

Chapter 1: Introduction

1.1 Kant's Philosophy of Physics

Immanuel Kant (1724–1804) was a philosopher of science because he deals with the general question of the possibility of synthetic *a priori* judgments in subjects like physics, mathematics and metaphysics. Kant's philosophical insights have influenced developments in philosophy of science, philosophy of physics in particular¹. This makes him very significant in the history of philosophy of physics.

Kant has brought the relationship between the human mind and objects of experience in focus in his philosophy (in asking how an object conforms to our way of knowing)². He has revolutionized philosophical thinking by arranging the marriage between understanding and sensibility. His reconciliation of

¹Kant's philosophy of physics helps to understand the philosophy of his predecessors like (to name a few) René Descartes, Benedict or Baruch Spinoza, Gottfried Wilhelm Leibniz, John Locke, David Hume, Christian Freiherr Von Wolff and the later philosophers like James Clark Maxwell, Bertrand Russell, Alfred North Whitehead, Ludwig Wittgenstein, Georg Wilhelm Friedrich Hegel, Edmund Husserl, Martin Heidegger, Hans-Georg Gadamer and many others, and scientists like Isaac Newton, Albert Einstein, Neil Bohr, Werner Heisenberg, Max Plank, Henry Poincare, Stephen Hawking, Lawrence M. Krauss and many others.

²The uniformity of nature is the uniformity of mind. So long as our sensibility and understanding remain the same, space, time and categories form the foundation of human knowledge.

Rationalism and Empiricism has given rise to a novel theory which is famously known as the 'Critical Theory of Knowledge'.

Philosophers before Kant, in their theories, required the mind to conform to the objects, but he was the first philosopher who said that the object must conform to the structure of the cognitive mind and opened the scope of human reason. He has epistemologically built a bridge between human reason and nature by asking how the objects of experience conform to our ways of knowing. Kant, in this process, has constructed a critical (or transcendental) system of concepts and a philosophical model (or transcendental model) of a special kind, the consequence of which is his philosophy of science. What he has done in philosophy throughout his life is no less a contribution to scientific work than that by a scientist. We realize this when we study him seriously in relation to his philosophy keeping in mind the background of his contemporary philosophical and scientific developments.

This philosopher who never left his hometown was a great mind adventurer. Kant's philosophical thoughts have transcended every geographical boundary. His philosophical thoughts were beyond his time. He always maintained that scientific knowledge involving theories and hypotheses is, to some extent, tentative. Theoretical physics as a human construction requires improvement and modification from time to time. Experimental sciences also cannot be regarded as free from this character.

Kant, from the very beginning of his career as a part-time professor at the University of Königsberg, was interested in teaching subjects that were related to science. He was very interested in dealing with the problems of epistemology that had important implications in science. The development of Kant's philosophy of science can be divided broadly into three stages: (a) Pre-critical Period, (b) Critical Period and (c) Post-critical Period. Kant in his pre-critical period was thinking and writing on subjects like geography, physics, logic, mathematics and metaphysics. We get some idea of his transcendental philosophy in a premature form even in his works of the pre-critical period and developed ones in the critical period. Kant continuously kept growing in his philosophical thoughts which later made him a great philosopher. How he was interested in the philosophy of science and engaged himself with it is evident from his formulation of the 'Nebular Hypothesis', which is now often called 'Kant-Laplace Hypothesis' in science³. In this thesis, however, I have focused on the works of his critical period. The subject matter of philosophy of physics has a broader scope, but as per the title of my thesis, I have confined myself to critical reflections on certain specific areas of Kant's philosophy of physics. Here, I chiefly deal with concepts like *a priori*, categories, substance, causality, space-time, and motion from a Kantian perspective.

Kant's philosophy of physics is found in the Transcendental Analytic portion of *Critique of Pure Reason* and subsequently in his *Metaphysical Foundations of*

³In this hypothesis, Kant attempted to give a mechanical explanation of all sidereal motion and development of planets. The planets that are farthest from the sun have a probability of producing a higher species of intelligent organisms, according to this hypothesis.

Natural Science and *Opus Postumum*. Kant has himself mentioned that his *Critique of Pure Reason* was completely misunderstood and misjudged by his critics when it was published for the first time in the year 1781⁴. Philosophers and scholars criticized him for things that he never said in the book. He decided to write a short illustrative book to make the *Critique of Pure Reason* more convenient to the readers because he felt that the book was voluminous and lacking illustrations (*Prolegomena to Any Future Metaphysics*, p.10). As a consequence of that, he brought out a book under the title *Prolegomena to Any Future Metaphysics* in the year 1783. Kant's later works have extensively dealt with physics although the *Critique of Pure Reason* occupies the central place among them because the other works are based on the foundations laid in this book. My main concern in this thesis is to carefully bring out Kant's philosophy of physics. I also focus on conceptual clarification and critical analysis of his philosophy of physics and thereby I take my position based on the study of both Kant's philosophy of physics and modern philosophy of science.

I started my research by studying the translations of Kant's original works and tried to understand his philosophy (I regret not being able to read Kant's works in his own language) from his perspective. Starting with Kant's works leads us to understand his contribution in a fairer way. Kant is still relevant in some areas and just the opposite in certain other areas of philosophy of science. Kant's transcendental philosophy has become a popular approach in the world of

⁴The same was published again in the form of the second edition in the year 1787 and that was after the publication of *Metaphysical Foundations of Natural Science* (1786).

philosophy. However, the question remains—how do we justify Kant’s philosophy of physics?

It seems that Kant’s philosophical works had a profound influence on the thinking of the scientists of the 18th and 19th centuries because they have referred to him (both in agreement and disagreement). The philosophers and scientists engaging with both philosophy and science think that Kant has rationalized science⁵. However, they are not in a position to deny the role played by Kantian philosophy in shaping their minds in some way and in constructing a system of concepts⁶. This contribution of Kant is not openly visible but has to be discovered in his ‘Architectonic Plan’ which is another name for his ‘philosophical system of concepts’ and transcendental philosophy as a whole.

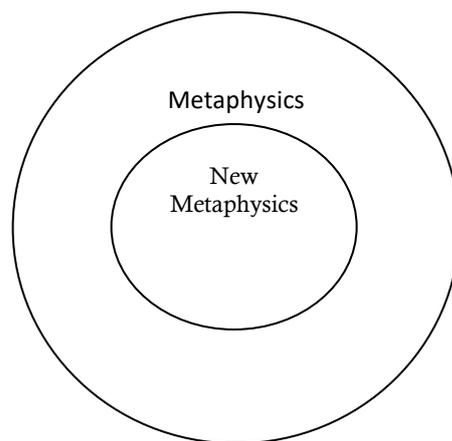
The traditional and modern theories of science like Mechanics, Theory of Relativity, String Theory, and Quantum Theory do not follow the methodology constituted by Kant in his philosophy of science. Some of the reasons behind it are the peculiarities of Kant’s way of dealing with science, which are: (i) Kant’s science is a part of the philosophy of science, (ii) It runs on philosophical methodology, (iii) It deals mainly with pure physics, mathematics and the problem of the possibility of metaphysics as a systematic subject of science, (iv) It derives pure concepts from understanding, (v) Pure reason is a source of necessity and strict universality, (vi) It deals with a new type of science, i.e.,

⁵To Kant, science is based on some fundamental principles which are instances of *a priori* knowledge.

⁶That is, a system of transcendental or critical philosophy.

universal science or formal science, and (vii) Kant regards physics as a science of nature and a body of knowledge.

Kant has titled his critical or transcendental philosophy as a ‘New Metaphysics’ on the ground that it mainly deals with the pure concepts, principles and laws of reason, *a priori* forms of intuition and pure aspects of science and nature. The word ‘new’ is the antonym of the word ‘old’. Kant has treated the word ‘old’ as ‘traditional’ or ‘metaphysics proper’. The new metaphysics is slightly different from the old metaphysics. It is just like an advanced (higher) form of metaphysics. The new metaphysics is not completely abstract like the traditional metaphysics. It presupposes empirical knowledge. It is a combination of metaphysics and epistemology in a system of cognition of the objects of experience or possible experience⁷. Hence, the pure concepts and principles of the system are meant to be applied to experience or possible experience. Kant’s new metaphysics is both subjective and objective.



⁷The word ‘possible’ is to be contrasted with the word ‘actual’. When we have empirical intuition, we have actual experience, but when we have no sensation and consequently no empirical intuition, we have only ‘possible’ experience.

The diagram⁸above shows us that the ‘New Metaphysics’ is included in ‘Metaphysics’. Kant’s transcendental philosophy as a new metaphysics is not the whole of metaphysics. The new metaphysics includes subjects like pure physics, mathematics and even transcendental logic. Kant’s primary concern in these subjects is the pure concepts that do not refer only to the pure objects of thought.

Kant’s new metaphysics does not make him a metaphysician because it is metaphysics only in the sense that it is mainly related to that which is not derived from experience. After all, he was concerned with the possibility of knowing the phenomena of nature. Kant suggested to the students of science that they should not venture beyond our understanding and possible experience. If they go beyond the two, then they would gain nothing because the concepts and principles are only of them. Objects-in-themselves are not brought into experience. This is the limitation of our knowledge which is merely of phenomena (CPR, Bxix, p.23⁹).

Kant’s view regarding the possibility of synthetic *a priori* propositions (or judgments) in pure physics does not make them infallible. As I have already mentioned, there are definite positives and limitations of his philosophy. His work designates our knowledge as dependent on both reason and objects of experience. He declares that the fields of empirical, hypothetical and

⁸Diagram mine.

⁹I have used the abbreviated form CPR for *Critique of Pure Reason*, MFNS for *Metaphysical Foundations of Natural Science*, and PFM is the abbreviated form of *Prolegomena to Any Future Metaphysics*. I have also used A and B in my citations and references to refer the first and the second edition of *Critique of Pure Reason* followed by the page numbers of the book translated by N. K. Smith, London, Macmillan & Co Ltd, 1963.

experimental study are left to empirical science. However, one cannot deny the role of our reason, pure reason, and understanding in the conceptual part of describing the phenomena of the world and reality. Albert Einstein also accepted that without using some parts of Euclidean geometry together with Non-Euclidean geometry, we cannot give a mathematical interpretation of a theory describing the phenomena of nature and universe. Even Isaac Newton's mechanics is relevant to a certain extent in his application to reality at the macro level. Kant intended to explain the possibility of synthetic *a priori* judgments in physics relating them with examples from Newtonian Mechanics.

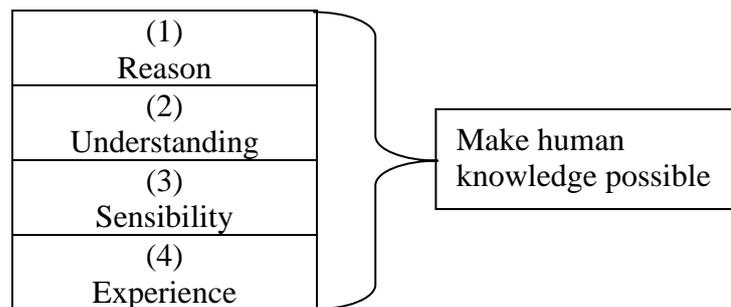
Kant's philosophy of physics is a part of his transcendental philosophy containing the pure part of physics. Throughout his philosophy of physics, Kant tries to show that the judgments of physics are not only necessary and universal (*a priori*) in their origin but also synthetic. Therefore, his philosophy of physics deals with *a priori* aspects of the judgments of empirical physics.

1.2 Architectonic Plan

The structure of the system is the work of reason; the empirical contents and their mutual relation must find their representation in the conclusion of the theory. In the possibility of such a representation lies the sole value and justification of the whole system, and especially of the concepts and fundamental principles which underlie it¹⁰.
(p.273)

¹⁰Einstein, A., *Ideas and Opinions*, C. Seeling (Ed.), New Delhi, Rupa and Co., 2002, p.273.

Kant's philosophy of science at the base is built on his Architectonic Plan. Kant's Architectonic Plan is very much similar to a basic architectonic plan designed by an architect while constructing a building. This architectonic design is a 'blueprint of the system' of his transcendental (or critical) philosophy. Kant's transcendental philosophy is not directly concerned with the empirical objects of the world but with their pure aspects and necessary connection to *a priori* principles and laws. We get Kant's general inquiry about the possibility of such *a priori* principles in physics, mathematics, and metaphysics in his *Critique of Pure Reason* and *Prolegomena to Any Future Metaphysics* and *a priori* laws in his *Metaphysical Foundations of Natural Science*. The latter show how the Newtonian laws of mechanics are fundamentally founded on the *a priori* principles of physics. However, both empirical physics and pure physics presuppose experience. The following is a simple structure of his Architectonic Plan:



In this diagram¹¹, 'Reason' is at the top and 'Experience' is at the bottom. Experience is the foundation and, on its withdrawal, the whole building will collapse. The other three levels of the building are an integral part of it. Both the

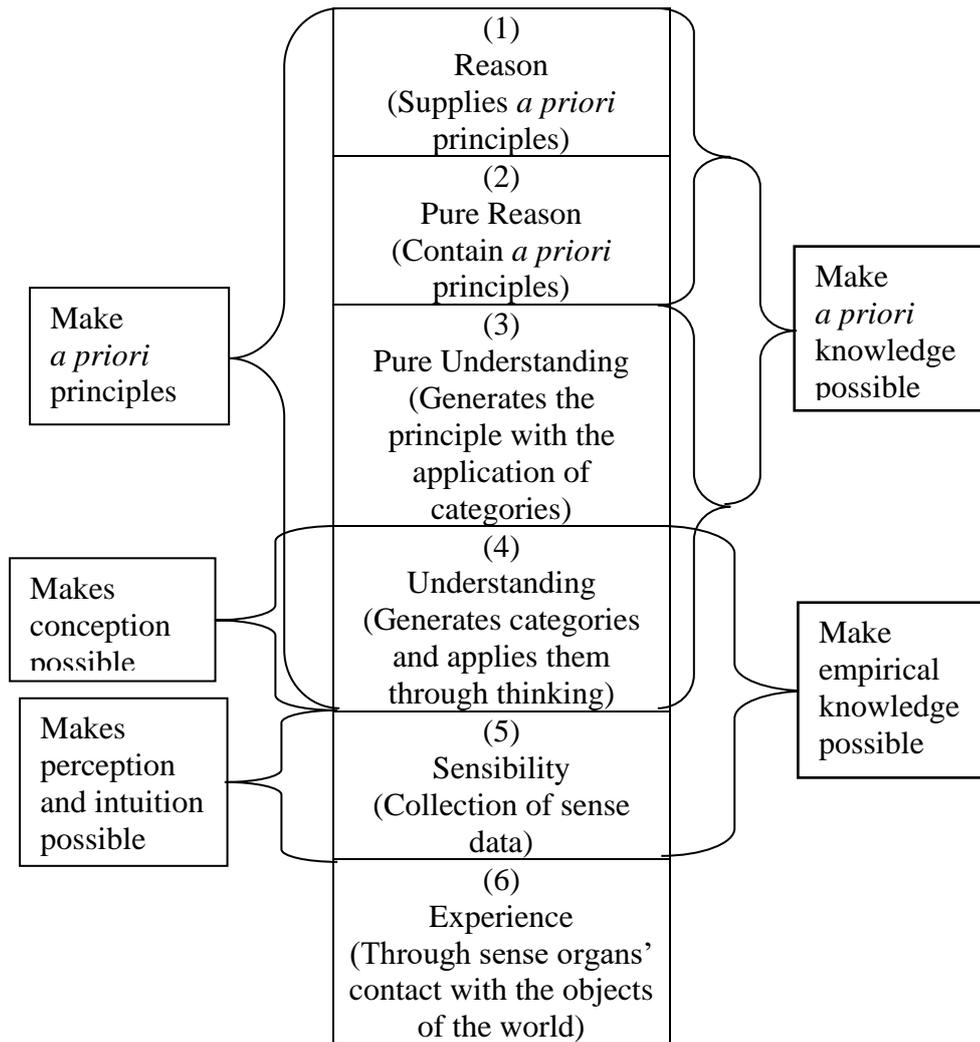
¹¹Diagram mine.

synthetic *a priori* knowledge and empirical knowledge are impossible without this foundation. In other words, both pure physics and empirical physics¹² presuppose experience. We have sensations in our empirical intuition but they are not of the objects of experience. The understanding and sensibility are in us because they are the human-equipments through which the knowledge of the objects of experience is made possible. The objects of experience are independent of us; only their sense-data as empirical representations are given to us in their intuition. Sensibility lies just above the experience and without experience, sensibility is useless. Understanding in the inner sense is pure understanding and in the outer sense is connected to sensibility. Thus, there are generally three faculties of knowledge, i.e. reason, understanding and sensibility (CPR, pp.83, 157, and 320). Here, it should be noted that sensibility cannot be the higher faculty of experience because the experience is itself a species (or entity) of knowledge. ‘Understanding’ is the faculty of thinking and ‘reason’ is the faculty of understanding but only by thinking we cannot obtain the knowledge of the object.

The above structure of the Architectonic Plan tells us that all the three faculties of knowledge together with experience make human knowledge possible, but it does not tell us how we get *a priori* concepts, principles, laws and sense-data. Thus, the above faculties need to be divided into the following faculties (diagram¹³) to make the picture clearer:

¹²Kant uses the term ‘empirical physics’ to mean both experimental and applied physics.

¹³Diagram mine.



Understanding is related to empirical intuition (perception and experience) in which sensation is present. Pure understanding as a faculty of understanding is without empirical intuition and sensation. The principles of pure understanding are purely formal. In Kantian words, they are the epistemological principles discovered by transcendental or critical philosophy. I have already mentioned that this thesis only deals with the validity of *a priori* principles and laws (synthetic *a priori* propositions and judgments) of universal physics. The knowledge of a thing (or object) requires both concept and intuition. But Kant's

philosophy of physics is merely conceptual, and hence, transcendental judgments are not about things though their knowledge is presupposed. Similarly, 'Reason' considered in conjunction with experience gives rise to knowledge of thing, but taken in isolation, we have 'Pure Reason'. Pure reason lacks intuition. The principles and conclusions of pure reason, being independent of intuition, are merely formal. Thus, the principles and laws of pure reason only explain to us how knowledge of things is possible. Again, reason is the faculty which supplies *a priori* principles and laws.

What is distinctive of reason is that it attempts to systematize the knowledge obtained. From this, it becomes evident that experience is the foundation of the Architectonic Plan and reason is related to both philosophy and science. Friedel Weinert has rightly pointed this out about Einstein's Theory of Relativity in his 'Einstein and Kant': "In Einstein's view of scientific knowledge, reason and experience go hand in hand. The rational even enjoys logical priority over the empirical because no amount of inductive generalizations can lead to the complicated equations of the theory of relativity"¹⁴.

The excerpt just quoted above, also means that in both the cases, human reason has a vital role in the revelation of our experience of the world, and also in the constitution of our experience of the objects of the world. However, human reason does not supply us principles, laws and theories in the way modern science does. It supplies transcendental and metaphysical principles and laws about the principles and laws of science, and it does so only because both science

¹⁴Weinert, F., 'Einstein and Kant', *Philosophy*, Vol.80, No.314, 2005, p.591.

and philosophy presuppose experience as well as reason. Hence, Kant's philosophy of physics containing transcendental and metaphysical principles and laws is not like a theory of science.

The Architectonic Plan does not show us how *a priori* principles are principles of modern physics, but how *a priori* principles and empirical principles presuppose experience. After all, all the principles of physics are meant to be applied to real situations and actual phenomena. When they are applied and found valid in reality, they become laws. Because of the nature of Kant's philosophy of physics¹⁵, we cannot relate it on a larger scale to modern physics, but at the foundational level, it has much to offer.

1.3 The Nature of Kant's Philosophy of Physics

Kant's philosophy of physics is a part of his philosophy of science, and his philosophy of science is a systematic study of subjects like pure physics, mathematics and metaphysics. Kant's study of physics as a philosophy of physics is not based on observation and experiment but deals only with arguments and inference. It is merely formal. Kant's philosophy of physics is dependent on reason. This reason is the faculty (of understanding) which gives us the principles of *a priori* knowledge. The purpose of Kant's rigorous search in his transcendental philosophy was to find out the possibility of synthetic *a priori* judgments (or in other words, *a priori* principles and laws) in physics,

¹⁵As a systematic epistemology.

mathematics and metaphysics. Kant's chief concern is not directly with empirical physics but with the *a priori* aspects of empirical physics.

Kant's philosophy of physics is also not similar to the theoretical physics that scientists deal with in theoretical sciences. There is a watertight line between a theory of physics and a theory of philosophy¹⁶. A question that might arise in our mind—"what kind of philosophy of physics is it?" Kant's philosophy of physics is not a theoretical part of physics. Even theoretical physics depends on experience for its claim to truth. The modern theories of theoretical physics are dependent on the discoveries and inventions made in the different branches of science and technology. However, philosophy is conceptual as it wholly depends on abstract arguments. In the case of Kant's transcendental philosophy, we derive conclusions from given premises (principles) with the engagement of our faculty of inference (reason). Those conclusions can be materially or factually true only if the premises themselves are true and the arguments are free of fallacies. The conclusions of his philosophy of physics are the premises of their respective theorems¹⁷. These theorems are the known truths and their premises also must be true. The relation between the premises and the theorem is not of the type of 'p and q' as symbolized by 'p \supset q' but it is a relation symbolized as 'q \supset p' (q if and only if p). Kant, in the strict sense, has regarded physics as a general science of nature. This science, being a body of knowledge, cannot be

¹⁶However, there are some similarities between theoretical science (physics) and philosophy because they both take up some important fundamental concepts and questions.

¹⁷The principles and judgments of empirical physics are known truths and can be considered as theorems.

merely hypothetical ¹⁸ (CPR, Axv, p.11). The pure part of physics where we get Kant's synthetic *a priori* propositions or judgments can be termed as universal science because such judgments consist of material necessity and strict universality. Hence, Kant's theory of physics is not a scientific theory but a philosophical theory.

Kant's philosophy of physics, as a part of his transcendental (critical) philosophy, is not metaphysics but universal physics. The following table¹⁹ shows how Kant's philosophy of physics differs from metaphysics.

S/No.	Metaphysics	Kant's Philosophy of Physics
1.	Metaphysic (General Metaphysics)	New metaphysics (Universal Physics)
2.	Presupposes the objects of experience or possible experience only in intention	Presupposes the objects of experience or possible experience
3.	Subjectively valid	Objectively valid
4.	About supernatural or supersensible objects	About the objects of experience or possible experience
5.	Confined to understanding alone	Confined to both understanding and sensibility
6.	Contains metaphysical propositions and judgments	Contains synthetic <i>a priori</i> propositions and judgments
7.	Cannot be systematic like a subject of science	Can be systematic like a subject of science

¹⁸What is hypothetical is tentative.

¹⁹Table mine.

Physics differs from metaphysics though we get conceptual principles in both of them. The principles of physics are intended to apply to empirical physics of experience. In this way, physics becomes representative of reality, but metaphysics is silent about the matters of fact. Metaphysics deals only with principles (CPR, Bxxiv, p.27). The principles of metaphysics by themselves cannot be transformed into synthetic *a priori* judgments. The main work of our pure reason is to analyze that which are already given in the representations of sense-data through our sensibility. Thus, metaphysics being non-empirical contains synthetic *a priori* judgments only in intention.

For Kant, metaphysics is a completely isolated speculative science of reason. It does not depend on the application to intuition but rests on concepts alone. This means that it is not intuitive but purely conceptual. Concepts are not similar to objects and by means of concepts alone, nothing can be known about objects. The existence of objects corresponding to the concepts cannot be known by means of the concepts themselves. In other words, whether there are objects corresponding to the concepts is not known. Metaphysicians had made numerous assertions about things which are non-empirical (God, soul, etc.). These assertions are merely conceptual because we can have intuition only in experience. These assertions not being about empirical objects (things) cannot be either confirmed or refuted. In the Kantian sense, metaphysics embracing such conceptual assertions is meaningless and cannot be established like science, although the fundamental questions of physics are equally shared by metaphysics. Thus, Kant's philosophy of physics (the science of nature) does not incorporate everything of metaphysics. However, Kant declares in the second

preface of *Critique of Pure Reason* (Bxxxix, p.30) that there is a relation between a kind of metaphysics and pure reason. And when he talks about metaphysics, he talks about the refined metaphysics.

Metaphysics is wholly dependent on reason, but Kant's philosophy of physics (as a new metaphysics of physics) is dependent on both reason and experience²⁰. That is why metaphysics as a body of knowledge is possible only if there is *a priori* knowledge acquired from pure reason.

1.4 Overview of the Thesis

Kant's philosophy of physics is a part of his transcendental philosophy. We need to understand even the other parts²¹ of his transcendental philosophy in order to construct his philosophy of physics. Every part of his works like the *Critique of Pure Reason* is a systematic whole and is in relation and connection to each other. The chapters of this thesis have been mainly derived from the studies of his critical period and post-critical period's works in connection to the subject matters of physics.

²⁰Kant's philosophy of physics is about the *a priori* concepts, principles and laws of speculative science that presuppose the principles and laws of empirical physics whereas theoretical physics is about the revelation of the world, universe and reality through theories. Theoretical physics aims at systematically constructing a theory to explain and reveal something perceptible by using technology, but metaphysics is purely speculative and beyond the realm of the perceptible.

²¹To name a few: Mathematics, Metaphysics, Logic, Ethics, Aesthetics, and Chemistry and the different chapters of the CPR.

It has already been mentioned that Kant's philosophy of physics consists of *a priori* principles and laws. These principles are generated by pure reason through understanding with the employment of categories. Categories give rise to principles and principles give rise to laws. The application of categories, principles and laws are not possible without the presupposition of space and time. Before explaining how Kant's transcendental principles and metaphysical principles are possible in physics, one has to understand the Kantian categories and their employments and applications. Furthermore, this cannot be done without understanding '*a priori*'. Thus, I have started with the chapter on '*A priori*' (after introductory chapter) to make the thesis more comprehensible.

The second chapter of my thesis '*A priori*' is about Kant's conceptualization and application of *a priori* in reference to his search for the possibility of synthetic *a priori* judgments in his philosophy of physics. In this chapter, I do not directly deal with Kant's general question "how are synthetic *a priori* judgments possible in physics?", but with the question "why is it important to have a clear idea of *a priori* in understanding Kant's philosophy of physics?" The reason behind it is that Kant's philosophy of physics is itself about the possibility of synthetic *a priori* judgments in physics. This is already demonstrated in the discussion on the nature of Kant's philosophy of physics (§ 1.2).

I begin my journey by finding out the importance of experience for both *a priori* knowledge and empirical knowledge. I argue that the so-called 'material necessity' of necessity (as a criterion of *a priori*) is the demarcating factor for differentiating between logical and material necessity, and it is the latter one that

we have in the synthetic *a priori* principles of physics. Logical certainty is a consequence of logical necessity, and material certainty is of material necessity. Logical certainty is analytic in nature and is governed by the principle of contradiction, but according to Kant, the certainty of physics (and mathematics) is synthetic. The certainty referred to here (in physics and mathematics) is dependent on the pure intuitions of space and time, categories (pure concepts) and principles and it should not be forgotten that they are contributions of our pure reason, understanding and sensibility (the three faculties of knowledge). Hence, the word ‘necessity’ generally used by Kant in his philosophy of physics, does not refer to logical necessity.

I also aim to argue that the material necessity as objective necessity gives rise to objective validity when used in the form of judgment. The pure concepts having *a priori* origin are applied in the formation of synthetic judgments in physics. The application of such pure concepts is discussed in the next chapter. I also investigate whether Caroline William’s view of Kant’s material-necessity is that of empirical universality or not. No doubt, empirical universality is only an arbitrary extension of the strict universality. This type of universality as found in physics is of ‘judgments of experience’²². This will help us to understand the difference between Kant’s and Newton’s laws of motion (discussed in § 7.4)

In Chapter Three, I will argue that the twelve categories as pure concepts of understanding given by Kant in the CPR have significant roles in physics

²²All the reconstructed laws of motion of Newton are examples of what Kant calls “Judgments of experience”.

because the principles and laws of physics incorporate categories. These categories derived from pure understanding apply to physics only because they are dependent on empirical knowledge. The process of incorporation and application is involved in 'physical thinking'. Physical thinking is one type of objective thinking in which the objects of experience are thought through the categories. The categories like substance, causality, community, reciprocity and relation when applied to reality become principles and all these principles can become laws, objectively valid of actual experience or possible experience.

I begin the chapter by presenting Kant's tables of categories and judgments. I show T. K. Seung's view of Kant's conception of the category to be partly novel and partly traditional and argue against his thought that the conjunction of the two functions (logical and transcendental) in the same set of categories creates a complication. However, I do not directly deal with the issue of Kant's logical and transcendental deductions of the categories in the way Seung has done. After that, I discuss Kant's conception of categories and argue for their subjective origin. Kant's categories and principles have their source in human reason (though they are not derived from it) and are only applicable to the objects of experience. They are not pure forms of intuition like space and time and do not represent the condition under which objects are given in intuition. In § 3.2, I explain how Kant is justified in saying that we cannot have empirical knowledge without the application of categories. I also explore and explain how the categories can be made temporal (or can be synthesized) in the process of gaining the knowledge of the objects of experience.

I argue that categories cannot be applied to transcendental objects and things-in-themselves. The transcendental employment is not of principles of pure understanding, because outside the field of possible experience, there cannot be a synthetic *a priori* principle. I also argue that the categories do not give us knowledge of things-in-themselves. In this regard, I also refer to the debate of F. Bristow William with Karl Ameriks and Paul Guyer on the question of thinking of things-in-themselves through categories. I also explain how transcendental objects are not similar to things-in-themselves. I critically examine how the compared and connected representations make knowledge possible by the synthesis of multiple representations (in the threefold acts of synthesis). I also explain why Andrew Chignell discards Thomas Kuhn's exploration of Categories as moveable in a scientific revolution in his discussion of 'Paradigm Shift'. Towards the end of the chapter, I give an exegetical reflection on how categories give rise to the laws of nature.

The fourth chapter is on 'Substance'. The question of substance is shared by both science and philosophy. The human endeavour from early Greek thought to the present day has been to find out a fundamental substance that can be used as a foundation to describe everything in reality. It was Kant who for the first time in the history of philosophy, tried to rescue substance from the cave of metaphysics²³.

²³According to Kant, if anything goes beyond human intelligence and sense experience, it is a matter of faith. That is why absolute and immortal substances like God and soul are excluded from his philosophy of physics.

I start by discussing Kant's three main rationalist predecessors—René Descartes, Benedict or Baruch Spinoza and Gottfried Wilhelm Leibniz's views on substance. I go on to critically examine and reflect upon how Kant goes further from his predecessors' thought that substance is the bearer of properties. I explore and explain in § 4.3 and § 4.4 why the substance is postulated and why it cannot be defined. I also deal with Dennis Sweet's criticism of Kant's indecisions in the two editions of *Critique of Pure Reason* (1781 and 1788) and agree with the difficulty²⁴ shown by W. Curtis Swabey. However, I defend Kant's consideration of the principle of permanence of substance to be a non-tautological one. I argue for Kant's permanence of substance as a necessary postulation in § 4.5. The inter-personal or inter-subjective knowledge of human beings is not possible without it. I also critically explain in § 4.6 how the permanence of substance is a necessary condition for our empirical knowledge. The application of substance-accident relation to our judgment makes the empirical judgment possible. I also make a point that something cannot be created from nothing and the principle of permanence of substance gives rise to a reorientation of many theories of the creation of the universe. If the creation of the universe out of nothing is allowed, then what Kant calls 'the unity of experience' will be impossible. This chapter (in connection to all the other chapters of the thesis) expounds the epistemological implications of categories, principles and laws.

²⁴This is a difficulty created by the principle of permanence of substance which has been quite differently presented in the two editions of *Critique of Pure Reason*.

In Chapter Five, I critically investigate how causality enables us to transcend our subjectivity. Experience as something objective cannot be possible. We humans as knowers must contribute to the data. Since appearances given to us are contingent and the relations they exhibit are also contingent, for the knowledge to be “something true for everybody” it should be necessary, not contingent, and for that, the categories have to be brought in. The proofs of analogies show that knowledge of objects cannot be possible without the application of categories like substance, causality and community.

In Transcendental Deduction, Kant has shown how the individual’s perceptions are transformed into universal or necessary judgments. In the second analogy, he shows how we cannot distinguish between what is subjective and what is objective in the apprehension of the manifold of empirical intuition²⁵. In this chapter, I argue that understanding arranges the successions of our perceptions as causes and effects. The cause-effect is a pure concept of understanding which enables us to transform our relative and private perceptions into synthetic judgments. I explore the inseparable relation between substance, causality and community. I present Eric Watkins’ suggestion for how to understand the analogies in connection to the objectives of Transcendental Deduction. I also explain how causality enables us to have empirical knowledge which is the basis of social life. Moreover, causality is not commensurate with the theory of revelation or the concept of creation of something out of nothing.

²⁵That is, in the case of having a cognition of the objects of intuition.

In Chapter Six, I give critical and exegetical accounts of Kant's metaphysical and transcendental arguments of space and time. Though discussed separately, they come together as pure forms of intuition or necessary conditions for having experience or knowledge of the objects of experience. I argue for Kant's space and time to be the subjective (human) forms in which we receive data of sense. Empirical intuition is made possible by space and time, and we cannot get rid of them even in our imagination. We cannot imagine the non-existence of space and time and we make images only with their help. They are not perceived in the sense, sensibilities and intuitions are perceived. We perceive objects spatiotemporally, and every object of perception must appear to us as existing in space and time.

According to Kant, the idea of space is presupposed in geometry. I also examine in § 6.6 how geometry presupposes *a priori* property of space. Transcendental property of space is the *a priori* property of space. Transcendental is that which is neither given in experience nor derived from it. Transcendental is purely formal. It is known only through understanding. Transcendental object as an object is without qualities. Space and time are transcendently ideal and empirically real. 'Transcendently ideal' means that they are the basis of synthetic *a priori* propositions like we have in geometry and arithmetic of mathematics. In § 6.12, I explore the differences between Newton, Leibniz and Kant's views on space and time from Michael Friedman's accounts. In § 6.13, I show how Kant's space is not a theory-bound concept. I also explain how Kant's formulation of space and time as forms of intuition or necessary conditions does not exclude any scientific theory of space and time of science.

Chapter Seven on ‘Motion’ is logically connected with the previous chapters because the laws of motion (both Newton’s and Kant’s laws of motion) are made possible only due to the *a priori* nature of space and time and involve both the categories and principles. This chapter is one of the more important chapters of my thesis because Kant himself thought that physics without motion is incomplete. However, Kant’s three laws of motion and their contribution to his philosophy of physics demand a clear understanding of his conception of motion. Kant gives a very brief discussion of motion in the CPR and PFN but opens a discussion on the concept of motion. He asserts that the motion that we talk about in physics cannot be included in the pure part of physics because it is in our outer intuition. Again, this intuition is possible just because of space and this space alone is determined as permanent. My first aim in § 7.2 is to explore Kant’s conception of motion by showing a difference between pure concept and empirical concept of motion. I explain how the Kantian conception of motion is also transcendental and geometrical. The concept of motion does not directly relate to phenomenal motion because it can be constructed and demonstrated. In this regard, I agree with Konstantin Pollok’s suggestion of not taking pure and empirical concepts of motion as identical and thereby argue that the two concepts cannot be collapsed into a single concept.

There are some similarities as well as dissimilarities between Newton’s and Kant’s three laws of motion. The former has created some kinds of distortions in understanding Kant’s real intention in his transcendental philosophy. Kant did not consider all the three laws of motion given by Newton in his *The Principia* to be synthetic *a priori*. In Michael Friedman’s view, Kant tried to build a

metaphysical foundation for Newtonian science, the consequence of which can be seen in the form of Kant's three laws of mechanics in the *Metaphysical Foundations of Natural Science*. In § 7.3, I argue for Newton's three laws of motion as judgments of experience from the Kantian perspective. I start this by explaining the certain implications of pure concepts and principles in the formation of the laws of motion. I critically explain and defend Kant's definitions of the judgment of perception and experience in comparison with the Newtonian formulation of the laws of motion. I explain how objective validity is one of the criteria of the judgments of experience. Objective validity is not of the objects of experience but of the uniformity of the human mind. I also defend Kant's argument that Newton's three laws of motion are founded on certain fundamental concepts and principles of higher understanding. More importantly, they presuppose *a priori* principles of substance, causality and community (reciprocal).

In § 7.4, I show some essential differences between Newton's and Kant's three laws of motion and also argue that Kant's laws of mechanics form an important part of Kant's philosophy of physics. I also outline Eric Watkins and Howard Duncan's views on the differences and the reasons behind them. I also argue that there is a close connection between Kant's principles of pure understanding given in the CPR and the laws of mechanics established in the MFNS. I also make a point that Newton's 'Gravitation' is a scientific name for what Kant calls reciprocal action between and among material bodies. In § 7.4.1, I answer a question regarding putten forth by Jr. Gordon G. Britton in *Kant's Theory of*

Science (1978, p.132). I deal with the question by supplementing some possible reasons behind considering Newton's third law of motion as synthetic *a priori*.