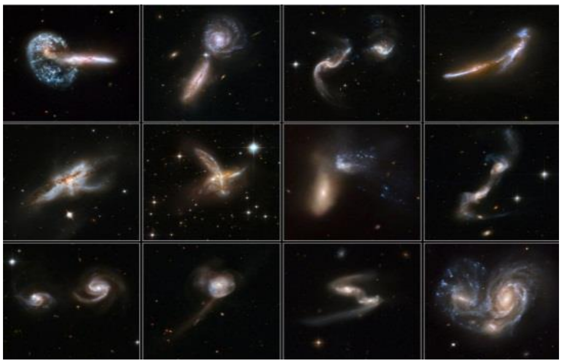
Is possible even, to find galaxies or universe zones, only with dark matter:



About the arms formation, if we see a hurricane from space, is possible appreciate the similarity with a galaxy:

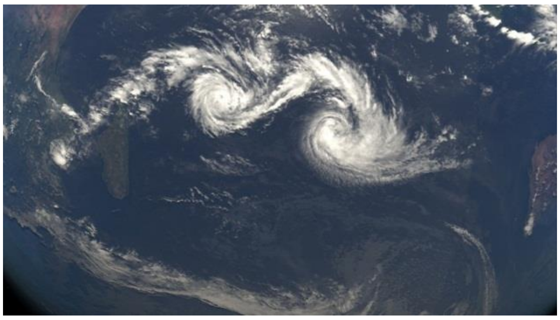
A rotating fluid, produce arms:

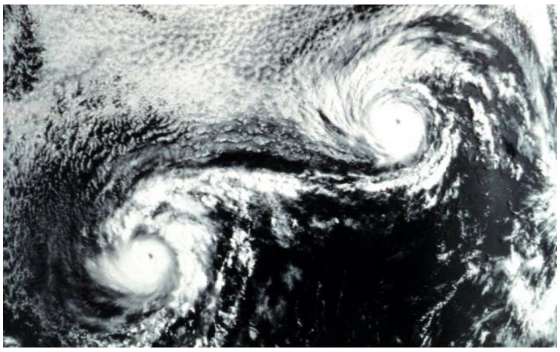
About the combination (colliding) between galaxies, we can see in the sky, a lot samples:



- ➔ When two galaxies collide, collide also the dark matter.

We can see the same between hurricanes:

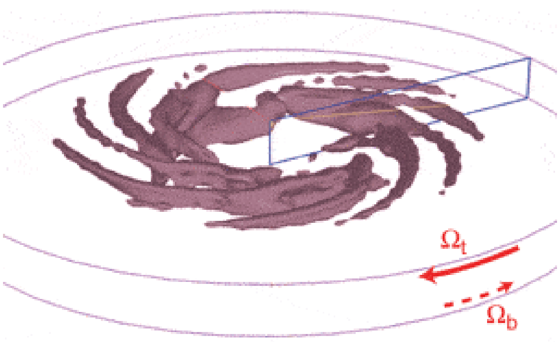




We can think about (evolution and combination), as an interaction between fluids vortex.

10. VALIDATION TESTS

Is possible generate a spiral with arms, trough 2 plates counter-rotating.; this study, is worked by O- Daube and P- Le Quéré:



But my main goal, is simulate something more realistic, and work with the viscosity and velocity basically, and only a cylinder initial with a fluid in rotation.

In order to produce a rotation "sweet" in a this cylinder of fluid, we generate a disc rotating with roughness.

11. *PARTICLES EVOLUTION: MODELIZATION*

From the Brownian movement in which the particles move without restriction, passing through aggregates of limited diffusion (DLA) where there is only one restriction or condition of movement, following the movement of planets, all the dynamics obey rules of movement between the particles that they make up the group, extremely simple and easy: flocks of birds or pedestrians, are clear examples of this fact:

In both latter cases, the study of their dynamics allows the optimal design of evacuation systems for sports stadiums and risk protocols, for example.

Brownian and not Brownian motion (very sensible to random motion limits):

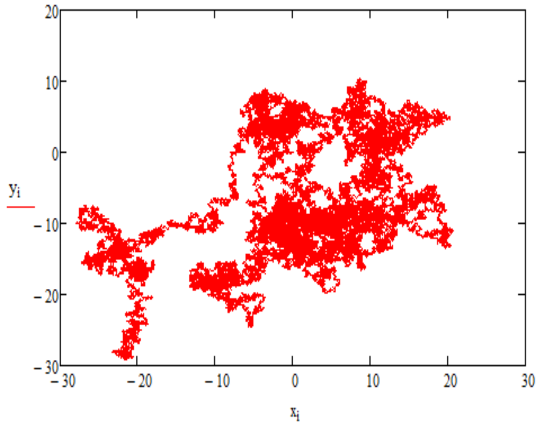
$$x_1 := 0 \quad y_1 := 0 \qquad i := 1..100000$$

$$alea1_i := \mathrm{if}(\mathrm{rnd}(1) < 0.5, -0.1, 0.1)$$

$$alea2_i := \mathrm{if}(\mathrm{rnd}(1) < 0.5, -0.1, 0.1)$$

$$x_{i+1} := x_i + alea1_i$$

$$y_{i+1} := y_i + alea2_i$$



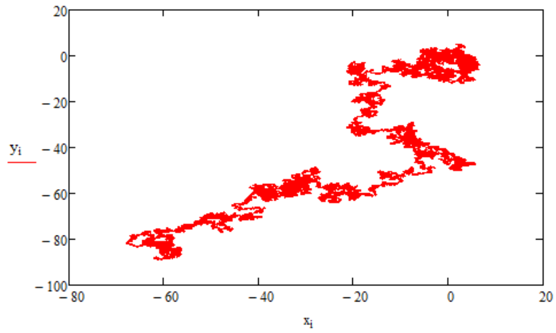
$$x_1 := 0 \quad y_1 := 0 \qquad i := 1..100000$$

$$alea1_i := \mathrm{if}(\mathrm{rnd}(1) < 0.505, -0.1, 0.1)$$

$$alea2_i := \mathrm{if}(\mathrm{rnd}(1) < 0.505, -0.1, 0.1)$$

$$x_{i+1} := x_i + alea1_i$$

$$y_{i+1} := y_i + alea2_i$$



To know the evolution, for example, of the price of oil, it is not enough to analyze trends or simply say that everything that goes down, rises, or evolves in the shape of saw teeth; it is necessary to know the reasons why it varies to model its dynamics.

With a lot laws, principles or variables that this price depends on, the easier it will be to determine the future.

It is necessary to know what has been their evolution a long time ago, in order to know or predict their future.

How difficult it is to predict, specially the future.

The principle of Minimum Action, determines that a particle will move following a trajectory with the minimum Action L = T-V (Kinetic energy minus Potential Energy). The Potential Energy is subtracted, since this Energy is like the Energy that has accumulated during the path.

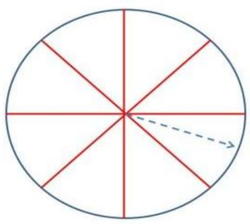
This Potential energy, in the case of a body submerged in a fluid for example, corresponds to the energy stored in the form of pressure energy, which is equal to mass*gravity*depth.

A system of particles tends to disorder, because it is simply the most likely: a book is thrown in the air completely undone in individual sheets: it will reach the floor in the form of a book completely ordered page by page?: it is not probable ....

We need an energy definition. We can define this Energy, as a Pressure:

The path of one particle, is the path with the minimum pressure. Also, the pressure work as a density; one particle will be where there is less density. So is possible create 2 algorithms in order to create the path for any particle.

A1) Give a particle and give "sectors" in a sphere with center the particle:



The particle will move toward the bisectriz of sector, with the least density; this movement, with a delay time (viscosity) (step by step).

Let $P=u^2\rho$; "u" and "ρ" depend of 3 variables (x,y,z). But now, work only in "x" variable.

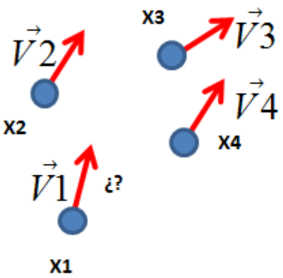
$$\frac{\partial P}{\partial x} = 2u\frac{\partial u}{\partial x}\rho + u^2\frac{\partial \rho}{\partial x}$$

$$\frac{\partial P}{\partial x} = 0 \rightarrow \frac{\partial u}{\partial x}\rho = -\frac{1}{2}\frac{\partial P}{\partial x}$$

$$\frac{\partial P}{\partial u} = -2\rho$$

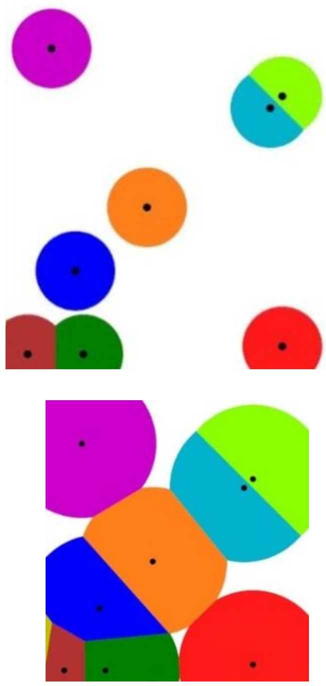
So if velocity is greater, then the density is smaller.

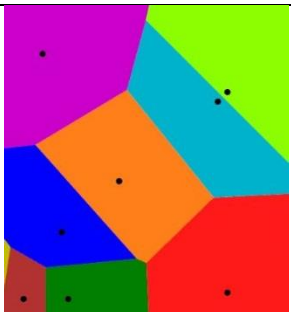
A2) We need to know what is the direction of particle movement "X_1", if we know the direction of particles "X_2", "X_3" and "X_4":



$$\vec{V}1 = \frac{\vec{V}2 + \vec{V}3 + \vec{V}4}{3}$$

- ➔ Voronoi scheme:





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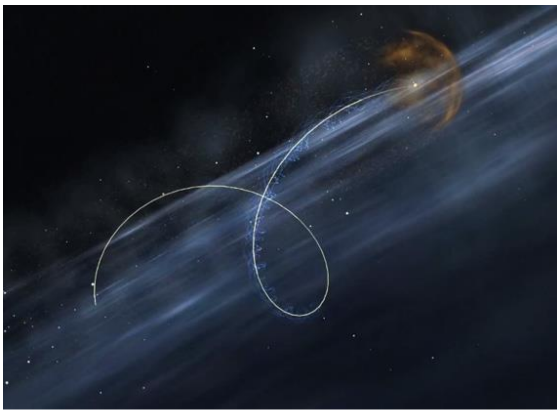
The evolution of a particle in the Universe, experiment some origins and their effects, produce the paths:

A4) Depression tube:



A5) Minimum energy:

*

A6) Magnus effect:

*

A7) Viscosity paths:

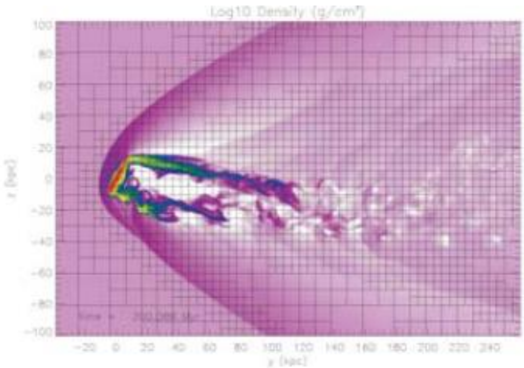
*

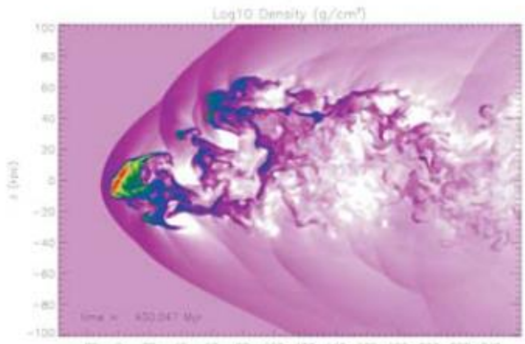
A8) Baryon acoustic oscillations.

A9) Coanda effect:

*

A10) Wakes of ram pressure, stripped disc galaxies (Elke Roediger, Marcus Bruggen and Matthias Hoeft):





All these origins and effects, produce the paths as a fluid flow.

12. BASIC RELATIONSHIPS TO ANALYZE: NAVIER STOKES AND OTHERS EQUATIONS

In cosmology, we know the next equations or relations: Friedmann, variation in time of density and critical density in the universe:

$$\left(\frac{\overset{*}{a}}{a}\right)^2 = \frac{8\pi G}{3}P - \frac{kc^2}{a^2} + \frac{\Lambda c^2}{3}$$

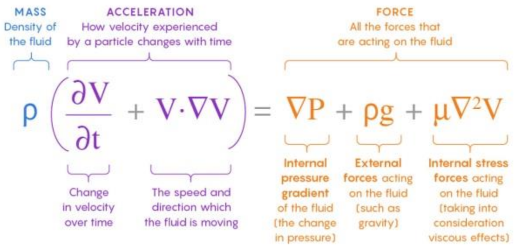
$$\overset{*}{\rho} + 3\frac{\overset{*}{a}}{a}\left(\rho + \frac{P}{c^2}\right)$$

$$\rho_{critical} = \frac{3H^2}{8\pi G} \rightarrow \frac{8\pi G}{3} = \frac{H^2}{\rho_{critical}}$$

From these equations, we can generate to combine between them:

$$\overset{*}{\rho} = \sqrt{9\left(\frac{8\pi G}{3}P - \frac{kc^2}{a^2} + \frac{\Lambda c^2}{3}\right)\left(\rho + \frac{P}{c^2}\right)^2}$$

We need know, what it means:



$$\sum \vec{f} = \overrightarrow{f_{gravity}} + \overrightarrow{f_{pressure}} + \overrightarrow{f_{viscous}} = \rho.\frac{d\vec{u}}{d\vec{t}}$$

$$\overrightarrow{f_{gravity}} = \rho\vec{g}$$

$$\overrightarrow{f_{pressure}} = \frac{\overrightarrow{F_{pressure}}}{dV} = -\nabla\vec{p}$$

$$\overrightarrow{f_{viscous}} = \frac{d\overrightarrow{F_{viscous}}}{dV} = \frac{d\overrightarrow{F_{viscous}}}{Surface.dy} = -\eta.\frac{\partial^2\overrightarrow{u_x}}{\partial y^2}$$

$$\overrightarrow{f_{viscous}} = \eta.\nabla^2\vec{u}$$

$$\rho\vec{g} - \nabla\vec{p} + \eta.\nabla^2\vec{u} = \rho.\left(\vec{u}.\nabla\vec{u} + \frac{\partial\vec{u}}{\partial t}\right)$$

$$\frac{\partial(\rho u)}{\partial t} + \nabla\cdot(\rho u\vec{V}) = -\frac{\partial p}{\partial x} + \rho f_x + (F_x)_{viscous}$$
$$\frac{\partial(\rho v)}{\partial t} + \nabla\cdot(\rho v\vec{V}) = -\frac{\partial p}{\partial y} + \rho f_y + (F_y)_{viscous}$$
$$\frac{\partial(\rho w)}{\partial t} + \nabla\cdot(\rho w\vec{V}) = -\frac{\partial p}{\partial z} + \rho f_z + (F_z)_{viscous}$$

Basically, the forces viscous are:

$$\mu\nabla^2\vec{u} + vvf\nabla\vec{u}$$

λ=vvf

$$\rho\left(\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{dy} + w\frac{\partial u}{\partial z}\right) =$$
$$\rho g_x - \frac{\partial p}{\partial x} + \frac{\partial}{\partial x}\left[2\mu\frac{\partial u}{\partial x} + \lambda\nabla\cdot\mathbf{V}\right] + \frac{\partial}{\partial y}\left[\mu\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right)\right] + \frac{\partial}{\partial z}\left[\mu\left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z}\right)\right]$$

$$\rho\left(\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{dy} + w\frac{\partial v}{\partial z}\right) =$$
$$\rho g_y - \frac{\partial p}{\partial y} + \frac{\partial}{\partial y}\left[2\mu\frac{\partial v}{\partial y} + \lambda\nabla\cdot\mathbf{V}\right] + \frac{\partial}{\partial z}\left[\mu\left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y}\right)\right] + \frac{\partial}{\partial x}\left[\mu\left(\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x}\right)\right]$$

$$\rho\left(\frac{\partial w}{\partial t} + u\frac{\partial w}{\partial x} + v\frac{\partial w}{dy} + w\frac{\partial w}{\partial z}\right) =$$
$$\rho g_z - \frac{\partial p}{\partial z} + \frac{\partial}{\partial z}\left[2\mu\frac{\partial w}{\partial z} + \lambda\nabla\cdot\mathbf{V}\right] + \frac{\partial}{\partial x}\left[\mu\left(\frac{\partial w}{\partial x} + \frac{\partial u}{\partial z}\right)\right] + \frac{\partial}{\partial y}\left[\mu\left(\frac{\partial v}{\partial z} + \frac{\partial w}{\partial y}\right)\right]$$

$$\rho\left(\frac{\partial\mathbf{u}}{\partial t} + \mathbf{u}\cdot\nabla\mathbf{u}\right) = -\nabla p + \nabla\cdot\left(\mu(\nabla\mathbf{u} + (\nabla\mathbf{u})^T) - \frac{2}{3}\mu(\nabla\cdot\mathbf{u})\mathbf{I}\right) + \rho\mathbf{g}$$

INCOMPRESSIBLE UNSTEADY EQUATIONS:

First of all, we need know, how the Navier Stokes equations work. That is: the physics and real, explanation (the nomenclature is the traditional and typical):

a.

Continuity Equation, for incompressible fluid:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

if and only if, ρ=μ=0 ;

$$\frac{u_{x,y} - u_{x-1,y}}{\Delta x} = \frac{v_{x,y} - v_{x-1,y-1}}{\Delta y}$$

- That can be true, only in local space around a particle; but in a big sphere around, the density is small, but not zero.
- Δx and Δy, are the proportional factors. That is: if Δx=Δy, then Δu= -Δv.

Continuity Equation, for compressible fluid:

$$\frac{\partial \rho}{\partial t} + u\frac{\partial \rho}{\partial x} + v\frac{\partial \rho}{\partial y} + w\frac{\partial \rho}{\partial z} + \rho\frac{\partial u}{\partial x} + \rho\frac{\partial v}{\partial y} + \rho\frac{\partial w}{\partial z} = 0$$

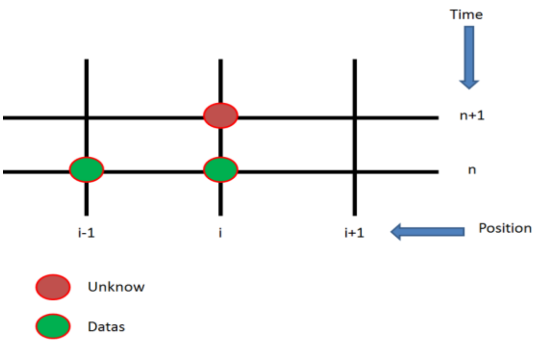
b.

$$\frac{\partial u}{\partial t} + c\frac{\partial u}{\partial x} = 0$$

$$u_i^{n+1} = u_i^n + c\frac{\Delta t}{\Delta x}\left(u_{i-1}^n - u_i^n\right)$$

$$A = u_{i-1}^n - u_i^n$$

$$B = c\frac{\Delta t}{\Delta x}$$

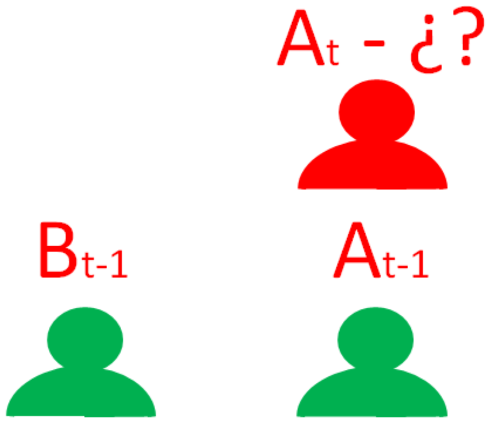


- If we want to know "n" in time "t", we need to know her, in a previous instant: the knowledge is essential….
- If "A=0", "u" is constant in time.
- "B" is a grow rate; this grow rate is lineal.
- If "B>0" or "B<0", "u" increases or decreases.
- "c", must to be a velocity (x/t as a dimension).

In others words:

For example, suppose that an "A" investor wants to know what amount of money to invest in a business right now. "A" needs to know how much he invested the last time and what was the difference with another friendly investor.

→ The "x" horizontal axis can be considered any type of relationship, more direct or distant (increment x):



$$A_t = A_{t-1} + c\frac{\Delta t}{\Delta x}\left(B_{t-1} - A_{t-1}\right)$$

→ About Relation in position "x":

*

c.

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = 0$$

$$u_i^{n+1} = u_i^n + u_i^n\frac{\Delta t}{\Delta x}\left(u_{i-1}^n - u_i^n\right)$$

- The same than before, with "u = c".

$$A_t = A_{t-1} + A_{t-1}\frac{\Delta t}{\Delta x}\left(B_{t-1} - A_{t-1}\right)$$

d.

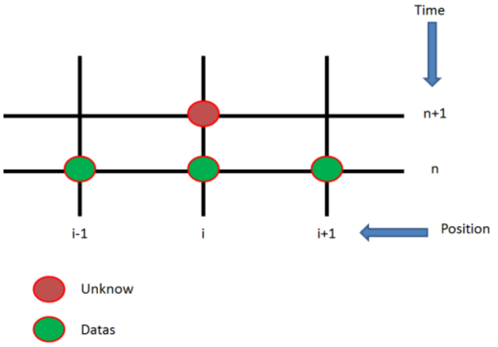
$$\frac{\partial u}{\partial t} = \nu\frac{\partial^2 u}{\partial x^2} \qquad \gamma = \mu/\rho$$

$$u_i^{n+1} = u_i^n + \frac{\nu\Delta t}{\Delta x^2}\left(u_{i+1}^n - 2u_i^n + u_{i-1}^n\right)$$

$$A = u_{i+1}^n - 2u_i^n + u_{i-1}^n$$

$$B = \gamma\frac{\Delta t}{\Delta x^2}$$

$$C = \frac{\partial u^2}{\partial x^2}$$



- Again, the previous knowledge, is important.
- "γ" must to be as a dimension = velocity * distance.
- "A" is an average; 2 samples:

$$1 \rightarrow u^n_{i-1} = 1, u^n_i = 3, u^n_{i+1} = 8 \Rightarrow A = 6$$

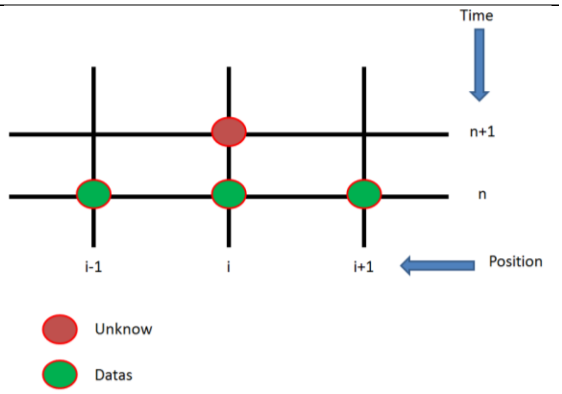
$$2 \rightarrow u^n_{i-1} = 2, u^n_i = 5, u^n_{i+1} = 8 \Rightarrow A = 5$$

- "B" is a grow rate.
- If "μ" is greater, the importance of "C", is greater. If the time of reaction of one particle is greater, the others particles are further each other, so is necessary one velocity greater.
- If "ρ" is greater, is not necessary so, this last velocity greater.
- If "γ" is greater, more influence has "C". "γ" is a damper factor.
- The units of "γ" must to be kilograms / (space * time).

BURGER EQUATION IN 1 DIMENSION:

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \nu\frac{\partial^2 u}{\partial x^2}$$

$$u_i^{n+1} = u_i^n - u_i^n\frac{\Delta t}{\Delta x}(u_i^n - u_{i-1}^n) + \nu\frac{\Delta t}{\Delta x^2}(u_{i+1}^n - 2u_i^n + u_{i-1}^n)$$



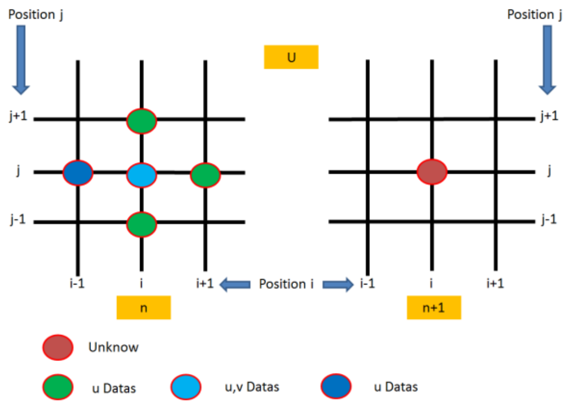
BURGER EQUATION IN 2 DIMENSIONS:

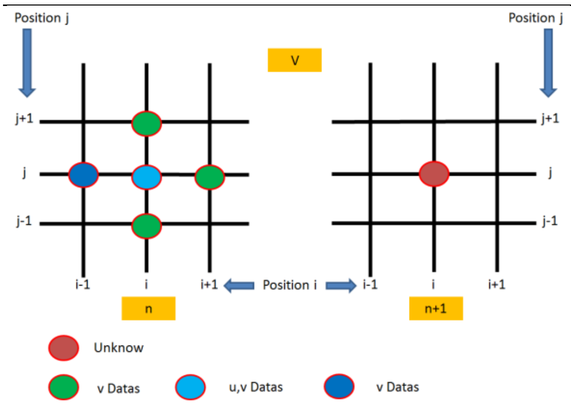
$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} = \nu\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$$

$$\frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} = \nu\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right)$$

$$u_{i,j}^{n+1} = u_{i,j}^n - \frac{\Delta t}{\Delta x}u_{i,j}^n(u_{i,j}^n - u_{i-1,j}^n) - \frac{\Delta t}{\Delta y}v_{i,j}^n(u_{i,j}^n - u_{i,j-1}^n) + \frac{\nu\Delta t}{\Delta x^2}(u_{i+1,j}^n - 2u_{i,j}^n + u_{i-1,j}^n) + \frac{\nu\Delta t}{\Delta y^2}(u_{i,j+1}^n - 2u_{i,j}^n + u_{i,j+1}^n)$$

$$v_{i,j}^{n+1} = v_{i,j}^n - \frac{\Delta t}{\Delta x}u_{i,j}^n(v_{i,j}^n - v_{i-1,j}^n) - \frac{\Delta t}{\Delta y}v_{i,j}^n(v_{i,j}^n - v_{i,j-1}^n) + \frac{\nu\Delta t}{\Delta x^2}(v_{i+1,j}^n - 2v_{i,j}^n + v_{i-1,j}^n) + \frac{\nu\Delta t}{\Delta y^2}(v_{i,j+1}^n - 2v_{i,j}^n + v_{i,j+1}^n)$$





NAVIER STOKESS + POISSON PRESSURE EQUATIONS IN 2 DIMENSIONS:

INCOMPRESIBLE EQUATIONS:

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y}=-\frac{1}{\rho}\frac{\partial p}{\partial x}+\nu\left(\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}\right)$$
$$\frac{\partial v}{\partial t}+u\frac{\partial v}{\partial x}+v\frac{\partial v}{\partial y}=-\frac{1}{\rho}\frac{\partial p}{\partial y}+\nu\left(\frac{\partial^2 v}{\partial x^2}+\frac{\partial^2 v}{\partial y^2}\right)$$
$$\frac{\partial^2 p}{\partial x^2}+\frac{\partial^2 p}{\partial y^2}=-\rho\left(\frac{\partial u}{\partial x}\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}\frac{\partial v}{\partial x}+\frac{\partial v}{\partial y}\frac{\partial v}{\partial y}\right)$$

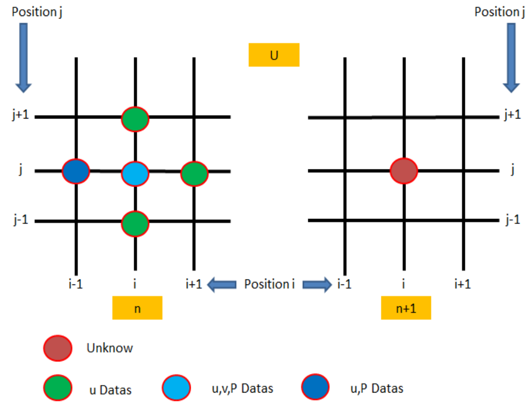
The momentum equation in the u direction:

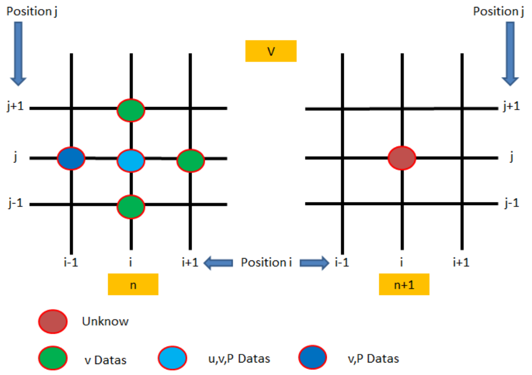
$$u_{i,j}^{n+1}=u_{i,j}^n-u_{i,j}^n\frac{\Delta t}{\Delta x}(u_{i,j}^n-u_{i-1,j}^n)-v_{i,j}^n\frac{\Delta t}{\Delta y}(u_{i,j}^n-u_{i,j-1}^n)$$
$$-\frac{\Delta t}{\rho 2\Delta x}(p_{i+1,j}^n-p_{i-1,j}^n)+\nu\left(\frac{\Delta t}{\Delta x^2}(u_{i+1,j}^n-2u_{i,j}^n+u_{i-1,j}^n)\right.$$
$$\left.+\frac{\Delta t}{\Delta y^2}(u_{i,j+1}^n-2u_{i,j}^n+u_{i,j-1}^n)\right)$$

The momentum equation in the v direction:

$$v_{i,j}^{n+1}=v_{i,j}^n-u_{i,j}^n\frac{\Delta t}{\Delta x}(v_{i,j}^n-v_{i-1,j}^n)-v_{i,j}^n\frac{\Delta t}{\Delta y}(v_{i,j}^n-v_{i,j-1}^n)$$
$$-\frac{\Delta t}{\rho 2\Delta y}(p_{i,j+1}^n-p_{i,j-1}^n)+\nu\left(\frac{\Delta t}{\Delta x^2}(v_{i+1,j}^n-2v_{i,j}^n+v_{i-1,j}^n)\right.$$
$$\left.+\frac{\Delta t}{\Delta y^2}(v_{i,j+1}^n-2v_{i,j}^n+v_{i,j-1}^n)\right)$$

$$p_{i,j}^n=\frac{(p_{i+1,j}^n+p_{i-1,j}^n)\Delta y^2+(p_{i,j+1}^n+p_{i,j-1}^n)\Delta x^2}{2(\Delta x^2+\Delta y^2)}-\frac{\rho\Delta x^2\Delta y^2}{2(\Delta x^2+\Delta y^2)}\times$$
$$\left[\frac{1}{\Delta t}\left(\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}+\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right)-\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}\right.$$
$$\left.-2\frac{u_{i,j+1}-u_{i,j-1}}{2\Delta y}\frac{v_{i+1,j}-v_{i-1,j}}{2\Delta x}-\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right]$$





$$\frac{\partial^2 p}{\partial x^2}+\frac{\partial^2 p}{\partial y^2}=-\rho\left(\frac{\partial u}{\partial x}\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}\frac{\partial v}{\partial x}+\frac{\partial v}{\partial y}\frac{\partial v}{\partial y}\right)$$

$$\frac{p_{i+1,j}^n-2p_{i,j}^n+p_{i-1,j}^n}{\Delta x^2}+\frac{p_{i,j+1}^n-2*p_{i,j}^n+p_{i,j-1}^n}{\Delta y^2}$$
$$=\rho\left(\frac{1}{\Delta t}\left(\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}+\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right)\right.$$
$$-\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}$$
$$-2\frac{u_{i,j+1}-u_{i,j-1}}{2\Delta y}\frac{v_{i+1,j}-v_{i-1,j}}{2\Delta x}$$
$$\left.-\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right)$$

$$p_{i,j}^n=\frac{(p_{i+1,j}^n+p_{i-1,j}^n)\Delta y^2+(p_{i,j+1}^n+p_{i,j-1}^n)\Delta x^2}{2(\Delta x^2+\Delta y^2)}-\frac{\rho\Delta x^2\Delta y^2}{2(\Delta x^2+\Delta y^2)}\times$$
$$\left[\frac{1}{\Delta t}\left(\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}+\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right)-\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}\frac{u_{i+1,j}-u_{i-1,j}}{2\Delta x}\right.$$
$$\left.-2\frac{u_{i,j+1}-u_{i,j-1}}{2\Delta y}\frac{v_{i+1,j}-v_{i-1,j}}{2\Delta x}-\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\frac{v_{i,j+1}-v_{i,j-1}}{2\Delta y}\right]$$

COMPRESSIBLE UNSTEADY EQUATIONS:

The continuity equation in compressible flow is:

$$\frac{\partial\rho}{\partial t}+\nabla\rho\vec{V}=0$$

$$\frac{\partial\rho}{\partial t}+u\frac{\partial\rho}{\partial x}+v\frac{\partial\rho}{\partial y}+\rho\frac{\partial u}{\partial x}+\rho\frac{\partial v}{\partial y}=0$$

If the density variation is the same in all directions:

$$\frac{\partial\rho}{\partial t}+(u+v)\frac{\partial\rho}{\partial x}+\rho\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)=0$$

The units of $(u+v)\frac{\partial\rho}{\partial x}$ are: Pressure/Velocity.

- If $\frac{\partial\rho}{\partial x}$ is greater, (u+v) is more important (that is: the principal direction of a particle. Or in others words, the direction of a particle, is generate from the others particles around her). And vice versa.

$$u+v+w=\sum_{i=1}^{3}V_i$$

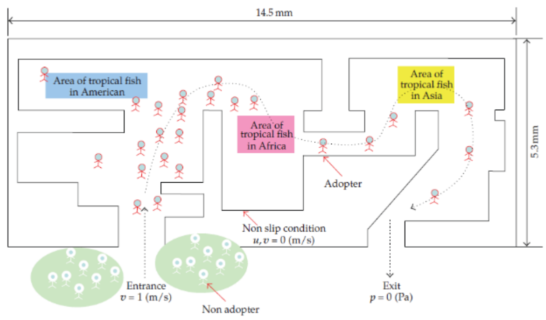
*

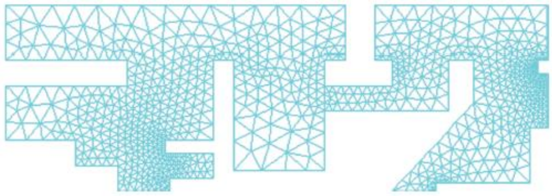
13. EQUATIONS EXTRAPOLATION TO OTHERS FIELDS

13.1

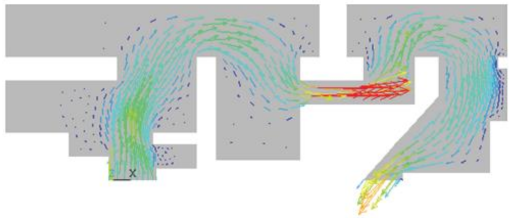
In Research Article, Modelling Adopter Behaviour Based on the Navier Stokes Equation, Kazunori Shinohara and Serban Georgescu, simulate the paths of a crown people in an aquarium.

As a viscosity, work as a attractive force between people:





Mesh of Tokyo Tower Aquarium.



13.2

$$\frac{\partial u}{\partial t}+c\frac{\partial u}{\partial x}=0$$

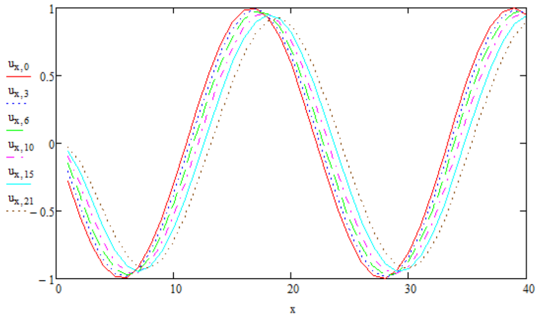
$$u_i^{n+1}=u_i^n+c\frac{\Delta t}{\Delta x}\left(u_{i-1}^n-u_i^n\right)$$

The evolution of a first sinus wave, have a gap in phase and reduce the amplitude:

$x := 1,2..40 \quad t := 0,1..20 \quad cte := 0.1$

$u_{x,0} := \sin(x\cdot 6)$

$u_{x,t+1} := u_{x,t} + cte\cdot\left(u_{x-1,t}-u_{x,t}\right)$



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13.3

$$\frac{\partial u}{\partial t}+u\frac{\partial u}{\partial x}=0$$

$$u_i^{n+1}=u_i^n+u_i^n\frac{\Delta t}{\Delta x}\left(u_{i-1}^n-u_i^n\right)$$

*

13.4

$$\frac{\partial u}{\partial t} = \nu \frac{\partial^2 u}{\partial x^2}$$

$$u_i^{n+1} = u_i^n + \frac{\nu \Delta t}{\Delta x^2}\left(u_{i+1}^n - 2u_i^n + u_{i-1}^n\right)$$

*

13.5

$$\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \nu \frac{\partial^2 u}{\partial x^2}$$

$$u_i^{n+1} = u_i^n - u_i^n \frac{\Delta t}{\Delta x}\left(u_i^n - u_{i-1}^n\right) + \nu \frac{\Delta t}{\Delta x^2}\left(u_{i+1}^n - 2u_i^n + u_{i-1}^n\right)$$

*

*

14. DYNAMIC PARTICLES AND EVENTS: SOME SIMILARITIES WITH FLUIDS EFFECTS

a.

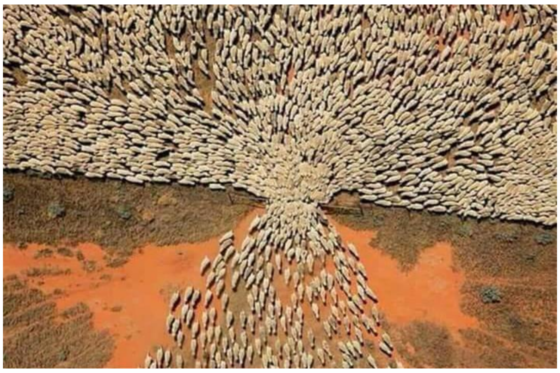
COANDA EFFECT / VISCOSITY / BOUNDARY LAYER:

Street laterals, people manifestation:

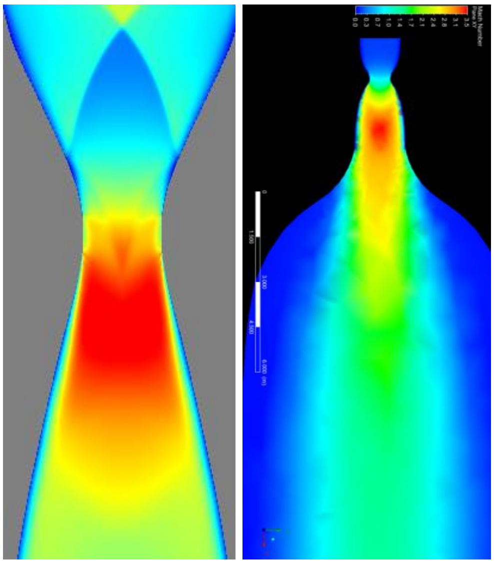
b.

BERNOUILLI EFFECT:

Sheeps:



This geometry is very similar to nozzle exhaust; and not only the geometry, also the density or pressure field:



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c.

ECONOMIC MEASURES / SOFT MEASURES:

Front bulb in ship:

An economic measure is necessary that softens subsequent measures in order to mitigate the effects.

*

d.

DYNAMIC SLOTH:

The universe cools; less energy and more laziness; despite this principle the galaxies are moving away from each other, and increasingly faster ....

Suppose a spiral pipe; at the extreme, the fluid will leave with a tendency to follow a spiral path; but, the fluid, "hardly" will take anything to follow a straight path.

To the dynamics of the fluid, it does not cost him anything to become dissatisfied with a certain dynamic that "forces" him to "something".

An economic measure, will remain in time (its effects), if the means are put periodically, so that it lasts or remains.

If we want to divert a flow of fluid to a very "far" point, we have to place several "corrective" devices or adapters "along the trajectory, to reach our final objective, not just a device (or corrector) initially.

11.5.

CONSIDERATIONS ON THE WORLD CRISES:

In the face of the evolution of an economic crisis, we always ask ourselves: "Even when ?".

We do not know at all, when it will stop downloading, or when it will stop uploading in your case; but one thing is clear: at some point it will stop going down.

There is nothing that goes up or down forever; like a diver, no matter how deep the waters you dive, "always" there will be a time when you touch the bottom or reach your maximum depth.

To say that the economy rises and falls alternately, like a sawtooth, is to admit our ignorance of how it evolves; Besides, if he did not do it, it would be absolutely incredible to go up or down constantly ... Sure we would be surprised.

And another question:

Is there any merit in "leaving" that some stones, thrown into the sea, reach the bottom, is there merit in saying that they will reach the bottom?

Imagine a pool like an ocean; if we open the drain, sooner or later, it will empty ...

The question always arises: "What to do".

All governments "try" to mitigate the effects of the crisis, "doing things" under the options and criteria, more or less successful, that mark or govern their ideologies.

But also, we can all verify, that these actions either have no appreciable effect, or are slightly appreciable in the very long term. If indeed we can see some effect, it is simply because the previous diver was already close to the bottom ....

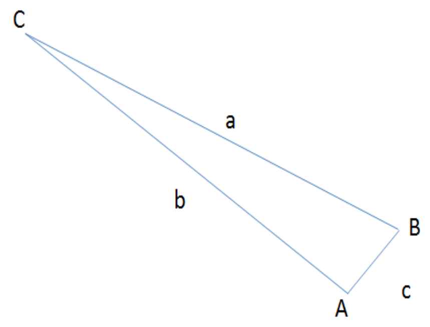
The world economy or global dynamics is the one that always prevails; It's like wanting to empty the sea, from glass to glass.

It is true that before a small action, as it is to cover the drain of the ocean, we make it never empty; but we will know that it is not going to be emptied, in a very long time. It is more: there are actions that do not affect "absolutely" in anything; therefore, we have 3 possibilities:

1. Do something and see its possible consequences in many many years.
2. Do something that does not affect anything (and people see that something is done).
3. Let the global dynamics prevail and flow ...

The best choice? the 3; At least, let's dedicate ourselves to enjoyment and that other rights are not affected.

Sup "A" fixed; then if "C" moves, "B" will move; but the greater "b" and the smaller "c", keeping "a" constant, the movement of "B" will be less.



It is an example to observe that although we have 3 dependent events, certain movements of one of them, may have very little importance on the others. Any government that takes credit for taking a country out of a crisis lies: it simply has been lucky to be at the right time.

11.6.
VISCOSITY: COMMENTS ABOUT:

We can define "being alive" to that substance that is able to have notion or consciousness of the passage of time.

It is possible to perceive time in a different way; In fact, when we are sleeping or when we are older, we do so. Is time the necessary variable for there to be a dynamic? if everything were causal, the existence of time would not be necessary, since "everything" would already be defined and marked until eternity. It is also true that, as we have already seen, in the dynamics of a set of phenomena, only one of them lacks the power to modify fully; it is the randomness that marks this effect or influence.

Randomness is necessary in the universe, for whatever reason, but it is necessary ... In fact, let's think of 2 different phenomena (water flow and galaxy formation): time scales and time are different. It is as if the dynamics of the universe invite us or force us to standardize time and its scale, in order to be able to compare.

15. GEOMETRICS SIMILARITIES

a. PREY AND DEPREDATOR NUMERIC MODEL:

"x" number prey and "y" number predator:

$$\frac{dx}{dt} = ax - bxy$$

$$\frac{dy}{dt} = -cy + dxy$$

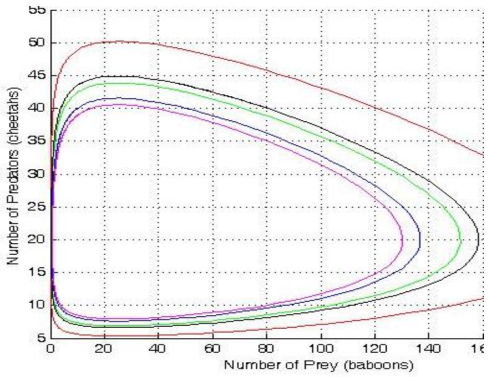
Is a model very simple with "x" and "y" initials, and point fix (a/b, c/d):

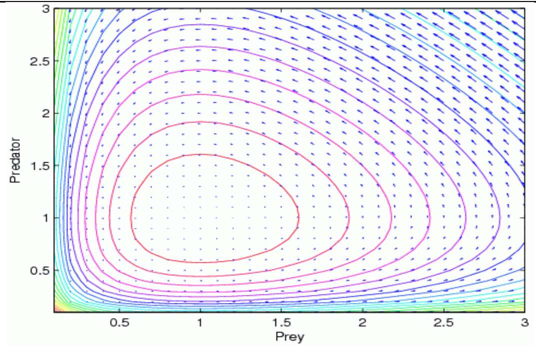
$$\frac{dy}{dx} = -\frac{y}{x}\frac{dx - c}{by - a}$$

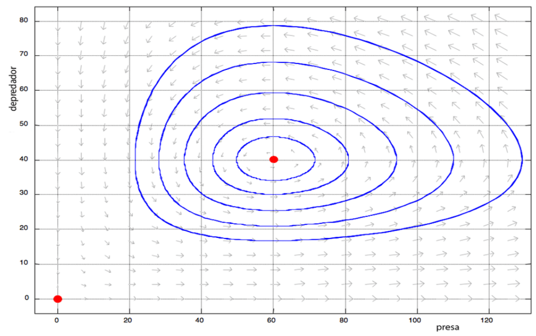
Phase space:

$$V = dx - c * \ln(x) + by - a * \ln(y)$$

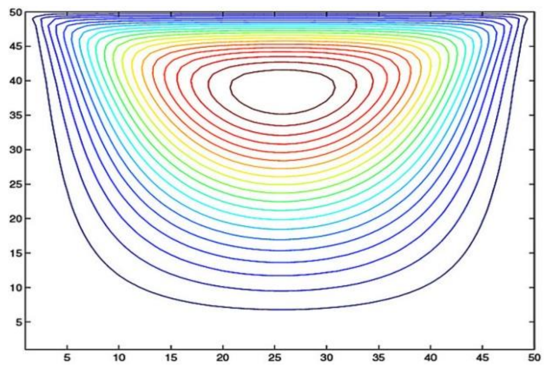
Some images with different "x" and "y" initials, and "a", "b", "c" and "d":

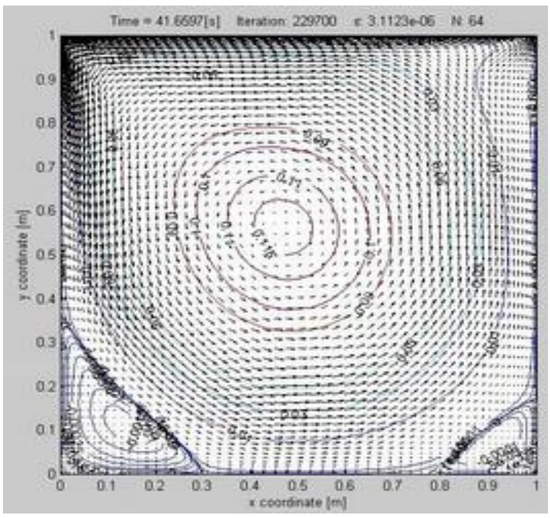






This geometry concept is very similar to:

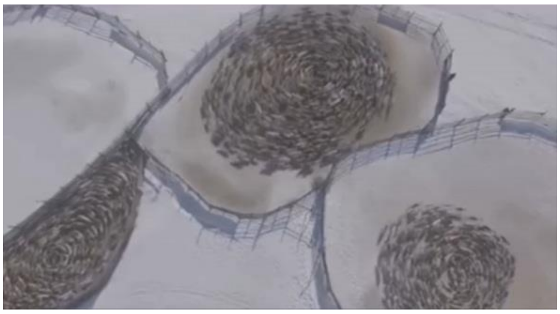




In the 2 last images, they are the representations of pressure lines in a cavity with a fluid in movement.

➔ Geometries very similar, numeric model, must to be also similar….

In these representation of space phases, is possible to change the orientation and scale, of axis. In the next image, we can see the movement of a flock of sheep, in particular, in corner left down:



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➔ Note: * study in progress.