The Growing Dissonance between the Kosmos and the Anthropos: A Hermeneutic Study of the Mechanistic World View brought by Classical Physics and the New Rationality introduced by Einstein's Relativity Theory and Heisenberg's Indeterminacy Principle in Quantum Physics

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Abstract

This paper centers on the implicit metaphysics beyond the Theory of Relativity and the Principle of Indeterminacy – two revolutionary theories that have changed 20th Century Physics – using the perspective of Husserlian Transcedental Phenomenology.

Albert Einstein (1879-1955) and Werner Heisenberg (1901-1976) abolished the theoretical framework of Classical (Galilean-Newtonian) physics that has been complemented, strengthened by Cartesian metaphysics. Rene Descartes (1596- 1850) introduced a separation between subject and object (as two different and self- enclosed substances) while Galileo and Newton did the "mathematization" of the world. Newtonian physics, however, had an inexplicable postulate of absolute space and absolute time – a kind of geometrical framework, independent of all matter, for the explication of locality and acceleration. Thus, Cartesian modern metaphysics and Galilean- Newtonian physics go hand in hand, resulting to socio- ethical problems, materialism and environmental destruction.

Einstein got rid of the Newtonian absolutes and was able to provide a new foundation for our notions of space and time: the four (4) dimensional space- time; simultaneity and the constancy of velocity of light, and the relativity of all systems of reference. Heisenberg, following the theory of quanta of Max Planck, told us of our inability to know sub- atomic phenomena and thus, blurring the line between the Cartesian separation of object and subject, hence, initiating the crisis of the foundations of Classical Physics.

 | ISSN 2012-2144

But the real crisis, according to Edmund Husserl (1859-1930) is that Modern (Classical) Science had "idealized" the world, severing nature from what he calls the Lebenswelt (life- world), the world that is simply there even before it has been reduced to mere mathematical- logical equations. Husserl thus, aims to establish a new science that returns to the "pre- scientific" and "non- mathematized" world of rich and complex phenomena: phenomena as they "appear to human consciousness".

Keywords: hermeneutics, philosophy of physics, quantum physics, classical physics, ecological crisis

INTRODUCTION

Albert Einstein (1874- 1955) and Werner Heisenberg (1901-1976), the two major theoretical physicists of the early 20th century, in their later years of life, concerned themselves not only with physics but also, with their impact on the realm of philosophy. Einstein, the genius behind the Theory of Relativity, wrote:

> At a time like the present, when experience forces us to seek an even and more solid foundation, the physicist cannot simply surrender the philosopher the critical contemplation of the theoretical foundation; for he himself knows best and feels more surely where the shoe pinches. In looking for a new foundation, he must try to make clear in his own mind how far the concepts which he uses are justified and are necessities.[1]

Werner Heisenberg, the one who formulated the Principle of Indeterminacy, asserted:

> But at this point, the situation changed to some extent through quantum theory and therefore we may now come to a comparison of Descartes' philosophical system with our present situation in modern physics. It has been pointed out before that in the Copenhagen Interpretation of Quantum Theory we can indeed

1 Albert Einstein, *Out of My Later Years.* (New York: The Philosophical Library Printing Press, 1950) p. 59. The book is the second volume of collected essays by Einstein (1934-1950). The first volume has the title "The World As I See it" (1922-1934).

proceed without mentioning ourselves as individuals, but we cannot disregard the fact that natural science is formed by men.[2]

It is worthy to note that while these two thinkers crossed the realm of philosophy, Edmund Husserl (1859- 1930), took a new standpoint in philosophy which is called Transcendental Phenomenology, which aims to establish an absolutely valid knowledge of all things: "*Philosophie als strenge Wissenchaft"* (Logos, vol. 1, 1910-1911, p. 289-341) or to arrive at "philosophy as a rigorous science." For Husserl, since its beginning in ancient Greece, Philosophy always aimed to be an all- encompassing and intellectually justified knowledge of everything. [3] What, if there is any, makes contemporary physics and contemporary philosophy cross paths?? This paper focuses on the points of convergence between contemporary philosophy and contemporary science (in early 20th century). It then offers a kind of hermeneutics of the Relativity Theory and the Indeterminacy Principle in the light of Husserl's discussion of the Crisis of the European Rationality vis-à-vis his appeal to return to the *lebenswelt* (life- world). Husserl's final critique/ evaluation of Galilean-Newtonian physics and the necessity of returning to the *lebenswelt* are

2 Werner Heisenberg. *Physics and Philosophy: The Revolution of Modern Science,* ed., Ruth Nanda Ashen, (New York: Harper and Brothers Publishers, 1958) p. 81. The whole Section V pertains to "The Development of Philosophical Ideas since Descartes in comparison with the new situation in Quantum Theory." Contemporary critics of Descartes, for instance, Martin Heidegger, Jean- Luc Marion, Alfred North Whitehead and Husserl would always point out the Cartesian Ego, *res cogitans*, the dichotomy between subject and object, and the metaphysical meaning of the mathematization of nature or the *physis*_

3 Joseph J. Kockelmans, Ph.D., *Phenomenology and Physical science.* (Pittsburgh: Duquesne University Press, 1966) p. 31. Here I would focus only on Phenomenology as being consonant with 20th century physics although Whiteheadian metaphysics might be readily judged as more obviously compatible with Einsteinian relativity and Quantum Physics. Take for instance Whitehead's refusal to categorize everything neatly in the manner of traditional metaphysics, which he calls "substantial". Whitehead's complex and paradoxical interpretation of the universe, of reality is organicist, more of following Hegelian interpretation of reality and history. We should take note, however, that it is also Hegel who first used the word "phaenomenologie" in his book The Phenomenology of the Spirit, and not Husserl. Hence, we can see the mindset of Hegel, Husserl and Whitehead going through similar lines though by no means the same. Hegel would end up as a pantheist while Husserl would be caught up into the *cul- de- sac* (dead- end) of the Transcendental Ego and inter-subjectivity (following Descartes' fate as a solipsist).

found in his last unfinished book, "The Crisis of European Sciences and Transcendental Phenomenology: An Introduction to Phenomenological Philosophy." But what does Husserl intend to say in emphasizing the need to return to the life- world? What does the life- world mean, how can this personal dimension be necessary to be looked at in the study of physics? When, in the age of modern science, everything can be subjected to the scientist, would there still be a need for any "metaphysics"?

It is certainly not only Husserl, Einstein, and Heisenberg who have started to point out this kind of "forgetfulness" on the part of the modern scientist. As early as 1787, in his Preface to the First Edition of the Critique of Pure Reason, we hear Immanuel Kant (1724- 1804) as regards to his task:

> For it is futile to try to feign indifference concerning inquiries whose object cannot be indifferent to human nature…however much those alleged indifferent try to disguise themselves in a popular tone by changing the language of the school, they inevitably fall back- insofar as they think anything at all- into metaphysical assertions, the very assertions they claimed to despise so much.

He thus wanted to inquire again about the conditions of possibility not just of the new and successful science of his day, but of metaphysics as well. As soon as the new kind of sciences sprouted in the Modern World, metaphysical questions have continually been both "discarded" and yet "disturbing" humanity. Almost 200 years later, we hear Edmund Husserl lamenting:

> But as philosophers of the present we have fallen into a painful existential contradiction. The faith in the possibility of philosophy as a task, in the possibility of universal knowledge, is something we cannot let go. (Crisis, p. 17)

The issues of philosophy, the metaphysical questions that have founded the civilization of Europe, are those which always haunt us despite the seemingly upward movement of human existence due to material and economic progress. It is obvious that the loopholes of modernity are the forces behind the criticisms of post- modernity. Indeed, this inevitable movement of "falling back" is rooted in our

human nature: To fall back, to move towards something "we cannot let go" may be something we should not despise or forget or dissociate ourselves from. Unfortunately, this is precisely what happened, and contemporary thought could be roughly characterized as a remedy for modernity by looking again at the relation between the *anthropos* and the *kosmos*, the human being, and the world.

This paper will discuss: 1) a summary of the Mechanistic Worldview of Classical, Galilean- Newtonian physics and of the History of Quantum Theory, 2) Einstein's Special and General Theory of Relativity and Heisenberg's Principle of Indeterminacy as stated in the Copenhagen Interpretation of Quantum Theory, 3) Husserl's conception of the Crisis of Europe and, of the *lebenswelt*. The last part, 4) will be the researcher's reflections on both Relativity and Principle of Indeterminacy together with a corrective notion of rationality that is evident in Husserl's critique of Newtonian Science and in his Transcendental Phenomenology particularly in The Crisis of the European Sciences.[4]

There is an overwhelming list of thinkers that have been discovered during the present studies who point out the limits and mistakes of scientific thinking: the logico- mathematical thinking that has championed not just a method but a rationality as well. Newtonian science vis-à-vis Cartesian metaphysics that have erected modern society- indeed science and philosophy seem to have proven that humanity has reached progress (i.e., modern civilization). Thinkers from the schools of Phenomenology, Pragmatism, and Process Thought, however though differing in their basic tenets of thought, seem to overlap with regards to their critique of science and philosophy (Modern) that are contemporaries in their development.[5]

4 Edmund Husserl. *The Crisis of the European Sciences and Transcendental Phenomenology: An Introduction to Phenomenological Philosophy,* trans. Paul Carr (Evanston: Northwestern University Press, 1970). Henceforth cited as The Crisis.

5 "The origin of modern philosophy is analogous to that of Science, and is contemporaneous ." Alfred North Whitehead, *Science and the Modern World.* (London: Free Association Book Press, 1985) p. 173. To be cited as SM

Richard Rorty criticizes the rationality of the scientist that emphasizes method: "to have criteria for success laid down in advance"[6] and so he, the scientist, replaces the medieval priest as the upholder of truth, his commitment to method, and his rationality makes him a kind of hero for humanity. Martin Heidegger also points out this emphasis on method, criteria "laid down in advance" by modern science when he speaks of "calculative thinking" in his Post- Being and Time writings. [7] More recently, Jean- Luc Marion offered a tedious critique of Cartesian metaphysics, the foundation that complements the experimental method of Galilean- Newtonian Science. In Cartesian metaphysics, beings are known "not as they exist in reality but as only reached by the intellect"[8] or objects become *ens only qua cogitate:* cogitation is a way of being. Marion declares then that this reduction of Being to being-known. (i.e., the primacy of the knowing mind as instituted) conceals Descartes' indecision as to what beings are: The indecision is covered up by the primacy of *cogitation* as determinant of existence/ what should be counted as "existent". Marion says:

> In thinking itself as being only through and for the exercise of the *cogitatio,* it masks, through the epistemic evidence of its nevertheless ontologically, loose existence, and then through the certitude of the other subsistent truths, the total absence of

6 Richard Rorty.*Objectivity, Relativism and Truth*. (New York: Cambridge University Press, 1961) p. 37

7 For instance, "Modern Science, Metaphysics and Mathematics" in Basic Writings from Being and Time to the Task of Thinking, ed. David Farnell, Krell, (New York: Harper and Row Publishers, 1977) p. 247-282. Calculative thinking for Heidegger is rooted in the mathematical character of thinking that there are some things we already know which makes us understand things: "The mathemata, the mathematical, is that "about" things which we already know. Therefore, we do not first get it out of things, but in a certain way, we bring it already with us." p. 252). From this inherent character of human thinking stems a projection, a knowing in advance, a kind of securing: the mathematical character of modern age.

8 p.60. Hence, the primacy of the *prima philosophia* of Descartes results from the primacy of the intellect: "Primacy results from interpretation of beings as known." p.62 "Metaphysics becomes first philosophy inasmuch as all beings are considered not first as they are, but as known or knowable." p. 68. Jean-Luc Marion, on Descartes' Metaphysical Prism. The Constitution and Limits of Onto- Theo- Logy in Cartesian Thought, trans., Jeffrey L. Kosky, (Chicago: The University of Chicago Press, 1999).

> decision concerning the Being of beings, which are reduced to the level of pure and simple *cogitate.*[9]

This is certainly not the kind of "return to the subject" that is pointed out in the contemporary thought when Husserl, Heisenberg, and Einstein seem to remind us of the limits of science and its human dimension. Nevertheless, it will be highlighted later on that Descartes was also, on the other hand, not totally far from this "return to the subject" in post- modernity: In fact, according to Husserl, it is Descartes who implanted the seeds of this very return and hence one notices the ambiguous evaluation of Descartes by Husserl as regards the *Cogito ergo sum* in the Crisis.

Hans-Georg Gadamer (as well as Heidegger) laments the fact that the Human Sciences have tried to pattern themselves in terms of method on the natural sciences.[10] Even Jean- Paul Sartre, a follower of Husserlian phenomenology and Heisenberg himself share the same sentiment towards modern science because of its thoroughgoing objectivism. Heisenberg writes in his book Physics and Philosophy, continuing the earlier quotation I mentioned:

> We cannot disregard the fact that natural science is formed by men. Natural science does not simply describe and explain nature; it is part of the interplay between nature and ourselves; it describes nature as exposed to our method of questioning.[11]

Heisenberg is here pointing to the fact that modern science has forgotten the human dimension of the enterprise of knowing, the same as what Sartre meant in saying that Newtonian science has only "abstract concepts of pure exteriority, of action and reaction, etc…

9 Jean-Luc Marion, *Reduction and Given-ness: Investigations of Husserl, Heidegger and Phenomenology*, p. 93.

10 Hans-Georg Gadamer. *Truth and Method,* trans., Garrett Barden and John Cumming (New York: The Crossroads Publishing Company, 1982) p. 5-10, XII (Introduction). In Science and the Modern World (SM)

11 Op.cit. p.81. The whole book centers on the impact of the Copenhagen Interpretation of Quantum Theory.

absolute objectivity… amounted to that of a 'desert world' or of a 'world without men'"[12]

But among critics of modern science however, Edmund Husserl occupies a peculiar position in a sense that on the one hand, he shares the criticisms of other post- modern thinkers, but he does not give up his ideal of a "rigorous science". While he places himself, beyond relativist-historicist and rationalist – objectivist perspectives, it can be gleaned that his position is by no means an easily held one. His unfinished book, The Crisis, lays down his project of providing a solution to the crisis of "Europe" when Europe signifies not just a geographical location but already a rationality, a culture. (The Vienna Lectures in the Crisis, p. 273). And yet, many questions are raised regarding his, I would say, initial pessimism that seems to turn out in the end an optimism, for he believes that his Transcendental Phenomenology is the rigorous science that can provide solution to the Crisis. Or is it just an ambitious but impossible project? In what way can we trust rationality as the one that is providing us the norms of life and true knowledge of the world when we know the faults of modernity?[13] How come transcendental phenomenology was believed by Husserl to be the solution to The Crisis? Is the Crisis a necessary step to the attainment of the ideal of "a rigorous science" (as against Galilean- Newtonian science) that in the first place has been the original goal of both the ancients and Husserl or are all these crises in modernity symptoms of an inevitable "nihilism"?[14] Would this comment of Heidegger be correct: "…Nietzsche thinks nihilism as the

12 Jean-Paul Sartre, *Being and Nothingness: A Phenomenological Essay on Ontology*, trans., Hazel E. Barnes (New York: Washington Square Press,1992) p. 406

13 Perhaps one would be reminded of Jurgen Habermas' Discourse Theory of Truth and his belief in Philosophy as stand- in and Interpreter. Habermas positions himself between the "Unitary Thinking of Metaphysics" and "Radical Contextualism" and thus, he proposes his procedural concept of Communicative Reason: A concept of situated reason that is given voice in validity claims that are both context- dependent and transcendent.

14 Heidegger comments on Nietzsche's evaluation of nihilism in the West: "Nietzsche himself interprets the course of Western history metaphysically and indeed as the rise and development of nihilism" (p.54). "Nihilism moves history after the manner of a fundamental ongoing event that is scarcely recognized in the destining of the Western peoples." (p.62). Martin Heidegger, The Question Concerning Technology and other Essays, trans. William Levitt (New York: Harper and Row Publishers, 1977) Henceforth cited as QT.

"inner logic" of Western history (Q.T. p.67)?" If the crises are an "inner logic" of modernity itself, then the attainment of a rigorous science via Husserl's phenomenology would be an illusion: The Philosophy (with capitalized "P") that Rorty criticizes in his Pragmatist perspective when he says, "…Husserlian phenomenology is simply one more attempt to put philosophy in the position which Kant wished to have – that of judging other areas of culture on the basis of its special knowledge of the "foundations" of these areas."[15] In short, the heart of the matter then would be: the necessity of asking ourselves, given the revolutionary discoveries of Einstein and Heisenberg and the aim and remedy offered by Husserlian phenomenology, whether or not we are to admit an escape from the nihilism of modernity, through these 20th century discoveries themselves. Therefore, it can be said that it is precisely the points of convergence between the 20th century physics and Husserlian phenomenology that constitute the escape from the Nietzschean forecast of nihilism,

1. The Mechanistic Worldview of Classical Physics and the History of Quantum Theory

Copernicus and Kepler can be recognized as the proponents of the mechanistic view of the world: the former asserted the heliocentric theory while the latter stressed the mathematical scheme in describing the orbits of planets around the sun.[16] Although the mechanistic world view ultimately abandoned the concept of the clock- maker God, at the outset of the progress of modern science, however, the medieval conception of nature still prevailed: Nature was the work of God and any inquiry about the world without reference to God is a senseless endeavour.[17] Heisenberg says that for Kepler, "To give praise to God, we

15 Richard Rorty. *Philosophy and the Mirror of Nature* (Princeton: Princeton University Press, 1979). In "Philosophy without Mirrors (p. 357-394), Rorty places Husserl with Russel, Descartes and Kant as revolutionary and yet going towards traditional philosophy still in its constructive- systematic framework. This very framework must be given up according to Richard Rorty.

16 Blin-Stoyle, R.J. et. al. *Turning Points in Physics*, A Series of Lectures at Oxford University in Trinity Term 1958 (New York: Harper and Brothers Publishing Inc., 1961) p.6

17 Werner Heisenberg, *The Physicist's Conception of Nature*, trans., Arnold J. Pomerans (Connecticut: Greenwood Press Publishers, 1970) p.8. Heisenberg quotes from Kepler's concluding remarks in *Mysterium Cosmographicum*

must read the book of nature…" Man was endowed both with mind and the senses that "he might conclude us to the causes of their being and becoming."[18] Furthermore, the belief was that man's ability to search into the workings of nature and the intelligibility of nature or creation itself were in full correspondence.[19] This is in fact what Husserl was pertaining to when he described what he calls "the natural attitude". In the next parts of this paper, this concept of naturalistic Einstenian view will be explained further but at this point, the paper will only take the remark of Dr. Kochelmans that for this attitude, the questions of the possibility of knowledge and meaning are excluded. This taking for granted of epistemological and hermeneutical questions can be considered as the result of the presupposed "faith" that man and the kosmos are in perfect correspondence. Dr. Kochelmans continues:

> Moreover in the natural attitude one tacitly assumes that we are in a world through our mind can roam at will and in which we can consider any part we want, without changing the objective nature of what we consider. According to this view, the object-pole of our knowing is an objectively existing, fully explainable world that can be expressed in exact, objective laws. This "objective" world exists wholly in itself and possesses a rationality that can be fully understood. The subject, on the other hand, is pure consciousness; it is fully transparent to itself and faces that rational world, which it can know objectively as it is in itself.[20]

18 Ibid., p. 73. Heisenberg refers to the "Preface to the Reader". This is the medieval conception of man as the steward of creation and the glory of the Creator can be perceived through nature, the world. This tradition goes back to Saint Paul. In the Bible, in Genesis it was declared that everything was created as "good". Hence, for Aquinas, Being is synonymous with one- ness or Unity. Truth, Goodness and Beauty: These are the transcendental categories of Being. All individual things created are analogues of God in various gradations of Being.

19 Ibid. p. 73

20 Dr. Joseph J. Kochelmans, *Phenomenology and Physical Science: An Introduction to the Philosophy of Physical Science*. Duquesne Studies, Philosophical Series, 21. (Pittsburgh: Duquesne University Press, 1966). Alfred North Whitehead describes the origins of Modern Science, also saying the same: "In the first place, there can be no living science unless there is a widespread instinctive conviction in the existence of an order of things, and in particular, of an order of Nature." P.4

This belief or faith in the intelligibility of the external world, that man can know an objective world will ultimately result to a mechanistic worldview or way of looking at the world: This is what we call classical physics, or Galilean- Newtonian Physics.

The gradual formation of this mechanistic worldview started with the notion of force, which can be found even in ancient writings. Later on, it developed into a comprehension of the laws of statics: "the laws of the balancing of forces, acting on a body at rest"[21] and of dynamics, which is the relation of force and motion. Galileo's contribution to dynamics lies in his study of a ball on a horizontal plane, wherein the result gave birth to the origin of the principle of inertia. It states that: "a body on which no forces act, will travel in a straight line with constant velocity."[22] However, the clear formulation of this principle of inertia is to be found originally in Descartes' writings, for he was, according to Sir James Jeans, "also the first; at least since the era of Greek speculation, to attempt to bring all the phenomena of physics within the scope of a single system of laws."[23] While the new quantities of momentum and kinetic energy were added by Huygens and Wallis to classical physics' description of the world, Descartes invented analytic geometry (1637), the 3-coordinate reference system that is essential to dynamics. Descartes even preceded Newton in his pursuit to formulate universal principles although with his too rationalistic bent, he did not achieve what Newton, with his 1687 *Principia Mathematica Philosophia Naturalis,* did. Nevertheless, There is an evident influence of Descartes' on Modern Science on both grounds: in his project to interpret reality within a system of laws and in providing Modern Newtonian- Galilean science with a complementary metaphysics. Descartes' project was based on his claim that nature does obey some universal principles that,

21 Roland Omne's, *Quantum Philosophy: Understanding and Interpreting Contemporary Science*, trans., Arturo Sangalii (New Jersey: Princeton University Press, 1999) p. 29

22 Dr. Joseph J. Kockelmans, *Phenomenology and Physical Science: An Introduction to the Philosophy of Physical Science* Duquesne studies, Philosophical Series, 21. (Pittsburgh: Duquesne University Press, 1966.

23 Roland Omnes, *Quantum Philosophy: Understanding and Interpreting Contemporary Science*, trans., Arturo Sangalii (New Jersey: Princeton University Press, 1999) p. 29

for him and for the subsequent Classical physicists, can be expected through logic and mathematics.[24]

Descartes' belief in the possibility of achieving a perfect knowledge of reality makes him assume the natural attitude. Despite the difference between Descartes' and Newton's methods and degrees of success, Newton, nevertheless had the same aim as Descartes'. This paper will slowly progress on the presentation of Husserl's critique and evaluation of both Galileo and Descartes in "The Crisis."

The framework of Newtonian dynamics were absolute time and absolute space; Absolute and mathematical space is eternally immovable, without any relation to any external thing[25] while absolute space and true time "flows equably", is distinct from the common experience and measure of duration.[26] These ideas were posited theoretical elements, pre-supposedly so that the researcher can explain the phenomena when doing his or her experiments and observations. By the end of the 19th century, it was generally believed that there were two broad dimensions of reality: The simple one-dimensional time continuum where all material and mental events take place and the three-dimensional space, as described by Euclidean geometry

24 Omnes writes: "It is certainly due to the accumulated weight of so many discoveries, to the evolution of minds caused by history, and to the effect of a systematic indoctrination, that this idea gradually became sufficiently conventional to be embraced by some so intensely that questioning is no longer necessary, and to make of it an article of faith, the stronger became not pronounced." p.32. The sciences of Behavioral psychology, sociology (Comte) would be born in subsequent centuries following the logico- mathematical interpretation of the world. Engineering and Economics follow this mathematical method of knowing.

25 "All motion became absolute motion if measured relative to the ether. This ether- filled space, identical to all observers, aloof, unchanging, unmoving, crossed by bodies and forces without being affected by them, a passive container for matter and energy, is absolute space." Isaac Asimov, *Understanding Physics,* Vol. II, Light, Magnetism and Electricity (New York: Barnes and Nobles Inc., 1993) p. 91.

26 Omnes, op. cit., p.32.

and as The Container of all material things.[27] But in trying to prove the existence of absolute space and absolute time, Classical Physics with its mechanistic worldview later was to show its limitations. Sir James Jeans, moreover, remarks that although Classical Physics on the one hand was very successful in its explanation and prediction of the man-sized world and large- scale phenomena/ problems in astronomy, on the other hand, it was failing in giving explanation of the structure of the atom. Hence, the presupposed "faith"- that man and nature are in perfect correspondence, that man can attain absolute objective knowledge of the laws of nature- of modern science with its mechanical worldview, is to be challenged by the new mindset of 20th century Physics. The two most important revolutionary contributions in 20th century Physics were the Theory of Relativity and the Principle of Indeterminacy. Heisenberg says that the dissolution of the mechanistic framework of Classical Physics and the provision of the new basis for a critical analysis occurred in two stages: First, through Einstein and secondly, through the discussions and experiments made on atomic structure.[28]

At the turn of the century, Max Planck worked on the problem of the radiating atom. He intended to amend the classical mechanics with its known laws for radiation and heat, for it to fit the observed facts of radiation and then find out the reason that the energy of bodies was not wholly transformed into radiation. The previous attempt by Lord Rayleigh and Jeans resulted to difficulties and failed to explain the Blackbody radiation at high temperature. Planck's shift of focus of research from the phenomenon of radiation to the radiating atom did

27 Lawrence Sklar, *Philosophy of Physics*, Dimensions of Philosophy Series, eds., Norman Danrels and Keith Lehrer, (Oxford: Oxford University Press, 1995) p.23- 24. Einstein writes, "The concept of true does not talk with the assertions of pure geometry, because by the word 'true' we are eventually in the habit of designating always the correspondence with a "real" object; geometry, however, is not concerned with the relation of the ideas involved in it to objects or experience, but only with the logical connection of these ideas among themselves." Albert Einstein, *Relativity: The Special and General Theory*, trans., Robert W. Lawson (New York: Routeledge Publishing Inc., 2001) p.4 This is precisely what Husserl, as we will see later, calls "idealization."

28 Heisenberg, *Physics and Philosophy,* p. 198-199. In this paper, I will not discuss the points of disagreement between Einstein and The Copenhagen School as regards quantum theory.

simplify the interpretation of empirical facts though was not capable of resolving the difficulties.

In 1900, Curlbaum and Rubens made very accurate new measurements of the spectrum of radiation and Planck made a representation of these measurements in simple mathematical formulae to explain the plausible relation between heat and radiation. Planck's theory led to the conclusion that the oscillator (i.e., the radiating atom) could only contain discrete quanta of energy. This entailed the abandonment of continuity or causality: "the representation of phenomena as changes taking place in space and time."[29] It means that changes in the universe are in some way discontinuous, not consisting of continuous motions in space and time. When for classical mechanics, matter was conceived to be constituted of atoms and the radiation of waves, Planck's new theory necessitated an atomicity of radiation itself which is like that of matter: Radiation was discharged from matter in discrete quantity, contrary to electrodynamics' postulate of continuous radiation.[30] Despite his conservative attitude and the dislike of the consequences of such a discovery, Planck published his quantum hypothesis in December of the same year.

Planck's theory of quanta, despite his efforts to reconcile it with the framework of Classical physics, did not fit into it. And it was Albert Einstein who in 1905, first used the new ideas in the problems of Photoelectric Effect and of the specific heat of solid bodies. In his experiment on photoelectric effect, he used Planck's idea by introducing the concept of light quanta. He suggested to consider Planck's packets of energy purposely to be particles: Certain aspects of the photoelectric emissions of electrons could be understood if light will be considered as a collection of particles and the photoelectric effect could be explained by a particle theory. This was, however, contrary to the 19th century physicists' conviction that light was a wave phenomenon, and it therefore introduced a dual character of light, the **wave- particle character**. Maxwell's electrodynamics assumed a wave characteristic of light travelling through an ether. The ether, in turn, was considered

29 Sir James Jeans, op. cit., p.127

30 Heisenberg comments that it was a novel discovery for Max Planck, "a result that was so different from anything known in classical physics that he certainly must have refused to believe it in the beginning." *Physics and Philosophy,* p. 31.

then, as the materialization of Newtonian absolute space.[31] Following this step was Rutherford's presentation of atomic structure (through his observations on the interaction of alpha rays) as it penetrated matter. However, this atomic model could not explain the atom's most characteristic feature- its enormous stability.[32] Two years after, in 1913, the young Dane Niels Bohr of the Copenhagen School explained the stability of the atoms as he proposed his new model.

Bohr's atomic model, rather conservative for its modest modification of classical physics, suggests that when the electron radiates, it emits a "puff", a quantum of luminous energy. Furthermore, Bohr added Planck's quantum hypothesis and his own new idea of stationary states to classical mechanics. He suggested that the electrons follow the orbits in accordance with the classical mechanics (i.e., Kepler's laws say that electrons "gravitate" on elliptical orbit) as they traverse around the nucleus. But only certain of these orbits can be given description – where the electron has a well- defined energy and thus, no emission of radiation occurs- and they are the smallest of these elliptical orbits. This latter idea is that with which Bohr departs from Classical Physics though, he synthesized the theories of Rutherford and Planck.

He also suggested that for the electron to radiate (i.e., emit radiation), it must change from one orbit to another, and from one ellipse to another of lower level of energy. Seen from a high-powered microscope, this movement of electron is said to be "hopping" and is thus known as "quantum jump". Through such quantum jumps, energy is liberated. Radiations of photons are the orbital jumps.

The next step after Bohr's efforts was done again by Einstein in 1917, when he connected Rutherford's and Soddy's fundamental law of radioactive disintegration (i.e., asserting the spontaneous breaking up of radioactive substances, suggesting an effect without a cause, announced in 1903) and Bohr's quantum jumps by showing that the very laws governing the electron's quantum jumps from one ellipse to another, as posited by Bohr, are the very same laws that govern the

31 Omnes, op. cit., p. 27

32 Rutherford's model of the atom was similar to the solar system: "…a heavy positively charged nucleus at the center and moving in orbits around the nucleus the negatively charged electrons. Blin-Stoyle, op. cit., p.40

radioactive substances' disintegration. These laws were simple, and out any number of electrons, a certain portion always jumped within a specified time. Moreover, there was no basis to distinguish those electrons which would make the jump from those which would not. As James Jeans concluded, "as discontinuity marched into the world of phenomena through one door, causality walked out through another."[33]

2. Einstein and Heisenberg

Einstein's 1905 paper on the Photoelectric Effect was followed by his paper on the Special Theory of Relativity. It was simply a systematic extension of Maxwell's and Lorentz's electrodynamics although Einstein said that such extension had consequences which reached beyond itself. In 1904, Marley and Miller repeated Michelson's 1881 experiment and they proved that it was impossible to detect the transitional motion of the earth and the presence of the hypothetical ether through optical methods.[34] This revised the idea of the Newtonian "principle of relativity" as possibly true in electrodynamics as well. Physicists still tried to formulate mathematical equations to reconcile the accepted wave equations for the propagation of light with the Newtonian relativity principle. Lorentz in 1904, offered a solution with his mathematical transformation. This mathematical transformation introduced the idea that, "in different schemes of reference, there are different 'apparent' times which in many ways take the place of the

33 Jeans, *Physics and Philosophy*, p. 127

34 That is, the interferometer. A beam of light from a light source in the interferometer is split into halves at an angle of 90 degrees. A set of mirrors for light interference was used in order to find the velocity of the earth relative to the ether, that is, if the earth has an absolute motion. The result after a series of repeated experiments was that there was no ether, implying that there is no absolute motion of the earth.

'real' time.[35] The Lorentz transformation gives a solution to the relation between two coordinate systems (K and K' representing two sets of space- time values, x, z, z and x', y', z', t') wherein the law of transmission of light in vacuum is supposed to be the same for one and the same light ray for both coordinate systems. The classical Galilean system of equation is altered by substituting x' = x – vt with:

$$x' = \frac{x - vt}{\sqrt{1 - v^2/c^2}}$$

While for the simple equation of Galilean mechanics for time, t' = t, Lorentz substituted:

$$t' = \frac{t - (v/c^2)x}{\sqrt{1 - v^2/c^2}}$$

Hence, it is regarding (the events on) the x- axis and the time factor that Lorentz transformation is centered. C represents the speed of light added as an essential part of the equations.

Einstein however, with his revolutionary Theory of Relativity (special), abolished Lorentz "real" time and suggested that the "apparent" time in Lorentz transformation be the "real" time.[36] Thus, not only time but even Newtonian absolute space (represented by the ether) has been abolished as well since, "all systems of reference that are in uniform translational motion with respect to each other, are equivalent for the description of nature."[37] Thus, mathematically implicit

35 Heisenberg, *Physics and Philosophy*, p.173. The Lorentz transformation deals with a "perfectly definite transformation law for the space-time magnitudes of an event when changing over from one body of reference to another." Albert Einstein, Relativity: The Special and the General Theory, trans., Robert W. Lawson, (New York: Routledge Publishing Press, 1993), p.33. The mathematical equations here indicated are taken and summarized from Einstein's book. One may consult Chapter 11 (the Lorentz Transformation) and Appendix 1 (Simple Derivation of the Lorentz transformation) for simplified explanations of Lorentz transformation. The most important element in Lorentz transformation is the addition of the constant velocity of light, c, in the equation of time. This will be the L- principle, the constant of Einsteinian Relativity.

36 Heisenberg, op.cit., p. 114

37 Ibid.

in the Lorentz transformation was the relativist space- time continuum[38], only later by Einstein was it elaborated.

The two principles of Einstein's Special Theory of Relativity are the following: 1) "Every law of nature which holds good with respect to a coordinate system K must also hold good for any other system K' provided that K and K' are in sufficient movement of translation." With such a principle, Einstein preserves the classical Galilean- Newtonian inertial- system (i.e., system of coordinates in mechanics) 2) The constancy of the velocity of light (L- principle) in a vacuum: "Light in a vacuum has a definite and constant velocity, independent of the velocity of its source."[39] In fact, with the use of this universal constant as light signal, Einstein removes what he claims as the inexactness of the traditional notion of simultaneity. In essence, he does this as he emphasizes a new kinematics. This lack of exactness is described by Einstein as follows: An "event" in space and time has three coordinates (x, y, z) representing three- dimensional characteristics, and a corresponding time t measured by clock C (an ideal periodic process). Being at rest at one point coordinate of the 3rd coordinate system, this C- clock's measurement of time at a certain point- event P (with coordinates x, y, z) is said to be "simultaneous" with point- event P. However, Einstein points this inexactness due to the acceptance of the idea of "simultaneity" without special definition. He says:

> The special theory of relativity removes this lack of precision by defining simultaneity physically with the use of light signals. The time t of the event in P is the reading of the clock C at the time of arrival of a light signal emitted from the event, corrected with respect to the time needed for the light signal to travel the

38 Milic Capek, *The Philosophical Impact of Contemporary Physics*, (Toronto: D. Van Nostrand Company, Inc., 1961), p. 158.

39 These are from Einstein's essay on "Time, Space and Gravitation" Chap. 12 of Out of my Later Years, p. 55. Einstein writes, "For the physical description of natural processes, neither of the reference bodies K, K' is unique as compared with the other." In Relativity, op. cit., p. 62. "If K is a Galilean coordinate system, then every other coordinate system K' is a Galilean one, when, in relation to K, it is in a condition of uniform motion of translation. Relative to K' the mechanical laws of Galilei- Newton hold good exactly as they do with respect to K." p. 15

distance. This correction presumes (postulates) that the velocity of light is constant.[40]

In observing for instance, two lightning strokes, say point event A and point event B occurring on two points R and S, where the middle is T, if one is traversing from point R to point S, s/he would not be statically placed on the middle point T (with a velocity V) and thus, s/he will perceive the lightning (point- event B) earlier because the light will reach him/ her faster as s/he transverses away from point event A (occurring at point R) to the direction of point event B (occurring at point S): For according to Einstein, simultaneity means that the rays of light emitted from A and B meet each other at midpoint T. If one has a static point of reference, in a precised midpoint T than light signals from both A and B would be perceived as simultaneous (based on the reading of clock C).

The second principle of the Special theory of relativity apparently, is incompatible logically with the first principle and Einstein's solution was to introduce a change in kinematics (i.e., physical laws of space and time). With this change, he revealed the intimate connection between space and time. In the succeeding discussions, the researcher will look at how Husserl's transcendental phenomenology looks at this 'spatio- temporal onta' as one of the structures of the pre-predicative experience of the life-world.

With his linking of the 3- dimensional space with a changing time factor, Einstein introduced the four-dimensional space-time: This 4-dimensional space-time may be reasonably said to be private and subjective insofar as it is constructed out of successive instance of one's own experience. But each space- time unity constructed out of the perceptual spaces of every individual will be identical in all of them albeit private and thus, there is a preservation of objectivity[41] and inter-subjectivity. What is emphasized in relativity is the fact that observers are continually altering their perspective from which they view the laws of nature, hence it is "relativized" and consequently, "no one can claim

40 Einstein, *Out of my Later Years*, p. 43. Chapters 8 and 9 of the book Relativity discuss the idea of time in Classical Physics and the Relativity of Simultaneity p. 23- 29. The point is that simultaneity depends on the speed of light which is c = 300, 000 km/ sec.

41 J. Jeans, op. cit., p.64-65

to have a privileged perception of the laws of nature, i.e., one superior to that of observers situated elsewhere."

His paper on the General Theory of Relativity (1915) primarily answers Newton's mysterious and unanswered nature of gravity. Einstein here uses the Special Theory of Relativity so that "with such a generalization, the coordinates can no longer be interpreted directly as the results of measurements."[42] He suggests the admission of curvilinear coordinate systems. Then, finding the 4-dimensional space-time unity (i.e., the inseparable space and time) as the most suitable grounding, he provides an explanation for the phenomenon of gravitation: the presence of the sun (a gravitating mass traversing a "world line", i.e., a line obtained by connecting various points of space at various points in time) in space-time continuum impresses a curvature on the continuum in the proximity of the point in space-time continuum occupied by the sun itself.[43] Hence, the curvature of the planets around the sun reflects the space-time continuum's curvature (caused by the sun's mass). Sir James Jeans sees the differences between Newton's and Einstein's conception of the planets' path around the sun: "Newton thought that a planet followed a curved path in a straight (flat) space: the theory of relativity pictures it as following a straight path in a curved space."

Einstein suggested the hypothesis that gravitational forces are due to the properties of empty space – i.e., the 4-dimensional space-time unity and not merely 3-dimensional space – and consequently that the properties of space must be influenced by the masses.[44] To state, thus, the laws of physics, the necessity for Galilean-Newtonian reference system has to be abandoned, although Einstein admits that the origin of the general theory of relativity is an attempt to explain a fact that is known since Galileo's and Newton's time: the correspondence between inertia and weight as measured by one and the same number, from such a correspondence between inertia and weight as measured by one and the same number, from such a correspondence, he came

42 Einstein, *Out of My Later Years*, p. 46

43 Non-technical explanation can be found in J. Jeans book, op. cit., p. 117-119.

44 Heisenberg, *Physics and Philosophy*, op. cit. p. 133. For Einstein, however, his own pursuit to explain the force of gravity was, "harder than was expected, because it contradicted Euclidean geometry." Einstein, Out of my Later Years, p.57.

up with the principle of equivalence." It is impossible to discover by experiment, whether a given system of coordinates is accelerated or whether its motion is straight and uniform and the observed effects are due to a gravitational field."[45] He also tells us that the presupposition of a mysterious property of physical space, supplying the necessity for a coordinate system was the weak point of Galilean- Newtonian mechanics. But Einstein nevertheless, recognizes the limits of the relativity theory:

> …This theory...has not up till now supplied an explanation of the atomistic structure of matter. This failure has probably some connection with the fact that so far, it has contributed nothing to the understanding of quantum phenomena.[46]

The revolution in atomic physics was to be accomplished in the Copenhagen Interpretation of Quantum Theory, with Heisenberg's Principle of Indeterminacy.

With Planck's research on the radiating atom and his Theory of quanta, the element of uncertainty came into physics for his discovery of the discontinuous transfer of energy brings a statistical character to quantum theory.[47] Bohr's combination of Planck's quantum theory and Rutherford's planetary model of the atom has also initiated the subsequent intense research among physicists. After his successful experiment on the hydrogen atom through which he was able to fit his atoms model (i.e., the Rutherford-Bohr model) into the readily measured and known spectrum of atomic radiation, through his predictions of the atomic frequencies (which can be spontaneously emitted by the hydrogen atom), Bohr provided an instant relief. However, in the following years, the contradictions implicit in this semi-classical atomic model began to surface and from then on, with the sufficient experimental material which was provided by spectroscopy, many experiments were done, and physicists learned to ask the right questions.[48]

45 Ibid. p.105.

46 Ibid., p. 106.

47 Heisenberg, *Physicists's Conception of Nature*, p. 38.

48 Heisenberg, *Physics and Philosophy,* p. 34-35.

In 1924, de Broglie asked, although initially caught only minimal attention with it, "why not extend Einstein's earlier introduction of the ideal characteristic of light (the Photoelectric Effect of 1905) to matter in dualistic nature of electrons?"[49] The first developed from Bohr's principle of correspondence and in 1925, it led to the formalism which is called matrix mechanics or quantum mechanics. The second formulation was developed from Schrodinger's dissatisfaction with de Broglie's idea and thus, he set up a wave equation through a mathematical analysis of matter waves (known as wave mechanics). Later on , he proved the mathematical equivalence of his mechanics with the earlier formulation of quantum mechanics. And yet with Schrodinger's attempt to abandon the ideas of quantum jumps and quanta through his "matter waves" replacing these, still the paradoxes of the particle-wave dualism of the character of matter were not solved.

The final solution was given in 1927 with the consistent interpretation of quantum theory. The simultaneous attempts to provide solution were not only proven to be consistent but also, ultimately recognized as identical despite the different mathematical techniques employed. The interpretation is now called the Copenhagen Interpretation.[50] In the Copenhagen Interpretation, Schrodinger, Bohr, and Heisenberg discovered that the matter wave is "a measure of the probability with which the electron can be located."[51] As Heisenberg says, "with the mathematical formulation of quantum theoretical laws, pure determinism had to be abandoned."[52] "Why would pure determinism have to be abandoned?"

This problem of the spread of wave packet of matter wave made Heisenberg call the foundations of Classical Physics into question.[53] Pure determinism had to be abandoned as Heisenberg does this inquiry, for his Principle of Indeterminacy states our inability to determine (or have knowledge of) both the position and the velocity (i.e., the momentum)

49 Blin-Stoyle, op. cit., p.57.

50 Heisenberg, *Physics and Philosophy*, p. 38-43.

51 Blin-Stoyle, p.60.

52 Heisenberg, *The Physicist's Conception of Nature,* p.34.

53 Omnes classifies Heisenberg as one of the young physicists who did "The Assassination of Classical Physics" in his book *Quantum Philosophy* (p. 140-144) with de Broglie, Pauli, Dirac, with older ones as Bohr and Schrodinger.

of any sub- atomic particle simultaneously.[54] When Planck introduced a statistical character to physics with his theory of quanta, Heisenberg assumes a radical position in the Copenhagen Interpretation of quantum theory with his Uncertainty Relations. Heisenberg affirms this statistical character of quantum theory:

> We can express the departure from previous forms of physics by means of the so- called uncertainty relations. It was discovered that it was impossible to determine simultaneously both the position and the velocity of an atomic particle with any prescribed degree of accuracy. We can either measure the position very accurately- when the action of the instrument used for the observation obscures our knowledge of the velocity; or we can make accurate measurements of the velocity and forego knowledge of the position.[55]

This is, of course, contrary to classical Galilean-Newtonian physics were both the velocities and positions ought to be determined at a particular moment to give a full description of a system. Accurate localization in space of an electron necessitates the illumination of an electron with a light wave of short wavelength, but this short wavelength represent a photon of high energy. However, this high-energy photon will change the momentum of the electron in an unknown manner. On the other hand, a photon of lower energy and thus, of a longer wave length, while allowing an accurate measure of momentum also entails sacrificing the accuracy of measuring the electron's position.[56] Einstein remarks that quantum theory differs from all previous physical theories insofar as it does not give a model description of actual space-time events but "probability and distributions for possible measurements as functions of time."[57] Einstein also comments on the implication of the Uncertainty Relations in terms of causality:

> Heisenberg has convincingly shown, from an empirical point of view, any decision as to rigorously deterministic structure of

54 Milic Capek, from his book; under the whole section "The End of the Laplacean Illusion" (p. 289-332)

55 Heisenberg, *The Physicist's Conception of Nature*, p.39-40.

56 Turning Points in Physics, p.61.

57 Einstein, *Out of My Later Years*, p. 109.

> nature is definitely ruled out, because of the atomistic structure of our experimental apparatus. Thus, it is probably out of the question that any future knowledge can compel physics again to relinquish our present statistical theoretical foundation in favour of a deterministic one which would deal directly with physical reality.[58]

For Heisenberg, "it is an indication of an ultimate limitation on our ability to fix all of the properties of a system to an arbitrary exactness by any experimental technique."[59] Any measurement of a system entails the disturbance of that system, that if we can determine one quantity precisely, other conjugate quantities cannot be known. Such inevitable interference or disturbance of a system, moreover, cannot be reduced through any physical means for it accompanies any attempt at a description of a system and and also determines a value of a given property.[60] Thus, from Heisenberg's perspective, the uncertainty lies in the lack of ability to discern the exact values of two given properties of a system simultaneously, which is resulting from the fact that measuring disturbs the system itself (This can be considered as a kind of principle of self- destruction.) Bohr, however, took a step further being dissatisfied with Heisenberg's perspective: The limitation, the uncertainty lies not in our inability but in the "spread- out" characteristic feature of the classical values of a system. Hence, while Heisenberg's uncertainty is founded on our activity of knowing (i.e., epistemological), on the other hand for Niels Bohr, it is an attribute of the object of knowing (i.e., ontological).

58 Ibid., p.109-110

59 Lawrence Sklar, *Philosophy of Physics*, p.177. "It is important to recognize that quantum theory has nothing in it that can be regarded as a description of qualities or properties of nature that are located at the point of infinitesimal regions of the space- time continuum…They are not, strictly speaking, descriptions of the external things in themselves. Moreover, they are not descriptions of microscopic qualities or properties." Henry P. Stapp, Mind, Matter and Quantum Mechanics (Berlin: Springer- Verlag, 1993) p.65.

60 Ibid., p. 178.

3) Husserl's Conception of The Crisis and of the Life- world (Lebenswelt)

The belief in the intelligibility on an external world, that man can know an objective world resulted to the mechanistic worldview of Galilean-Newtonian/ Classical physics and to its mathematization or idealization of the "physis" or nature (L. *natura*). But most of all, it all resulted to the Crisis of European civilization. When Husserl speaks of the Crisis, he speaks of three kinds – the separation of the crisis of philosophy and the crisis of culture.[61] Ultimately, all three are the results of the kind of thinking of modern science which is the traditional thinking that Husserl hopes to counter. This peculiar traditional thinking, (objectivist- rationalist) is also that which Heidegger criticizes in his Post-Being and Time writings. Husserl proposes a return to the *Lebenswelt* and thinks of transcendental phenomenology as the proper method for a reformed (i.e., renewed) psychology, instead of psychology adapting itself to the objectivism of the natural sciences.[62]

> In fact, for a genuine psychology, and for the exactness which belongs essentially to it, transcendental philosophy plays the role of the *a priori* science to which it must have recourse in all its actually psychological knowledge, the science whose *a priori* structural concepts it must utilize in its mundane inquiry.[63]

And then from the rectification of the sciences with their peculiar thinking, a remedy for the Crisis of culture itself will be arrived at. Husserl's conception of *lebenswelt* must be seen from the context of his critique or modernity and thus giving his starting point a reactive

61 In his comparative study of Husserl and Heidegger, R. Philip Buckley discusses these crises. Husserl, Heidegger and the Crisis of Philosophical Responsibility (Dordrecht: Kluwer Academic Publishers, 1992) Chapter One, p.9-33.

62 John B. Watson and B.F. Skinner are some who launched the behaviourist movement in psychology imitating classical physics. Sociology was also launched by Auguste Comte, a study of society also imitating the method of Classical physics.

63 Husserl, *The Crisis.* P.260.

hue (i.e., not initially constructive/ systematic) paralleling Einstein's and Heisenberg's correction of the loopholes of Classical Physics.[64]

At the outset of his project, Husserl says that the problem is not about the method of science as such, not its scientific character for everyone knows the success of the sciences, but the problem is precisely, "what science in general, had meant and could mean for human existence"[65] Heidegger and Husserl thus, have similar thoughts regarding this modification of the real by modern/ classical science. But while Heidegger's emphasis is on the unfolding or presencing of Being (*Sein*), Husserl's emphasis is on the subject[66]. For this reason, the concept of *lebenswelt* is central in his crisis philosophy.

Husserl rightly says that the Renaissance took over the ancient emphasis on Reason- and its metaphysical questions. "Reason is the explicit theme in the disciplines concerning knowledge" (Crisis, p.9) and these questions do surpass the realm of mere facts which are of a lower, inferior level. Sections 4-6 (p. 10-16) center on Husserl's lamentations on the lost belief in reason which amounts to nothing less than loss of faith in humanity's own true being, meaning of history, human freedom, and rational existence. Thus, modern philosophy became a struggle for meaning. Are we really the *animal rationale?* The possibility of philosophy for Husserl, is something intrinsic in us that we cannot let it

64 Husserl confides to his readers: "Perhaps it will even become manifest that the total phenomenological attitude and the epoché belonging to it are destined in essence to effect, at first, a complete personal transformation, comparable in the beginning to a religious conversion, which then, however, over and above this, bears within itself, the significance of the greatest existential transformation which is assigned as a task to mankind as such." Crisis, p.137.

65 Crisis, p. 5, sec. 2. Hence its heading "The positivistic reduction of the idea of science to mere factual science, The Crisis of Science as the loss of its meaning for life."

66 Hence, in Being and Time, Heidegger uses *Da-sein* (Human reality) only as a point of entry to the discussion of the Temporality of Being. Heidegger uses phenomenology as a method to raise the Question of Being, following initially but ultimately straying away from Husserl. Jean-Luc Marion emphasizes such difference of concerns and goals of Heidegger and Husserl although not entirely different as well (in Reduction and Given-ness)

go and thus, he thinks of philosophers as "functionaries" of mankind."[67] And in phenomenology, the authentic idea of a universal philosophy is manifested and hence, philosophy becomes a rigorous science. Husserl looks at history to see what caused the failure of modernity when, in fact, the renaissance revival of the ancients was initially a successful endeavor of knowing.

Husserl thinks that in the history of modern philosophy, there is implicitly a "completely new way of assessing the objectivity of the world and its whole ontic meaning." Hence, he tried to define his use of the word "transcendental": to see subjectivity as the primal source, "locus of all objective formations of sense and ontic validities" and thus, his philosophy is an inquiry back into the ultimate source of all the formations of knowledge. Healthy and genuine rationality for Husserl is a turning away from the naturalistic attitude, from objectivism which for him is a naiveté. How come objectivism is a naiveté? We know that the answer to this question is the very reason why Husserl tells us to "return to the ego."

In the Vienna lecture, he characterizes the theoretical attitude, that despite its apparent contrast to the mythical attitude (or natural attitude)[68], the two are the same because both presuppose man as a "non- participating spectator" of the world. If we understand "participating or non-participating spectator" in the traditional-realistic sense, the subject that produces replicas, and mirror images in the mind (concepts) then, this means that we may be misinterpreting Husserl. He is giving a new definition of objectivity, meaning, and validity through the recognition of the "constituting subject" that follows the Kantian-

67 Husserl's point is to make philosophy (as a rigorous science or universal science under which all sciences are to be subsumed, a kind of *scientia scientiarum*) applicable or connected to life again, to make philosophers not stay in their "ivory towers" as Marx says. The ancient Greeks down to the Hellenists treated philosophy as a therapy for the diseases of the soul and Husserl seems to be following, indeed continuing this kind of therapeutic philosophy that is also in line with the Renaissance revival of ancient philosophy.

68 Husserl sometimes calls mythical attitude as "natural attitude" although "natural attitude" is more accurately the "naturalistic attitude" of modern science. Natural attitude in the Vienna lectures is equated with the pre- scientific thinking or thinking before the Greek cosmologists' theoretical, reason-speculating attitude. Hence the theoretical attitude is more of the naturalistic attitude, p. 292.

Copernican revolution. The objectivism of modernity presupposes a non- participating spectator and Husserl's aim is not just to place the spectator and the world as two self- subsisting entities side by side, affecting each other "externally."[69] Husserl therefore, accuses the scientific objectivism of modernity: "Since the intuitively given surrounding world, this merely subjective real, is forgotten in scientific investigation, the working subject is himself forgotten." (Crisis, p.245)

4) Reflections on Einstein's Relativity, Quantum Physics and a New Rationality

It is evident that as early as the time of Planck, the deterministic laws and postulates of Mechanistic- Classical Physics, necessarily acquired a questionable status because of the discrepancy between the theory and the results of experiments/ empirical data. While Copernicus, Kepler, and Galileo founded the "mathematization" and thus, the "idealization" of (the endeavour of knowing providing a new manner of looking at the world and the method of knowing), and Descartes provided the dichotomic metaphysics of the subject vs. object resulted to what Husserl calls the naturalistic attitude, an objectivist "exacting" mind which had a break down by the end of the 1800's. First of this series of breakdown are the laws for radiation and heat: Known laws for radiation and heat were found to be inapplicable to explain Blackbody Radiation. The gravitation of matter, calling into question the structure of atoms and the uniformity of nature, however, although a novel discovery, was not something that Planck was too ready to accept. Even Niels Bohr tried to explain the enormous stability of atoms when Rutherford's model failed to explain it, preserving Kepler's classical elliptical orbit (using it for electrons) while synthesizing the precedent findings of Planck and Rutherford. Although eventually, Bohr, with Heisenberg, was to cause shock with the Copenhagen Interpretation of

69 Husserl does not see simple psychological reflection capable of resolving the crisis caused by objectivism. The world and subjectivity are not two self-enclosed entities. This should be understood from the context of the equiprimordiality of both: "This is not the subjectivity of psychological reflection, of a subject perceiving itself situated in the presence of the world as already complete… but as a subjectivity bearing within itself and achieving all of the possible operations to which this world owes its becoming," E. Husserl, Experience and Judgment: Investigations in a Genealogy of Logic, p. 48-49.

sub- atomic reality, Bohr himself, as much as possible, tried to maintain connection with Classical Physics. However, as soon as the atomicity of radiation occurred, our commitment to the uniformity of nature with its laws of causality had to be given up. And with Einstein and Heisenberg, this emerging new perspective of looking at ourselves and at the world almost came to completion.

Sir James Jeans[70], in agreement with Heisenberg, says that the Theory of Relativity and the Principle of Indeterminacy have recognized the necessity of looking at the subject and the object in a different way from that of classical physics. He points out that classical physics' division of two detached realities – the perceiving subject and the perceived object- was found to be unhealthy. In Einstein's relativity, each one of us (as an observer) creates a picture of the world that is to a certain degree, subjective or, "relativized" to everyone. In the theory of quanta, the classical division between the subject and the object is negated, and absolute objectivity as well. Perception of the man-sized world is different from the sub- atomic level. From here it follows that the laws of causality cannot apply at the sub-atomic level and we cannot hold on to a complete deterministic-mechanical view of the world that is based on causality. We can also see more clearly that this subject- object dichotomy of classical physics is a consequence of an implicit worldview of metaphysics, if you will, as we try to put the two contemporary theories, viz., Relativity and Principle of Indeterminacy, vis-à-vis the new perspective that is taken up by Husserlian Transcendental Phenomenology. I tend to see that the new way of looking at reality of this early 20th century Philosophical school resembles to great extent, the implicit view of reality behind the revolutionary thoughts of Einstein and Heisenberg.[71]

First, according to Dr. Kockelmans, the starting point of Einstein's Theory of Relativity, "lies in a very refined critique of a few fundamental postulates of classical physics" (p.111). Such a critique became

70 Physics and Philosophy, Chapter V "The New Physics" p. 143-152.

71 I based my reflections partly on the analysis made by Dr. Kockelmans of Einstein's Relativity from the perspective of phenomenology in his book Phenomenology and Physical Science: An Introduction to the Philosophy of Physical Science and on Heisenberg's own reflections in his books cited here and on the expository study on Husserl's transcendental phenomenology at the Third Part of this paper.

necessary when experiments conducted were found out to be not in agreement with classical physics' earlier postulates. Yet, in Einstein's critique, he started with the idea that the only experimental datum to be considered is what is supplied numerically through the measurement of instruments and hence, to speak of any *a priori* absolutes (which are un- observable), not subject to the operational method is to be unreasonable. In other words, contemporary physics, through the works of various physicists and ultimately through Einstein's genius, was able to do away with "unverifiable absolutes." In Husserl's evaluation, these are the "idealizations". In the same way, Husserl puts into epoché this idealized world of mechanistic classical mechanics. We are reminded that the hypothetical ether (through which the propagation of light was said to take place) was proven to be non- existent and superfluous through the interferometer. The principle of equivalence of all inertial systems, later as stated by Einstein, moreover, proved the superfluity of the ether hypothesis (in Einstein, Relativity, p.152). Einstein thought of substituting the "apparent" time in Lorentz transformation, preceding his Relativity theory as the "real" time, while doing away with any Newtonian absolute time, because this is precisely the only sense of time.

Moreover, Einstein uses the L- principle to modify our accepted, yet inexact notion of "simultaneity", as a constant. Insofar as the classical concept of simultaneity had no special definition, it only rested on the *a priori* presupposition of Newtonian absolute space. These are some of the modifications being introduced by Einstein when he tried to make up for the inadequacies of the older physics. [72] One of the major ideas abolished was that of absolute space, together with absolute time. In Newtonian physics, these ideas have a dual role:

> First, they play the part of carrier or frame for things that happen in physics, in reference to which events are described by the space coordinates and the time. In principle, matter is thought of as consisting of "material points", the motion of which constitute physical happening… The second role of space and time was that of being an "inertial frame". From all conceivable systems

72 Einstein writes: "The theory of relativity arose out of efforts to improve, with reference to logical economy, the foundation of physics as it existed at the turn of the century." Out of My Later Years, p. 104.

of reference, inertial systems were considered to be advantages in that, with respect to them, the law of inertia claimed validity.

In this, the essential thing is that "physical reality", thought of as being independent of the subjects experiencing it, was conceived of consisting, at least in principle, of space and time on one hand, and of permanently existing material points moving with respect to space and time, on the other. The idea of the independent existence of space and time can be expressed drastically in this way: If matters were to disappear, space and time alone would remain behind (as a kind of stage for physical happening) – Relativity, p.146-155.

Here, Einstein implies the exclusion of any subjective dimension that results to what was mentioned earlier. Physical occurrence or event is reduced to an object defined by material points giving it a definite outline in 3- dimensional space, a kind of Heideggerian "en-framing". These two absolute and independent ideas of classical physics exist even without particular object or any subject. And yet, in abolishing these absolutes through relativity, one cannot assume that there is no such thing as space or that any spatial distance we see around us is mere illusion. This would be to misunderstand Einstein's claim.[73]

Through this standpoint, the either-or of Newtonian absolute, static space, and the illogical idea of an illusory space or non-existence of space can ignored if the idea that the spatio-temporal onta will be retained and if it is not the measured localization frame that is independent of matter and of the perception of a subject (i.e., consciousness): if it is the formal structure of the Husserlian life-world (*lebenswelt)* which actually could help in grasping the Einsteinian four-dimensional space-time, as "constituted" by the subject. In Einsteinian physics, this can be termed as "scheme of reference" that constitutes the perceptual spaces which continually alter due to our altering perspectives and yet remain the same insofar as consciousness is an intentional lived experience. This intentionality of lived experience is

73 Heisenberg gives this warning: "…the idea of absolute space has been abandoned. But such a statement has to be accepted with great caution. It is true that one cannot point to a special frame of reference in which the substance ether is at rest and which could therefore deserve the name "absolute space". But it could be wrong to say that space has now lost all of its physical properties." Physics and Philosophy, p. 120.

something forgotten by Classical physics for it places the whole weight of the world only on one side of the *noesis-noema* correlation: the world is objective, independent of any subject.

Another necessary consequence of the negation of the *a priori* absolute time was that the element of time had to be added as a fourth dimension to 3-dimensional space. But even here in Einstein's new kinematics, it cannot be assumed that any sense of duration of "before" and "after" has been negated. It can be gleaned that in assuming such a way of looking at the reality of the world, Einstein could be taking up a phenomenological perspective. The subjective element is Einstein's notion of space-time is founded on the reality that observers are subjects to which the world appears as a phenomenon. The world, the external reality that is being encountered as a phenomenon in general (insofar as it appears in sensible intuition, in the intentionality of consciousness) is encountered only in relation to us. Hence, there is no privileged frame of reference or a privileged perception of the laws of nature: The very existence, upsurge of consciousness entails the equiprimordial existence of a correlate of consciousness.

Secondly, in evaluating Classical physics and the roots of the Crisis, Husserl is in complete agreement with Heisenberg as both of them point out the Cartesian influence serving as the powerful impetus towards the mechanistic conception of the world.[74] Modern science started its career thinking that nature, as God's creation, cannot be explored independently of God but Descartes provided a metaphysics behind the mathematical methods of Kepler and Galileo, when he emphasized extension and measurement, and ultimately, the concept of a Creator behind the world became superfluous in a mechanical universe. Modern science, with its mechanistic worldview and mathematical method gradually aspired for its own criteria to be used in all other kinds of knowledge: This scientism is acutely opposed by Husserl. He pointed out that Descartes was the first thinker to aspire such synthesis (Kockelmans, p.73, Crisis, Sec. 6 and the ff.). Heisenberg notes that Descartes, "the first great philosophy of this new period of science" (Physics and Philosophy, p. 77) introduced a division between God and the World, between God and Man and between Man and the

74 Heisenberg devotes Chapter 5 of his book to discussing Descartes: "The development of Philosophical Ideas since Descartes in comparison with the New Situation in Quantum Theory" (p.76- 92), In *Physics and Philosophy*.

World. Modern science considered only, moreover, the *res extensa* (the mathematical, measurable) and viewed in a derogative way as simply "unscientific" anything immeasurable. In other words, "quantities" were the only true statements about the world and all "qualities" had become mere subjective perceptions, untrue, and non-objective.[75] One would agree with Heisenberg when he observes that Classical physics, following the Cartesian project and Galilean method, has exorcised not just God but also man as observer, the one who perceives the world: Modern science inherited the Cartesian partition. Even Newtonian mechanics was founded on this fundamental assumption, that it is possible to arrive at an absolute knowledge (termed as "objective", presupposing a distinction of subject and object) of the world without (speaking about) God or any subjective aspect. In the advent of the 20th century physics, however, Einstein and Heisenberg posed the question regarding this Cartesian partition: Is there really such a partition that renders us capable of knowing a mechanical working of nature? Is nature really mechanical down to its minute details? Obviously, the "perfect correspondence" between man and the world presupposes an admission of the Cartesian dichotomy between the subject and the object.

Heisenberg, coming from a similar line of thought with that of an existential phenomenologist, points out the inevitable role of man in the act of knowing the world:

"We cannot disregard the fact that natural science is formed by men. Natural Science does not simply describe and explain nature; it is part of the interplay between nature and us; it describes nature as exposed to our method of questioning. This was a possibility of which Descartes could not have thought, but it makes the sharp separation between the world and I impossible."[76]

75 The distinction between primary and secondary qualities have led to the degradation of poetry, literature, as we all know.

76 *Physics and Philosophy*, p.81. Dr. Kockelmans' remarks regarding the change of mentality of 20th century physics, "Undoubtedly also, Heisenberg's Uncertainty Relations have exercised a certain influence on the change of mentality" (Phenomenology and Physical Science, p. 80. He discusses intentionality and existence (Chapter III) and the Method of Phenomenology (ChapterII); p. 30-69

One does not simply observe to determine the position and momentum of a sub-atomic particle (while these two required values of classical physics are a consequence of the mathematization of knowledge, of space and of time): Rather, it is through the illumination of either a short or long wavelength that we are able to determine one value among the two required values of momentum and position. Natural science with its required values for determining a system, the method of knowing is "formed by men": We lay down in advance what we require (and thus, include not what is not required) of nature, before nature is examined. Following are the four violated realizations that were pointed out earlier in the Husserlian series of epoché (bracketing), namely:

1) that there is always a pre-given world as ground for all knowledge;

2) that the ego is not the starting point, grounding the existence of extra- mental reality;

3) (paradoxically) that the ontic meaning of the world is constituted by the ego and not discovered through mathematico-logical methods; and

4) the world and the ego are correlative, equiprimordial.

The Cartesian partition does not posit statement 1 because it posits statement 2, when this is also adapted by the Galilean-Newtonian method of knowing (that is statement 2 in its affirmative form). This means that for the Cartesian-Galilean-Newtonian mind, the question of the truth of an external world depends on the satisfaction of the requirements by the world which are the requirements being laid down by the logico-mathematical mind. These requirements serve as ground, for establishing and proving an extra- mental/ real world. Husserl, Heisenberg, and Einstein on the contrary, recognize the truth of statement 1 because even our mathematico-logical requirements and idealized abstract shapes of geometry all have their origin in the concrete pre-scientific world, hence the world is the ground for all knowledge: a) as to knowledge's historical origin and b) as to the horizon of any human experience of particular objects. The world, Husserl contends, is singular, a phenomenon in general insofar as it is a correlate in intentionally lived consciousness. With regards to statement 3, this is denied by the confused objectivism of Classical physics: any

scientific equation and/or logical statement is said to be "discovered" and the subjective component denied, while self-contradictorily: when classical physics and Cartesian metaphysics affirm the affirmative of statement 2 is not this an admission of the subjective component?

The external reality and the human subject are correlative not in the sense of two self-enclosed substances; man on one side, world on the other side, statement 4 can be stated more accurately: when we assert the equiprimordial existence of the subjective and the objective, it means that the concept of "world" as a mere correlate/ phenomenon "happens" or comes-to-be because of seamless meeting of the subjective and the objective. For Classical physics, the world is ready- made apart from any subjective dimension, for this subjective dimension becomes not anymore, a source of weakness of knowledge (which cannot be only humans) only when human experience of the world has the intentionality of consciousness for its starting point.

It is therefore agreeable if one would assert that the scandal caused by the Indeterminacy Principle is rooted in the fact that Classical physics is a whole system while Quantum theory still uses the Categories of Classical physics itself, it has no categories of its own. This is explicitly said by Heisenberg when he says: 1) that we cannot just discard the concepts of Galilean-Newtonian physics and then try to formulate another set or system of concepts 2) that the Copenhagen interpretation of Quantum Theory starts from a paradox[77]. The Indeterminacy Principle appears scandalous to a mind that is still entangled in the deterministic-mechanistic physics, for underlying this, are the *a priori* presuppositions and dichotomies which are exactly questioned by the 20th century physics. But looking through the perspective of Husserlian phenomenology, one can get rid of any Cartesian Anxiety.

Thirdly, with regards to the meaning of the "world" from the viewpoint of Classical and Contemporary physics, it is evident that the limitations of the former necessitates a radical change of our

77 Chapter III, Heisenberg's discussion on the Copenhagen Interpretation of Quantum Theory, p. 44-58. Even when we look at Modern Philosophy, the Categories have been borrowed as well from both Medieval and Ancient philosophical categories. This is due to the fact that we all work within a vast historical tradition.

traditional concepts of "truth" and "meaning". Einstein and Heisenberg have seen the limits of classical physics that resulted from too much commitment to an objectivist-mathematical approach in interpreting reality and causality. All these presuppose a static view of reality: as Newton's absolute space and absolute time, by which Euclidean geometry could function. The determination thus, of both position and momentum became a necessity in knowing a system. But these standards of Classical physics which serve as our standards of knowing the world do rest on the premise that, we have known, that there is an objective word which is fully explicable by an ideal observer which is implicitly "us". But again, who is this, the ideal observer, if it were not "us" who are individuals, each occupying certain limited perspectives by which an encounter with an external world happens? But it is true that the appearance of the world (phenomena) appears to a particular concretized consciousness (through physical body), not to one who is an ideal observer. Just as being- man implies an essential relation to the world (escaping idealism and Cartesian solipsism) so the very concept of the world implies an essential relation to man: this is a consistent application of Husserlian intentionality.

Just as we must see that, "there is nothing in man that escapes from his "being-in-the- world" and "no matter how deep one penetrates into human subjectivity, he will always find the world there, since the world permeates the very heart of subjectivity" (Kockelmans, p. 61). We must acknowledge as well, by stating inversely, that no matter how deep one penetrates into the world to discover any laws of causality and determinism, man will always find himself as an observer to which the external world is connected. There is no mechanical-deterministic law in the world that escapes from it, being a world, in relation to human consciousness. Hence, agreeing in these basic tenets of thought of phenomenology, "meaning" itself would yield a different character. It would not be some objective laws discovered as workings of a merely indifferent and mechanical universe by an ideal unaffected observer. Meaning and truth will not come solely from consciousness (as in idealism) nor from outside consciousness alone (as an objective realism).[78] Meaning is "constituted"and created as a meeting of both *noesis- noema* – ontic meaning presupposes an intentional structure.

78 "It is man's living of this fundamental intentionality that meaning originates. Meaning is the result of the encounter between man and the world, an encounter in which both are essentially involved." (Kockelmans, p.63)

Finally, this study would like to dwell now on the more philosophical aspects of Husserlian thought that will provide a corrective notion of rationality, that in turn hopefully, would provide a hint on how to escape the now standard scientific mentality (in terms of goals and methods) that we have (paving the way for technocracy, environmental destruction, loss of belief in God, ethics and metaphysics) which ultimately, Nietzsche did forecast, will inevitably end in nihilism (*nihilo*: nothingness). But before surrendering to our nihilistic fate, this question must be asked first: What then is the corrective notion of rationality in Husserl's transcendental phenomenology which, as realized in this discussion, is already implicitly contained in Einstein's Theory of Relativity and Heisenberg's Indeterminacy Principle, with regards to the relation of human beings to the world? Husserl, saying that there is already an implicit *telos* (goal, purpose) in the whole history of European philosophy/ science, has already outlined his corrective notion of rationality by pointing out the misconstrued philosophies of, primarily, Descartes and Kant, and carrying to its extreme (in a manner that is different from Hegelian Idealism), Kant's transcendental approach. It is a rationality that is different from that of the Enlightenment, not that of naïve naturalism not scientific objectivism. It is then a rationality that has the intentional structure of the subject (consciousness) as its central thesis. The word "transcendental" in transcendental phenomenology connotes "something of which consciousness is always consciousness- of" (a correlate). Neither the subject nor the object is first given on the ontic level without one or the other. Correlation means a coming-to-be of both (constitution) and not merely two substances (self and nature) that are externally posited in front of each other, and then the mind discovers the internal workings of things (logico-mathematical laws). Meaning is constantly created in the Husserlian transcendental phenomenology, and this is to be understood as the opposite of idealizations of objectivistic sciences and of modern philosophy. Idealizations are logical constructions that sever us from and make us forget the life- world (of everyday living). Meaning is not the idealizations and mathematical formulae of the natural sciences that can make us successful to predict or manipulate future events (the basis of modern technology). This is the same point where Husserl says that

he characterizes logic having lost its original mission or sense and has become a mere *techné* for natural sciences.[79]

The attainment of a rigorous science is a humanized science, against the de-humanizing idealizations (which has disenchanted the natural environment) of the successful dominant and exact sciences. For Husserl, The Crisis then, is not an inner logic of modernity towards nihilism. This rationality proposed by phenomenology can be seen as realiable in providing a foundation of a rigorous science but is not based on the traditional abstract-deductive one, that albeit exact due to its mathematical-logical language, fails to answer every question of human life: it is therefore, a humanized rationality. This seems to be implied in the metaphysics in Einstein's Relativity and Heisenberg's Indeterminacy Principle.

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79 Edmund Husserl, Analyses Concerning Passive and Active Synthesis (See bibliography). Part I, preliminary considerations, p.1-38. Here, Husserl, preceding The Crisis, already tells us about a need to have a science of the subject, the original meaning and function of a broader logic and science of logic vs. the technical logic subsumed under modern science and philosophy. Husserl starts an investigation (preliminary one, which he expounds on subsequent chapters) of perception, ideality of linguistic phenomena, constitution of sense in lived experiences as originating from the ego.

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