FRANÇOIS ARAGO'S GALACTIC ARC OF CREATIVE MENTATION

A higher hypothesis for the unified field theory

By Pierre Beaudry, 5/24/2019

FOREWORD

"Space is there. It is a challenge within man's grasp. It is a challenge which bears upon the improvement of life on Earth. We must respond to that challenge with goodness.

"What is the desire of the good person? What else but to discover the laws of creation less imperfectly, to the end that our knowledge, as guide to our practice, deviates less from that will of the Creator expressed in the lawful ordering of this universe. Who can be good, who does not yearn for agreement with the Creator, and, on that account, to lessen the imperfection of one's own understanding of the lawful ordering of creation?

"What could be a more beautiful event in the existence of mortal mankind than to step up from the mud of our planet, into space, to accept whatever challenge we discover to be awaiting us there? To think of such a task as imminently before us, is to experience an awesome sense of beauty within us."

Lyndon LaRouche, ***The Science and Technology Needed To Colonize Mars, (part 2)***, 1986, republished in EIR, May 3, 2019.

INTRODUCTION

On April 25, 2019, our French website, *Solidarité & Progrès*, republished an important historical report on the crucial role that François Arago (1786-1853) played in the fight for republican scientific knowledge during the first half of the nineteenth century. The fight was in opposition to the Newtonian form of oligarchical reductionism which had been ravaging the European continent and the United Kingdom.[1] As Lyndon LaRouche demonstrated many times over, such discoveries as those of Arago's could have only been made through fundamental axiomatic changes by individual human minds.

The most significant contribution Arago made to the advancement of scientific knowledge was his polemical opposition to the Newtonian theory of light based on the emission of particles. It was Arago's geometry and epistemology of universal motion which made the second generation of the Ecole Polytechnique students discover how the human mind makes scientific discoveries based on a new and more truthful theory of light.

The discovery of a black hole in the Messier 87 Galaxy on April 10, 2019, is a very good example of Arago's method of thinking. The black hole of M 87 was discovered by a worldwide collaboration of eight scientific teams and their radio telescopes located as far apart as the United States, Antarctica, Chile, and Spain, etc. The discovery represents a gargantuan event, not only because a black hole is a very big galactic phenomenon, but primarily because its discovery is a gigantic breakthrough in human thinking.

A black hole is not an entropic phenomenon where everything is sucked into oblivion as in a galactic vacuum cleaner; it is the opening of a new dimensionality which demonstrates how the limits of the human mind must be surpassed by leaping beyond our present state of knowledge into the unknown.

This M 87 discovery is the first planetary-wide attempt at capturing a galactic object with a planetary purpose as a whole, because such a discovery could not have been made by one country alone. It is from that vantage point that

[1] Solidarité & Progrès, ***François Arago: organisateur du génie scientifique républicain***, *by L. R., June 14, 2018.*

the discovery represents the opening of a new and higher dimensionality of thinking involving all of the peoples of the world for the purpose of bringing the whole of mankind to the boundary conditions where the human mind is ready to leap to a higher level of creative thinking, a galactic way of thinking.

This galactic way of thinking is a LaRouchian idea of thinking from the top down. Vladimir Vernadsky used a similar conception in his discussions on the triply-connected view of the three phase-spaces of the Physical universe: the non-living (Geosphere), the living (Biosphere), and cognitive (Noosphere). Those three spherical characteristics reflect the LaRouche anti-entropic ordering principle of the universe as a whole.

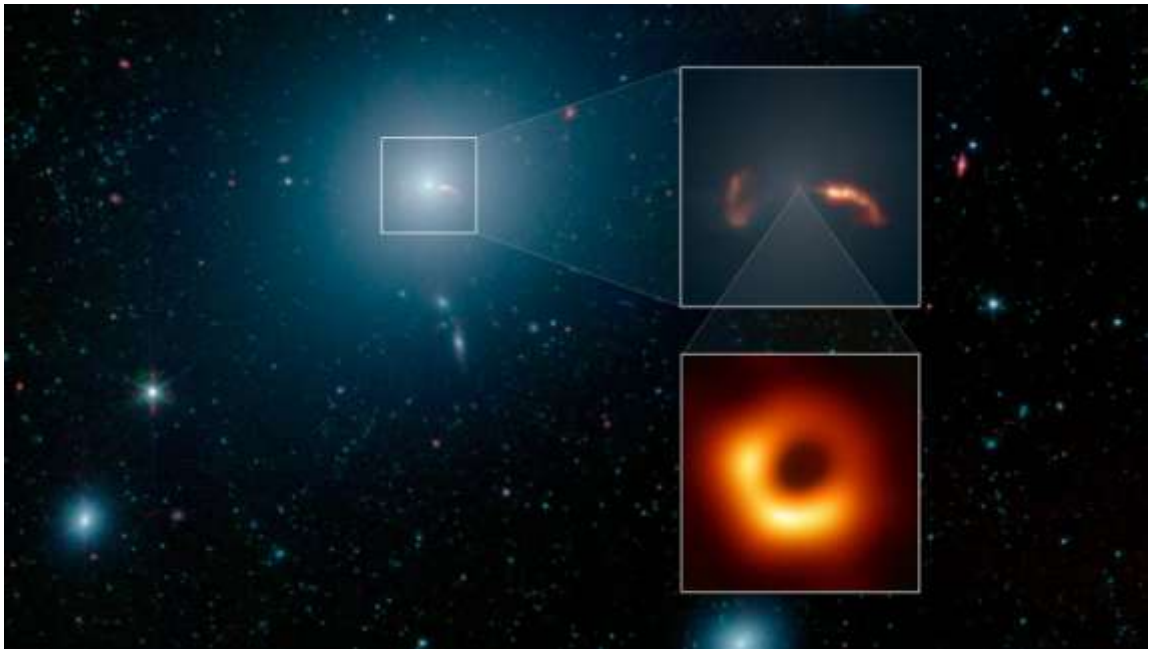
This articulation is also related, epistemologically, to the Christian view of the *Filioque* as represented in the Charlemagne doctrine of the Holy Trinity, which was first established in the Nicene Creed of 325 AD. Geometrically, the idea may be expressed more simply in the three fundamental forms of circular least action relating to the spiral action of the Galaxy, the spiral action of our Solar system, and the rotation of the Earth on itself within the Keplerian spherical of the universe. The Peace of Westphalia principle of the benefit of the other is also an echo of the same triply-connected dynamic of conflict solving. In Platonic terms, thinking galactically relates to the LaRouche required higher form of understanding of hypothesizing the higher hypothesis: Galactic thinking is, in essence, *agapic* thinking.

However, such a higher form of thinking requires the mental framework of a world citizen, a mind-frame capable of internalizing at the same time past, present, and future needs and aspirations of all human beings on this planet. And that effort requires an understanding which must be based on an arc of rotation which is always universal in character and expressed in the simultaneity of eternity. How can one be a citizen of one's own nation and a world citizen at the same time?

As Helga Zepp-LaRouche noted regarding the black hole in her presentation to the Schiller Institute New Paradigm Webcast of April 28, 2019: "You could not have done that with only one country working on it, but we needed practically the span of the planet Earth to do it, which shows that if we want to get more deeply

into the secrets of the universe, then that is an absolute requirement to work together internationally in this way."[2]

My objective, here, is not to discuss the discovery or the nature of the black hole itself, but the nature of the geometrical and epistemological principle underlying its discovery, as exemplified by the principle of discovery made by François Arago on the subject of light. Lyn's method of axiom busting has always been to teach others how to see through space with the eyes of Monge. Take a look at the following image of Messier 87, for example, as if it were a classical artistic composition and see if you can discover the Arago singularity which allows you to identify the epistemological principle hidden behind the discovery of this black hole.



This wide-field image of the galaxy M87 was taken by NASA's Spitzer Space Telescope. The top inset shows a close-up of two shockwaves, created by a jet emanating from the galaxy's supermassive black hole. The Event Horizon Telescope recently took a close-up image of the silhouette of that black hole, shown in the second inset. NASA/JPL-Caltech/Event Horizon Telescope Collaboration. **https://www.digitaltrends.com/cool-tech/messier-87-black-hole-galaxy/**

[2] MORNING BRIEFING, Monday, April 29, 2019.

What is important to know about this picture is that the three inset images reflect the singularity of an axiomatic transformation representing the actual limit of the present state of human knowledge; it is also a projection of man's yearning for what lies beyond. The capturing of such a limit in the way that it was done represents the stepping stone to the next period of space exploration of mankind which is within our reach and has already begun with the Chang'e 4 landing on the Moon.

My purpose, therefore, is to look at this giant transformative singularity from the standpoint of epistemology, as if it had been projected from the entrapped setting of Plato's Cave, and compare it with the epistemological discovery of François Arago from the standpoint of the LaRouche method of discovery.

Before you start examining the changes from one inset image to the other, you should know that all three small images are fabrications and the third and final close-up, the image representing an orange circular ring, required the collaboration of eight different telescopes located in eight different yet coordinated positions around the Earth. The point here is not to look at these celestial objects, *per se*, but to look at the changes between them and investigate how they relate to a universal human mind discovering them.

A lot of lawful deformations went into the construction of these images. For example, the first image shows the distant galaxy in infrared and the second image is a close-up of the first image. However, the circular torus that you see in the third image is a complete transformation of the previous one; it is a radio wavelength representation of shockwaves. All three images represent transformations of something invisible which is deceiving your sense perception, but not your mind. Lyn might have called this an experiment in "sense deception." Actually, the last image is a projection of the supergiant elliptical galaxy of Messier 87 whose radio-shockwave material surrounds an elliptical black hole. The short NASA report of the event stated this idea quite beautifully as follows:

> "It is actually the shockwave that Spitzer detected, more than the jets themselves. The shockwaves are two different shapes because of their positions relative to Earth. The shockwave on the right looks larger and

> brighter because it is heading almost straight towards us, and it is even brighter because it is traveling at nearly light speed. The second shockwave on the left is smaller and dimmer because it is moving away from us."[3]

The beauty of this Platonic Cave shock wave deception is a lawful reconstruction of something that the human eye cannot see because the wavelengths used to capture the different images are between 3.6 and 8.0 microns; and nothing is visible to the human eye at that level. But, this doesn't make it fake news, because it reflects something lawful that is also happening in your own mind and in your own society.

The good news about this LaRouche discovery process is that in spite of the sense deception, you can follow the change with you mind. And, that's the important thing to discover about the Monge brigade approach of the Ecole Polytechnique. Change is illustrated by the *coincidence of the opposites* between the large and the small, between the micro-wavelength level of a microscopic individual observation and the macro-galactic level of a telescopic planetary observation. It is the singularity of this *coincidence of opposites* which I am now going to examine with Arago's extraordinarily singular experiment of electromagnetic rotation and his experiment on the polarization of light.

[3]Georgina Torbet, ***Supermassive black hole resides inside a supermassive galaxy*.**

ARAGO'S ROTARY MAGNETISM

Dominique Francois Jean Arago (1786-1853)

François Arago represents the continuation of the Monge brigade tradition at the Ecole Polytechnique, especially its legacy in epistemology and in constructive geometry. The fight that Arago waged in that arena was explicitly against the Newtonian misconception of science in general and against the reductionist conception of the nature of light as a particle more specifically. This conflict is reflected in what Lyn had identified as the paradox of the "wavicle." The main outline of the disputed matter can be found in the recent reprint of our French newspaper, Nouvelle Solidarité, under the title: ***Francois Arago: organisateur du genie scientifique republicain.*** (June 14, 2018)

An important part of Arago's contribution was to bring together the republican thinkers of Europe together around the little known but fundamental institution of the Société d'Arcueil (1802-1822), which included: Claude Louis Berthollet, Jean-Baptiste Biot, Jean-Antoine Chaptal, Pierre-Simon de Laplace, Alexander von Humboldt, Louis-Joseph Gay-Lussac, Etienne Louis Malus, etc, and later the younger generation of Augustin Fresnel, Andre-Marie Ampere, and Louis Pasteur. Part of that group was the crème de la crème of the humanist republican faction in France after the revolution of Monge and Carnot.

As Tony Chaitkin reported earlier, Arago was also a close friend of Benjamin Franklin's grandson, Alexander Dallas Bache.[4] The influence of Arago on American science remains to be researched. He is likely to have had some influence on the United States because as the Minister of the Colonies in 1848, Arago was the French leader who officially banned slavery in the French colonies. Arago was also Minister of the Navy, Minister of War, and the first President of France during the short but crucial Provisional Government of 1848. Monge, Carnot, Arago, and Pasteur are the four French Republicans who best represented the humanist fight for progress in France by attempting to unify art, science, economics, and politics.

An example of the moral character of this man, Arago forced Louis Napoleon to accept his rejection of the oath of allegiance to the empire. After Arago sent Napoleon his resignation in protest, Louis "Le Micron" was forced to amend his rule by declaring that he had to make "an exception in favour of a scientist whose works had brought luster on France, and whose existence the government would regret to embitter."

The question of electromagnetism and the wave/particle paradox that Arago initiated remains the most significant epistemological problem that has yet to be resolved in science and artistic composition to this day. A few of Arago's discoveries shed light on the much needed epistemology of physics and, even more so, on the need to bring unity between science and artistic composition, most notably music.

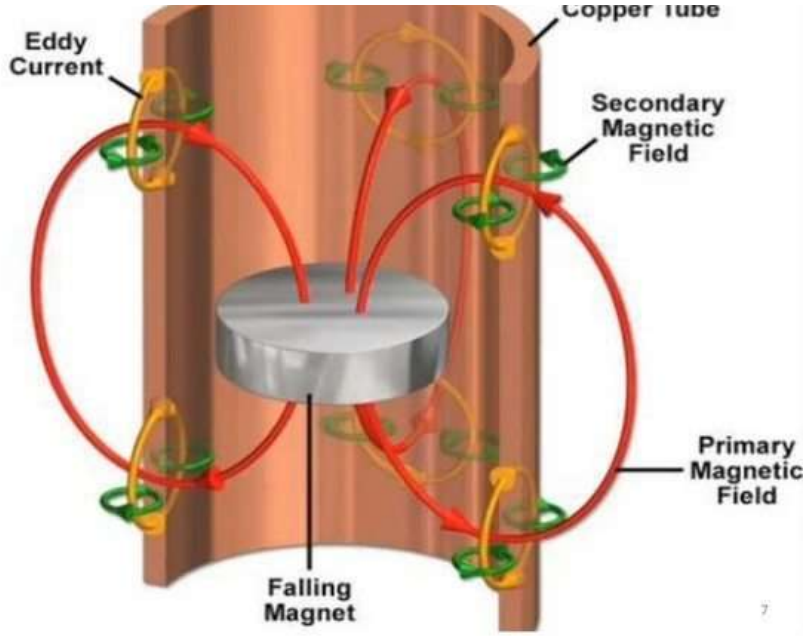
[4] Anton Chaitkin, ***The French alliance revived***, EIR, August 14, 1987, p. 69.

In 1824, Arago was the first scientist to observe the phenomenon that later became known as Foucault currents, which Arago called "rotary magnetism." During the same period, Arago also discovered that all conductive metals, such as copper, silver, aluminum, or zinc, could be magnetized. Thirty one years later, in 1855, French physicist, Léon Foucault, discovered that the force required to rotate the Arago copper disk was greater when the experiment was conducted between the two poles of a horseshoe magnet.[5]

In Arago's disk experiment, if you stand a magnetic needle on a pivot or suspend it from a string and place it a short distance from a copper disk that you rotate in the same plane, the magnetic needle will also rotate in the same direction and at the same velocity through the invisible currents generated between the two.

Arago's disc experiment

[5] See report on ***Eddy Current***.



Foucault currents https://www.quora.com/What-are-eddy-currents

In Foucault's current experiment, a falling magnet goes through a copper tube conductor and creates electrical currents (Foucault currents), thus causing electrical resistance inside of the copper tube which has the effect of slowing down the falling magnet. The more powerful the magnet is, the slower the descent inside of the tube. The point to be made here is that one does not need to go into a difficult and complicated physical space-time experiment to discover that triply-connected circular action is a fundamental principle of the universe. The challenge is to discover how Arago discovered *what is not there* in both of those experiments.

The above diagram of the Foucault currents shows the red lines representing the primary magnetic field, the yellow lines representing Foucault currents generated at right angle to the primary magnetic field, and the green lines representing a second magnetic field generated by the interaction of the first two currents. Since the green magnetic fields are moving at right angles and in opposition to both the primary magnetic field and to the Foucault currents, the triply-connected electromagnetic relationship represents a *unity of opposites* within

the copper tube. Such electromagnetic action can be used for producing levitation, causing movement, or give a breaking effect.

It was due to this sort of simple observation and commitment to avoid the fallacies of the dimly lit wall of Plato's Cave that Arago became known as the most devastating opponent of the Newtonian theory of light particles. The following polemical display of Arago's method makes the point:

> "The effects that a cannon-ball can produce depend so directly on mass and speed, that one can, without altering them, change one of these elements at will, provided one varies the other proportionately and in the opposite direction. Thus a two-kilogram ball brings a wall down; a ball of one kilogram will have the same effect, provided you double its velocity. If the weight of the ball were reduced to the 10th, or to the 100th of its original weight, the same effect would require a velocity to be 10 times, and 100 times greater. Now we know that the speed of a ball is six hundred and forty thousandth of that of light; if the weight of a luminous molecule were six hundred and forty thousandth part of that of the cannonball, like this ball it would have to break all walls down."[6]

This method of triply-connected-electromagnetic-interaction had a devastating effect on Newton's French followers, but instead of changing their shattered conceptions, they found it more expedient to exclude Arago and to ignore the heuristic value of his experiments. Arago failed to convince his opponents and was blamed for his lack of an appropriate mathematical description. This was done to prove that whenever you wish to exclude a valuable scientist from being acknowledged, you can always blame his shortcomings in mathematics.

The above illustration shows that the slow motion of the descending magnet is caused by triply-connected electromagnetic currents acting as what appears to be the interactions of a unified field of multiple rotations among the magnetic field, the electrical field, and the gravitational field. If the reader takes the time to reflect

[6] Francois Arago, ***Fresne***l, *Œuvres complètes de Francois Arago*, secrétaire perpétuel de l'académie des sciences, 1854, P. 150.

on what such a causal process might mean for the development of the human mind, he might discover that the slow motion descent of the magnet is caused by the fact that the magnetic flux-density is changing under the effect of a right angle relationship of the triply-connected rotations; the same triply-connected motions which are required for galactic thinking. The genius of Arago was to have discovered a way to apply the same galactic principle to the polarization of light.

FOUCAULT'S PENDULUM AND GYROSCOPE

Today, no one doubts that our planet Earth goes through three motions inside of our galaxy; the first is the galactic rotation of the solar system, the second is the yearly orbiting of the Earth around the Sun, and the third is the rotation which cradles the nights and days of our lives. However, this simple fact is too often taken for granted and cannot be regarded as a mere impression.

For over twenty five hundred years, scientists and philosophers have attempted to prove the rotation of the Earth by astronomical observations but were not able to find a direct method of showing the truth of the matter simply because they had left out of the equation the role of the self-reflective process of the human mind. In 1851, Léon Foucault, proved the rotation of the Earth by using a 67 meter long pendulum inside of the Pantheon of Paris.

On March 26, 1851, Foucault demonstrated that the motion of the Earth could be made visible by the use of the most ingenuous and contradictory of methods; he showed that the motion of the Earth could be seen by means of a pendulum moving in a straight line. Unfortunately, most reproductions of the experiment online are deceptive, because they show a curving motion of the pendulum. That impression is a fallacy of composition. The pendulum oscillates in a straight zig and zag lines in flat planes and the room and the Earth turns around them.

Once the observer is made aware of this shadow on the wall of Plato's Cave, the demonstration becomes more than amazing because of the nature of the paradox which underlies its discovery. How can circular action be demonstrated through straight line motion? Anyone who has investigated the nature of spherical action and polygonal formation knows that the polygon comes from spherical action and not the other way around. However, the key idea to understand here is that the two domains of linearity and circularity are axiomatically incommensurable as LaRouche has been emphasizing with Nicholas of Cusa's demonstration of the impossibility of the quadrature of the circle. This is where the crux of the matter lies. It is circular action which produces straight lines, but, how can such a discontinuity be made intelligible?

Scientists from around the world were so baffled by this amazingly paradoxical discovery that within only a few weeks of its original display in the Pantheon of Paris, the same experiment was replicated in a hundred different places around the world. It was replicated in 25 different cities in the United States during the summer of 1851 alone. But, what about the epistemological nature of the problem? What is the significance of this paradox?

Foucault's pendulum at the Pantheon of Paris. The image shows the 24 hour rotation of the Earth around the plane of the pendulum. **https://www.youtube.com/watch?v=zO0dg4a_70o**

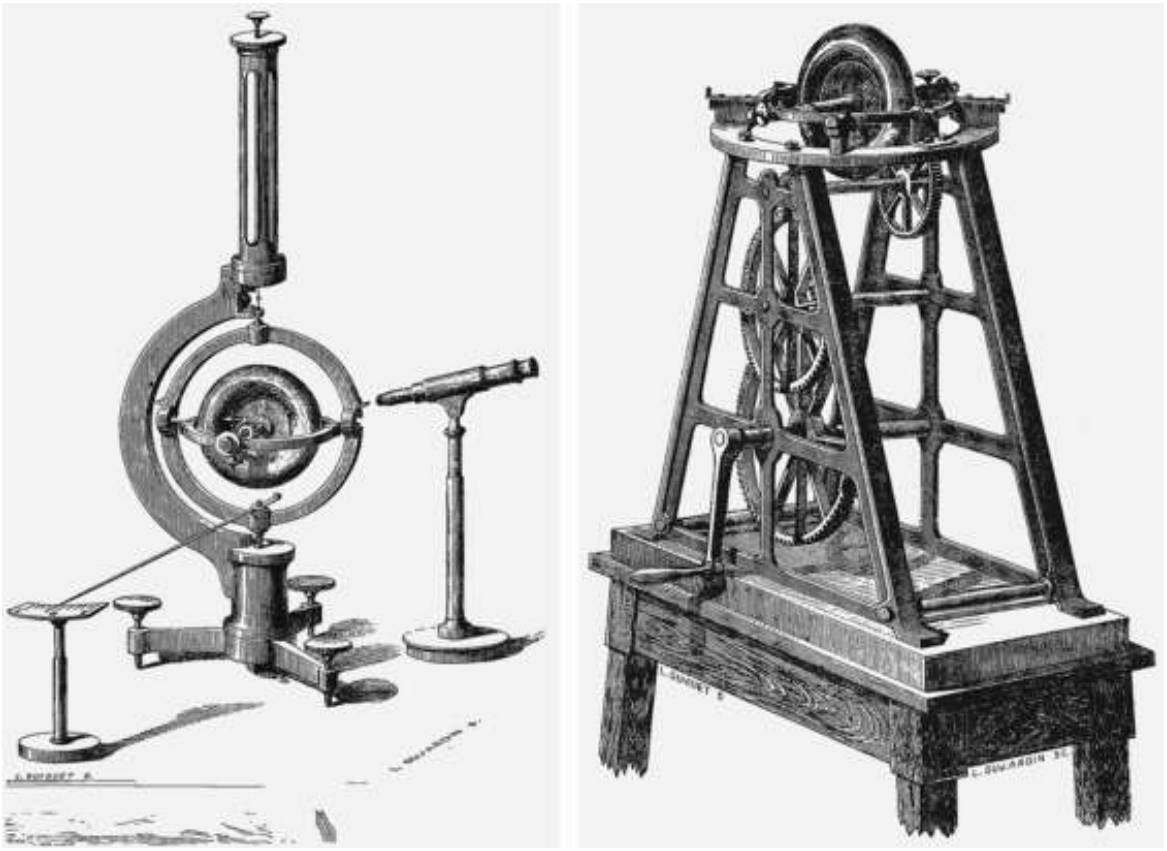
Léon Foucault's experiment defied the imagination by using a simple pendulum device which not only showed the rotation of the Earth, but also demonstrated how the human mind related to change in the universe by going through two opposite movements: one is the great motion of rotation of the Earth on itself and the other is the much smaller straight line motion of oscillation of a pendulum moving in a constantly fixed plane. This is an amazing experiment because it shows how the mind makes new discoveries by resolving the paradox of the *coincidence of opposites*.

The elementary principle underlying the experiment is that when you let a pendulum swing under its own weight, the oscillations always remain in the same plane while the Earth rotates around it, as a circle rotating around a diameter.

Although the visual observation may give the impression that the pendulum is travelling through an elliptically curved pathway around a circle, it is, in fact the Earth which rotates around the pendulum.

The Foucault demonstration implies, therefore, that an inversion must take place in the mind of the observer, when he discovers that it is the Earth which rotates around the pendulum, and not the plane of the oscillation of the pendulum which is rotating around the room. In reality, the trajectory of the pendulum always remains in the same plane of oscillation.

A second anomaly had to be resolved in the demonstration of the Foucault pendulum. The time of the rotation of the Earth around the oscillation plane of the pendulum varied depending on the latitude of the experiment. Only at the North or South poles was the period of rotation effectively of 23 hours and 56 minutes. The further away from the poles the experiment was located, the longer the period was extended. For example, it was discovered that in French Guyana, near the equator, the effect of the pendulum oscillation had a much lower frequency than in Paris. Moreover, the period of the Paris experiment was 31.8 hours. What is the significance of this anomaly? Foucault found the answer by inventing a special device which required moving along three different axes of rotation at the same time. He called it the gyroscope, from the Greek terms *gûros*, (circle) and *skopéō*, (to look).



Foucault's gyroscope (left), and its launching device (right). Taken from the *Astronomie populaire* by Camille Flammarion. https://www.sciencedirect.com/science/article/pii/S1631070517301019

The underlying conception behind Foucault's gyroscope is that it is based on a three axis support system called a triple gimbal; that is, a triply-connected spherical action. The principle of the gimbal allows for three rotations mounted on each other around a central axis (like the rotation of a planet rotating on its axis within a galactic setting) and allowing for a center ring or torus to be fixed vertically onto the inner horizontal axis of the innermost gimbal; thus, the torus remained independent of the rotation of the two other gimbals.

This is the principle of suspension of compasses on ships preventing them from tilting and keeping them always upright with respect to the horizon regardless of the rolling and pitching of the waves. This is also how the mind works by triply-

connected galactic principles of least action, in spite of the gyrations of public opinion.

The idea is that when the three gimbals are mounted together, each one offers a new degree of freedom similar to a new discovery of principle adding a new degree of freedom to the human mind.

Triply-connected gimbals. Wikipedia

A report on the experiment that Foucault and his technical advisor, Gustave Froment, made in 1852 with his gyroscope invention, indicated that "Using a hand crank and four stages of gearing (as shown in the figure above), the torus of Foucault's gyroscope was launched with an amazing initial speed of up to 200 rotations/second, allowing the rotation to persist for 10 minutes. This was sufficient to observe the deviation due to Earth rotation, using a microscope." [7]

The experiment demonstrated that Foucault had been correct in assessing that the change in frequency changes could be calculated in accordance with the sine of the latitude. It was further noted that the rotation of the Earth was also affected by both the precession and nutation. Most importantly, Foucault had proven that he had the right epistemological approach to connect the gimbal of science to those of artistic composition and of politics.

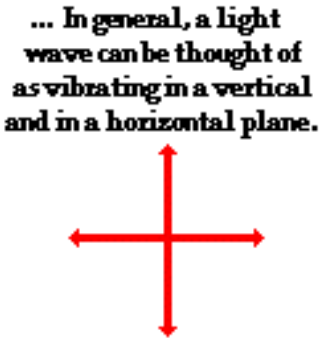
[7] Joël Sommeria, ***Foucault and the rotation of the Earth,***

A PEDAGOGICAL EXPERIMENT IN THE POLARIZATION OF LIGHT

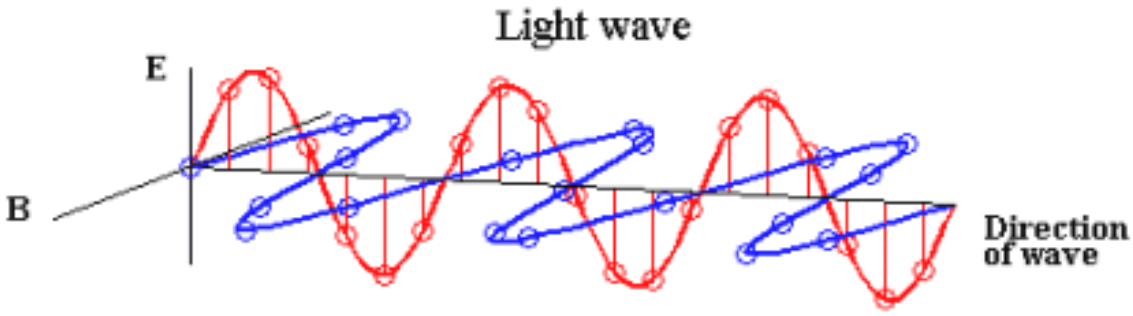
"Science has nothing to do with mathematics; science is the understanding of how the human mind can cause change in the universe."

Dehors Debonneheure

[*The following pedagogical experiment of light polarization is the reconstruction of a tutorial taken from* ***The Physics Classroom*** *online. I have used some illustrations from that tutorial, but I have also added to it an angular rotation which includes the LaRouche method of axiomatic transformation of the mind and some valuable insights from François Arago's original discovery of light polarization. (See last section)*]



What is a light wave? A light wave is an electromagnetic vibration which travels in both a vertical and horizontal plane. Light waves are of two types, ordinary light and polarized light, or what François Arago called extraordinary light. The singular thing about all light waves is that they are transverse waves instead of longitudinal waves, as Augustin Fresnel demonstrated in 1817; that is, light waves have both an electrical and a magnetic component which act at right angles to each other, vertically and horizontally, and at right angles to the direction of the wave. Thus, like galactic thinking, traverse light waves are triply-connected, because they oscillate in opposition to each other and in opposition to the third direction they are traveling.



Electromagnetic transverse waves: red waves are electrical and blue waves are magnetic.

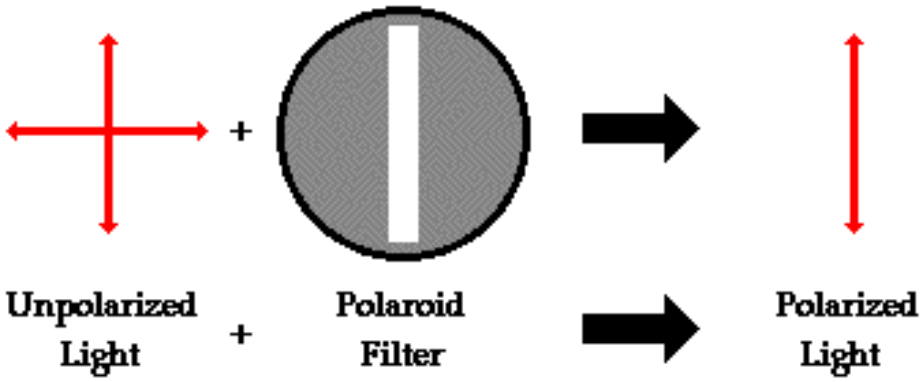
This process of opposition is called polarization because, as in the case of magnetism and of electricity, the polarity of the two opposite directionalities are held together by triply-connected circular action, even when the poles inverse each other. As Arago demonstrated, polarized waves are the singularities to pay attention to in order to understand how the mind works, especially when the mind has to undergo an axiomatic transformation by going into an inversion through a process of *coincidence of opposites*.

A traverse wave is different from any other wave by the fact that it vibrates up and down as well as from left to right as they are traveling back to front. Ordinary light waves, like sunlight, candle light, or lamplight are unpolarized forms of light because they vibrate in a scattered direction, that is, in all directions at once. However, the curious thing about polarized light is that it is stable only when it vibrates in a single plane, horizontal or vertical, never in the two at the same time. This gives light a very special character and special role that Plato had recognized as being crucial for understanding the metaphorical nature of what goes on in the human mind when the prisoners are confronted with the tormenting reality of the dimly lit wall of his Cave.

The most interesting type of polarized light to experiment with for our epistemological purpose is polarized refraction because it is filled with the sort of

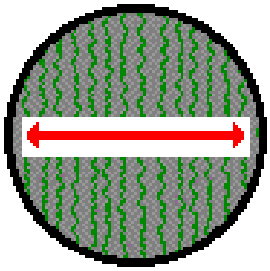
anomalies that are crucial for discovering *what is not there* and for solving the paradox of the *coincidence of opposites*.

The best way to understand polarization is to use a Polaroid filter which is capable of blocking one or both planes of vibration of electromagnetic waves. As the illustration below shows, the Polaroid disk is able to filter out all of the horizontal vibrations of ordinary light.

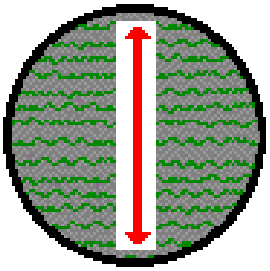


If you construct a Polaroid filter by using a long-chain of polymeric molecules stretched out horizontally across the filter, only the vertical portion of ordinary light projected will go through the vertical plane. On the contrary, if you construct a filter where all of the long-chain molecules are stretched out in a vertical manner, then, light will go through only in the horizontal plane.

Relationship Between Long-Chain Molecule Orientation and the Orientation of the Polarization Axis



When molecules in the filter are aligned vertically, the polarization axis is horizontal.



When molecules in the filter are aligned horizontally, the polarization axis is vertical.

The irony of those two filters is that polarization creates inversions. As a result, when you use the two different filters together, perpendicular to each other, you block light completely, which means that half of the light in space is horizontal and the other half is vertical. This is one of Arago's favorite polemical arguments against Newton's conception of light based on particles. When the Polaroid filters are oriented with their polarization perpendicular to each other, light is blocked out entirely, thus, demonstrating that light could never be explained with the Newtonian theory of particle emission. That is what I call the Platonic Cave effect.

Teacher

Teacher seen through two Polaroids

Axes aligned parallel to each other

Teacher seen through two Polaroids

Axes aligned perpendicular to each other

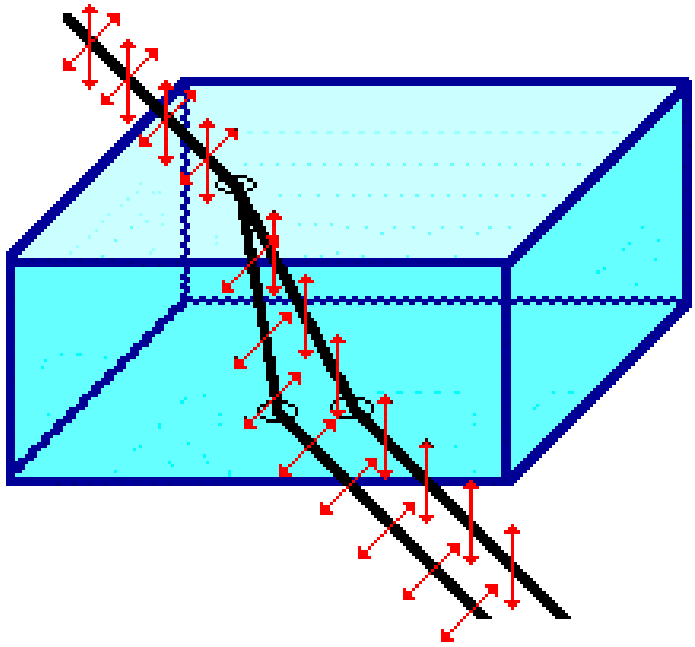
POLARIZATION BY REFRACTION

Refraction of light is a very useful pedagogical means of demonstrating the role of singularities that take place when the human mind has to go through the inversion of an axiomatic transformation, as in the current period of history. In such a case, the refraction causes an anomaly which cannot be explained by previously acquired knowledge; it can only be understood through the introduction of a new principle that did not exist before and which comes into opposition to the previous knowledge which has become obsolete.

Light refraction is useful in epistemology because a change takes place when light passes from one material into a different material like an idea passing from one mind to another denser mind. When light hits the surface of the new material, the direction is changed, which means that the refracted light wave has been subjected to a certain degree of polarization. The double-refracting Iceland crystal is a good example of such a change because, as Arago said: "A change of pathway may be the opportunity for a change of nature."[8]

The most fascinating aspect of this refractive change, however, is that while the direction of a wave is perpendicular to the surface of the crystal, a polarizing filter can be used to block the view of one or the other refracted wave. When you use an Iceland crystal, a single light wave is split into two different waves taking two different pathways: one wave becomes parallel to the surface of the crystal while the other is refracted perpendicular to the same surface. Thus, because the two waves are polarized at right angle to each other, one can be blocked by the rotation of a polarized filter while only the other remains visible. (See next image)

[8] **https://fr.wikisource.org/wiki/Fresnel_(Arago)/Texte_entier**, p.144.



The two refracted rays passing through the Iceland Spar crystal are polarized with perpendicular orientations.

Provided that the axis of the filter is perpendicular to the plane of the polarized wave, the light waves which are in the same direction as the filter will be blocked. If the filter is rotated 90 degrees in either direction, the light of the second wave will be blocked and the light of the initial wave will reappear. See how those two images alternate by rotating a polarized filter over ***this Iceland crystal.*** This fascinating result could never be observed unless a light wave were understood as a double electromagnetic wave as opposed to a linear ray of particles or as a single longitudinal wave. The wave has to be understood as a galactic wave; that is, triply-connected.

POLARISATION[9]

Excerpts from *Fresnel*, by Francois Arago

DOUBLE REFRACTION OF ICELAND CALCITE OR ICELAND SPAR

Although I realize how one risks annoying the most receptive audience when speaking for a long period of time on the same subject, I find myself returning again to the phenomenon of double refraction by the very nature of [Augustin]

[9] **https://fr.wikisource.org/wiki/Fresnel_(Arago)/Texte_entier**, p. 138-148. Translation by Pierre Beaudry. A biography of Fresnel read in a public meeting by Arago at the French Académie des Sciences, on July 26, 1830. ***Œuvres complètes de François Arago***, *secrétaire perpétuel de l'académie des sciences*, 1854, 1 (p. 107-185). The discoveries of Fresnel were in continuation with the previous discoveries of Huygens. It was André-Marie Ampère who in 1816 led Fresnel to the discovery that the polarization of light resulted from the transverse character of the light wave.

Fresnel's work ; but this time, instead of dealing with the way in which the light waves split in two by going through certain crystals, I will examine the permanent modifications they come under in such cases; I will present, in a word, the main features of the new branch of optics which is called light polarization. [138]

Any light beam projected, even perpendicularly, against any crystal, natural or artificial, among translucent crystals called carbonate of lime, calcite spar, or Icelandic crystals, must split into two parts; one half of this beam passes through the material of the crystal without deviating: it is called an ordinary wave; the other, on the contrary, goes through a very special refraction, and for this reason it is appropriately called an extraordinary wave. Ordinary and extraordinary light waves are contained in one and the same plane perpendicular to the surface of the crystal. This plan is very important to consider, for it is that which determines in what direction the extraordinary wave will be oriented; it has therefore been given a special name called the *main section*.

With these premises and a fixed reference point in mind, I am going to hypothesize that a given crystal of Iceland has its *main section* oriented from *north to south*. At any distance under it, I will introduce another crystal which will be similarly oriented, that is to say, in such a way that its *main section* will also be contained in the meridian. What is going to happen to this setting when light goes through the whole system? A single beam strikes the first, but two beams emerge: each of them seems to go through a double refraction through the next crystal; therefore, we can expect to have four distinct emerging beams. However, nothing of the sort happens. The waves coming from the first crystal do not bifurcate through the second. The ordinary beam remains only an ordinary beam and the extraordinary beam remains entirely an extraordinary refraction. Thus, by crossing the upper crystal, the light waves have changed their nature. They have lost one of their former specific characteristic; that of permanently generating a double refraction while crossing an Iceland calcite. [139]

Let us remember what light waves are , and perhaps one may concede that an experiment that changes its original properties so obviously deserves to be known even to those for whom science is a mere object of curiosity.

The idea which, at first glance, presents itself to the mind, when we wish to explain the singular result of which I have just given an account, consists in supposing that, in the first place, there are in each natural wave of light two distinct species of molecules; that the first species must always undergo ordinary refraction; that the second is destined to follow only the extraordinary pathway. However, a very simple experiment overturns this hypothesis completely. In fact, when the *main section* of the second crystal, instead of being directed from North to South, as I had first supposed, is extended from West to East, the wave which was ordinary in the higher crystal becomes extraordinary in the other, and vice versa. [140]

What is different, in fact, between the two experiments that give such dissimilar results? A very simple condition of little importance at first sight. First, the *main section* of the second piece of crystal cuts the waves from the first by their *north and south* sides, and then later it cuts them off in the east and west sides.

Necessarily, therefore, the north and south sides and the east and west sides differ in some manner for each of these waves. Moreover, the north-south sides of the ordinary wave must have precisely the same properties as the east-west sides of the extraordinary wave; such that if this last wave rotates a quarter turn on itself, it would be impossible to distinguish it from the other. Light waves are so loose, that hundreds of billions of these waves can pass simultaneously through a needle-hole without interference. Here however, we are concerned with their sides and by the fact that we have to recognize that they display the most dissimilar properties.

When they deal with a large natural or artificial magnet, physicists claim that it has *poles*. They merely mean by this that certain points around it are endowed with special properties that are not found at all in other points, or which manifest themselves more faintly if they are present. For much the same reason, we have therefore resolved to identify ordinary light waves and extraordinary ones in the same manner, as in the case of the double refraction of light through Iceland calcite. We have agreed to call them polarized waves as opposed to the natural waves in the case where all the contour points seem similar. [141]

Not to go beyond acceptable limits, the analogy between a polarized wave and a magnet, it is important to note, appears to have exactly the same properties on the radius diametrically opposite the poles. But when the poles are dissimilar, they are constantly on points of the wave located in two right angle directions.

The lines of diameter species which join analogous poles on each wave deserve special attention. When these lines are parallel on two separate radii, we say that the polarized waves are in the same plane. Therefore, I do not need to add that two polarized waves at right-angle must have identical poles in two directions perpendicular to each other.

The two ordinary and extraordinary waves, for example, given by any crystal whatsoever, are always polarized at right angle.[10]

All that I have just reported on the polarization of light, Huygens and Newton already knew before the end of the seventeenth century. Never had a more curious subject of research ever been submitted to the consideration of physicists; and yet one has to go through an interval of more than a hundred years to find, I will not say discoveries, but even simple investigations intended to improve this branch of optics.

The history of all of the sciences offers a multitude of similar quirks; the reason is because in each case there comes a time when, after great efforts have been exerted, they reach the end of their progress. Then, experimenters become generally very timid; they think of themselves as being guilty of a lack of modesty if, by a sort of desecration they dared to put their indiscreet hand over the barriers which illustrious predecessors had erected. So, they are usually satisfied with having perfected some numerical elements or having filled some gaps, at the cost of a work which is often very difficult, and which hardly attracts public attention.

In short, Huygens' experiments had clearly established the fact that the phenomenon of double refraction modified the elementary properties of light in such a manner that after having gone through a crystal a first time, the waves

[10] That appears to be the locus of change in energy flux because that is the locus of the inversion.

remain simple or split into two depending on the orientation that a new crystal is being given for them to penetrate a second time. However, do these modifications relate exclusively to double refraction? Have all other properties of light remained unchanged? [142]

It is the work of one of our most illustrious colleagues, such as [Augustin] Fresnel, whose life was taken from the pursuit of scientific excellence at a very young age and for which he was the hope, which would have enabled us to answer this important question. In fact, it was Malus who discovered that in the act of reflection, polarized waves behave differently than natural waves; these, as everyone knows, are reflected in part when they fall on even the most translucent bodies, whatever the incidence and position of the reflective surface is in relationship to the side of the wave. To the contrary, when one deals with polarized light, there is always a mirror relation with respect to the poles in which all reflection disappears if we combine it with a special angle which varies only from one mirror to the next, depending on the sort of matter they are made of. [143]

Stimulated by such a curious observation, researchers began to wonder if double refraction was indeed the only means of distinguishing polarized light from ordinary light. But, soon after this initial discovery, Malus made a new one informing the scientific world, to its great surprise, that there existed much less hidden ways to capture such a modification. The simplest phenomenon of optics, the reflection on a diaphanous mirror, was discovered to be also a great means of polarization. Light reflected on the surface of the water at an angle of 37 degrees, on the surface of a common glass mirror at an angle of only 35 degrees 25 minutes, is just as completely polarized as two ordinary and extraordinary waves coming out of a crystal of Iceland.

Since the time of Plato and Euclid observers have been studying the reflection of light. From that time forward, reflective studies have been the object of thousands of experiments and of hundreds of theoretical speculations. The law according to which the reflection of light operates is the basis of a large number of ancient and modern instruments.

Well! In this multitude of enlightened minds, of men of genius, and of skillful artists, who for more than two thousand and three hundred years had concerned themselves with this phenomenon, no one had suspected anything but the means of deflecting waves, of reuniting them or separating them. No one had imagined that reflected light might not have all the properties of incident light; that a change of pathway might be the result of a change of nature.[11] Generations of observers follow each other for thousands of years, touching the most beautiful discoveries every day but without making them. [144]

As I have already explained, Malus discovered a different path of polarizing light than what Huygens had formerly followed; but the polarizations generated by the two methods are identical; the reflected waves and those coming from an Icelandic crystal have exactly the same properties. Since then, a member of this Academy (Arago himself ed.) has discovered a completely different kind of polarization, which manifested itself differently than through the phenomena of intensity. For example, the waves chosen for the experiment always give two images when crossing an Iceland crystal; but these images are tinted in all their points with a bright and uniform color. Thus, although the incident light is white, the ordinary beam is completely red, completely orange, yellow, green, blue, or purple, depending on the side from which the wave enters the *main section* of the crystal. As for the extraordinary wave, suffice it to say that it will never again resemble the ordinary wave; it must be said that it differs as much as possible for the reason that, if one is colored red, the other will be of the most beautiful green, and so it will be with all of the other prismatic shades.

When the new species of polarized waves are reflected on a diaphanous mirror, we perceive phenomena which are no less curious. [145]

In fact, let us conceive, as a solid reference point in mind, that one of these waves is vertical and that it meets a reflecting mirror of the purest glass, at an angle of about 35°; this mirror may be to the right of the wave; it will be able, the inclination remaining constant, to be on its left, forward, backward, and in all

[11] What becomes determinant in Arago's discovery is that the pathway of the experiment is more important than the reductionist mathematical formula. The moral path of nature as Fermat indicated to Clerselier was the least action pathway of light.

intermediate orientations. It should be remembered that the incident wave was white; well, in none of the positions of the glass mirror, will the reflected wave have this shade of white: it will sometimes be red, sometimes orange, yellow, green, blue, indigo, or purple, according to the side by which the glass slide is presented to the primitive wave; and it is precisely in this order that the shades will succeed one another, if one gradually goes through all the possible positions.

DÉSIGNATION DU RAYON SIMPLE.	ARC DE ROTATION EN DEGRÉS SEXAGÉSIM.	LOGARITHMES DE CET ARC EN DEGRÉS.
Rouge extrême.....	17,° 4964	1,2429499
Limite du rouge et de l'orangé..	20, 4798	1,3113251
de l'orangé et du jaune..	22, 3138	1,3485731
du jaune et du vert.	25, 6752	1,4095149
du vert et du bleu.	30, 0460	1,4777883
du bleu et de l'indigo....	34, 5717	1,5387209
de l'indigo et du violet...	37, 6829	1,5761447
Violet extrême.	44, 0827	1,6442681

Arc of rotation of the different elementary waves through a millimeter of rock crystal. (Source: Jean-Baptiste Biot, **Sur les rotations que certaines substances impriment aux axes de polarisation des wavéons lumineux**, *Mémoires de l'Académie royale des sciences*, II (1819), 58.)

Here, it is not only four poles placed in two rectangular directions that must be admitted inside the wave; we see that there are thousands; that each point of the contour has a special character; that each face brings the reflection of a particular shade. Thus, this strange *dislocation* of the natural wave (permit me the use of this term since it is correct) gives the means to break down the white light by way of

reflection. The colors, I must confess, do not have all the homogeneity of those which Newton obtained with the prism; but also objects do not experience any deformity, and in a multitude of studies this is the most important point. [146]

To recognize whether a wave has been subjected to either the polarization of Huygens and of Malus, or to the one that I have just mentioned, which has been called chromatic polarization, it suffices, as we have seen, to make such a wave undergo a double refraction; but since a wave of light crossing an Iceland crystal would always give two equally bright white images, it would not follow that it is formed by ordinary light; this is another discovery of Fresnel. It is he who first showed that a wave can have the same properties on all points of its outline and yet not be a natural light. To show, by a single example, that these two kinds of light behave differently and should not be confounded, I will say that by experiencing double refraction a natural wave which has just crossed a crystalline plate gives two white images, while in the same circumstances the Fresnel radius is broken down into two brightly colored beams.

We attribute to ordinary polarized waves this new modification, which is that, regardless of the chosen side, we designate by the name of circular polarization, the process which subjects them to two complete reflections with the appropriate glassy surfaces.

The joy of having appended one's name to a new kind of hitherto unknown polarization would probably have satisfied the vanity of a vulgar physicist, and his inquiries would not have gone any further, however, Fresnel was driven by higher sentiments. In his view, nothing was achieved as long as something remained to be discovered. Therefore, he investigated whether there should be any other means of producing circular polarization; and, as can be expected, a new remarkable discovery blessed the patience of his efforts. This discovery can be stated in two words: there is a particular kind of double refraction which communicates circular polarization to the waves, as in the case of the double refraction of the Iceland crystal given by the polarization of Huygens. This special double refraction does not come from the nature of the crystal, but from certain cuts that Fresnel has

pointed out. The properties of circularly polarized waves also led our colleague to new and very curious ways of giving birth to colored polarization. [147]

Throughout all times and in all countries one finds gloomy spirits, who are ready to proclaim the glory of the dead, and who do not treat their contemporaries at all with the same enthusiasm. As soon as a discovery appears, they first deny its existence; then, they dispute its novelty and pretend to have seen it in some ancient report which is very obscure and is quite forgotten; finally, they claim it was merely the result of chance.

I do not know if the human beings of our century are better than their predecessors; but no doubt has been raised as to the accuracy, the novelty, nor the importance of the discoveries I have just described. The instruments used by Fresnel in his study of circular polarization were complicated, meticulous, and went straight to the goal that he had set for himself. His discoveries were such that not even the most envious individual would have dared to mention the possibility of chance.

Perhaps it should suffice to say that most of them had already been prepared in advance with some theoretical ideas; for without them, many of our colleague's experiments would have appeared to offer combinations whose meanings might have been, so to speak, impossible for anyone to conceive. If, by writing the history of scientific knowledge, it is appropriate to shine the light of day on all aspects of discoveries made by those who have cultivated them with such a glorifying passion, it is also important, as far as I am concerned, to avoid any tendency which might lead one down the road of discouragement. [148]

CONCLUSION

Arago discovered that as in the case of music, light always travels at the same speed. He expressed this by the following devastating insight:

> "If light is a wave, the waves of different colors are similar to the various sounds used in music, because they will be formed by unevenly rapid vibrations, such that the red, the green, the blue, and the violet waves, will be transmitted through ethereal space as do all the notes of the scale through the air with equal velocities.
>
> "If light is an emanation, the waves of various colors will be formed of necessarily different molecules as to their nature or mass, which, moreover, may be endowed with dissimilar velocities."[12]

Thus, Arago came to realize that human beings were capable of generating an optimistic unified field view of matter, energy, and mind coherently by investigating the domains of light and music with the heuristic device of polarization of light and colors. It remains to be demonstrated, however, that if the fixed axis of such polarizing rotations interacts in the same way as the fixed mental process of galactic thinking, then, like the fixed multiply-connected rotation of a gyroscope, which Leon Foucault had invented with the help of Arago, the human intellect will also be attracted directly by truthfulness like the Earth rotating around Foucault's pendulum in spite of the fact that it always oscillates in the same plane and in a straight line.

The consequences of such hypothesis formation are devastating for Newtonians, because they don't like hypothesizing, and if the wall of your eye has not been pierced by the impact of particles coming from the Sun at the speed of light, no more than your ears have been pierced by particles flying in the atmosphere at the speed of sound, this simply means that light or music, and maybe both, have not yet been properly conceived. Therefore, there must be some sort of non-material side to the physical nature of light and sound which is yet to be identified, because your mind is also protected from such piercing impact; but this might require an axiom busting action of a much higher order than the one we have used up until now.

The fallacy of the concept of "relativistic mass," for instance, is a good example of where to start investigating to discover the errors that physicists have

[12] François Arago, Op. Cit., p. 154.

been making for the last two centuries. The error came when physicists decided to replace the idea of field interaction with the idea of mass and the idea of wave with the idea of particle. As a result, the photon is to account for electromagnetic interactions, gluons for pions, pions for the strong force, fermions as carriers of W and Z bosons for the weak force, and the graviton for gravity. How can all of these Newtonian-types of particles be unified into a *coincidence of opposites*?

The irony, in all of this, is that the process of such exchanges is not merely a matter of finding rationalizations for gaps in a universe filled with holes; what in fact is required is an actual transformation of the mind from the virtual reality of Plato's Cave to the truth of the real world located outside the cave. Thus, the fallacy of the current conception of light and of mind must be abandoned because it has been adopted merely to fit mathematical equations.

Lyndon LaRouche was right when he came upon the notion of the "wavicle." His secret can be found in his epistemological method of axiomatic transformation; that is, replacing the idea of void by the concept of field and the idea of force at a distance by the concept of circular motion. Then, you may discover that the higher unity you are looking for is not out of reach because it is *agape* which is the true nature of the "substance" that connects science and art as the ordering of change in the universe.

As Lyn put it repeatedly, "the substance of all great art is creativity"[13]; and creativity begins when you start correcting your own mistaken underlying assumptions for the benefit of mankind. This is how Lyndon LaRouche proved that *agape* is the ether of the universe.

FIN

[13] Quoted by John Sigerson in LaRouchePAC: **Class #4: Italy—Science & Culture**.