CHAPTER IV
CRITIQUE OF LAKATOS ON
THEORY DEPENDENT OBSERVATION
4.1 Analysis of Foundational Problems

This section explicates the foundational problems of Lakatos’ philosophy of research programmes through systematic analysis. This analysis guides to observe on how Lakatos’ receives the concept of historical analysis of the scientific process from Kuhn and how he integrates this with Popperian philosophy. Here, the concepts of dogmatic falsificationism, methodological falsificationism, sophisticated methodological falsificationism, protective belt of auxiliary hypothesis, positive heuristic, negative heuristic, theory dependent observation and the language of the theory are included for discussion.

4.1.i Integration of Historical Analysis and Science

Lakatos argues that for centuries knowledge is taken to be the proven knowledge, proven either by the power of intellect or by the evidence of the senses. He states,

Wisdom and intellectual integrity demanded that one must desist from unproven utterances and minimize, even in thought, the gap between speculation and established knowledge. The proving power of the intellect or the senses was questioned by the skeptics more than two thousand years ago; but they were
browbeaten into confusion by the glory of Newtonian Physics.

Einstein’s results again turned the tables and now very few philosophers or scientists still think that scientific knowledge is, or can be, proven knowledge.¹

Lakatos argues that Popper grasped the full understanding of this problem from the taking over of Einstein physics over the Newtonian physics. From this Popper got the inspiration to think that one does not have to try to avoid errors but one has to eliminate errors. Lakatos states, “Boldness in conjectures on the one hand and austerity in refutations on the other: this is Popper’s recipe.”² Lakatos was a student of Popper and a great supporter of Popper’s approach towards science. Later he realized difficulties with Popper’s methodologies and started to formulate different approach towards the methodology of science.

He analyzes both Kuhn and Popper to come up with a different approach. He got interested in the formulations of Kuhn where Kuhn started to analyze the methodology with respect to the history of science. He finds the historical analysis of Kuhn’s theory of ‘paradigms’ to be more close to real scientific practices than the Popper’s concept of falsifiability. He finds that even if Kuhn and Popper propose different methodologies in science, there are many areas where they share common ground. Both of them give priority to theory over observation. Search for an observation, interpretation of an observation and acceptance or rejection of an observation over a test or an experiment; all are analyzed against the back ground of a theory. Kuhn too rejects the idea along with Popper that science grows with the
accumulation of eternal truths or empirical facts. Kuhn is also inspired by the change of physics from Newtonian to Einstein. Kuhn’s main problem is scientific revolution and this revolution is exceptional and extra scientific, but for Popper science is revolution in permanence. According to Lakatos the position of Popper on scientific change is rational on the other hand Kuhn’s position on this is mystical. He states,

For Popper scientific change is rational or at least rationally reconstructable and falls in the realm of the logic of discovery.

For Kuhn scientific change – from one ‘paradigm’ to another – is a mystical conversion which is not and cannot be governed by rules of reason and which falls totally within the realm of the (social) psychology of discovery. Scientific change is a kind of religious change.3

The merits of proposing a theory of methodology of science as working in a framework, attracted Lakatos and he proposes the theory ‘research programmes’ to explain the methodology of science.

Lakatos tries to modify Popper’s falsificationism with some insights from Kuhn. In this regard he is very sensitive to reject the relativistic position of Kuhn. Thus Lakatos attempts to integrate the historical analysis of science with an improved concept of falsification to explain the methodology of science.

Kadvany John analyses that the whole of Lakatos’ philosophy is essentially contained in two of his essays; ‘Falsification and the Methodology of Scientific
Research Programmes’ and ‘History of Science and its Rational Reconstructions’.

Kadvany states,

The two papers amount to a compact and effectively complete book. The longer ‘Falsification’ essay leaves open questions explicitly answered in ‘History’, as well as providing historical case studies to which the historiographical theory of ‘History’ applies. Several cues in the first ‘Falsification’ essay, published originally in *Criticism and the Growth of Knowledge*, also suggest that it was constructed to develop the historiographical problems explicitly discussed in the ‘History’ sequel. The two pieces form a continuous and continuously reflective organic whole, and should be read as such.\(^4\)

As Kadany notices in the first paper ‘Falsification and the Methodology of Scientific Research Programmes’ Lakatos tries to criticize Popper’s falsification and reaches his position of scientific methodology, the methodology of research programmes. He analyses that Popper maintains different notions of falsification in his philosophy. Lakatos classifies these different notions in Popper’s philosophy as ‘dogmatic (or naturalistic) falsification, naive methodological falsification and sophisticated methodological falsificationism.

### 4.1.ii Dogmatic Falsificationism

Lakatos asserts that dogmatic falsificationist is strictly an empiricist without being an inductivist. He denies that the certainty of the empirical basis cannot be
given to the theories. Lakatos brands this kind of falsification as the weakest brand of justification. He argues that admitting an empirical counter evidence as a final arbiter against a theory, will not make one a dogmatic falsificationist; but if one asserts that empirical counter evidence as the one and only arbiter which judges a theory, then the stand becomes that of a dogmatic falsificationist. The main characteristics of the dogmatic falsificationist are presented by Lakatos as,

Scientific honesty then consists of specifying, in advance, an experiment such that if the result contradicts the theory, the theory has to be given up...According to the logic of dogmatic falsificationism, science grows by repeated overthrow of theories with the help of hard facts...\(^5\)

Lakatos argues that the dogmatic falsificationism rests on two wrong assumptions. He then argues against these two assumptions to reject the dogmatic falsification. According to Lakatos the assumptions are,

The first assumption is that there is a natural, psychological borderline between theoretical or speculative propositions on the one hand and factual or observational (or basic) propositions on the other...

The second assumption is that if a proposition satisfies the psychological criterion of being factual or observational (or basic) then it is true; one may say that it was proved from facts. (I shall call this the doctrine of observational (or experimental) proof.)\(^6\)
Lakatos asserts that these two assumptions complement the dogmatic falsificationist’s demarcation criterion. The criterion is: a theory is scientific only if it forbids some observable state of affair and thus become refutable. Lakatos argues that psychology testifies against the first assumption and logic testifies against the second assumption and the demarcation criterion is testified false with the methodological judgment.

There can be no natural demarcation between observational and theoretical propositions. This is well established in the case of theory dependence of the observation statements. This proves the first assumption to be wrong. Lakatos proves the second assumption to be wrong by taking a logical rule into account. He states,

…no factual proposition can ever be proved from an experiment. Propositions can only be derived from other propositions, they cannot be derived from facts: one cannot prove statements from experiences.7

Lakatos argues the factual propositions are unprovable and so they are fallible. Now there is no difference between the theory and the factual propositions, factual propositions cannot falsify a theory. Lakatos with this notion states, “Thus we cannot prove theories and we cannot disprove them either.”8 Lakatos states that, the demarcation criterion of the dogmatic falsificationist cannot stand up to methodology of science in the real realm. Scientific theories fail to forbid observable state of affairs. Lakatos points out that the methodology of science works with providing auxiliary hypotheses to anomalies and in this account the falsifiability criterion of the dogmatic falsification cannot differentiate science from non science. With these
criticisms Lakatos rejects dogmatic falsificationism and proposes Methodological falsificationism.

4.1.iii Methodological Falsificationism

Lakatos starts with the explanation of dogmatic falsificationism as a solution to the problems of dogmatic falsificationism by asserting that it is a brand of conventionalism. Here he introduces the demarcations of theories of knowledge as ‘passivist’ and ‘activist’. He states,

"Passivists" hold that true knowledge is Nature's imprint on a perfectly inert mind: Mental activity can only result in bias and distortion. The most influential passivist school is classical empiricism."Activists" hold that we cannot read the book of Nature without mental activity. Without interpreting it in the light of our expectations or theories.9

He further states that,

Now conservative "activists" hold that we are born with our basic expectations; with them we turn the world into ‘our world’ but must then live forever in the prison of our world. The idea that we live and die in the prison of our ‘conceptual frameworks’ was developed primarily by Kant.10

According to Lakatos, the revolutionary activists believe that the conceptual frameworks can be developed and replaced by new and better ones. Lakatos states
Poincare, Milhaud and Le Roy, main revolutionary activists in conventionalism, preferred to explain the continuing historical success of Newtonian mechanics by a methodological decision taken by scientists. They analyzed if a theory stands for a long time against empirical refutations then the scientists decide not to refute the theory and when an anomaly comes against the theory it is explained away using auxiliary hypotheses or other ‘conventionalist stratagems’. Lakatos argues that criticism of this view give rise to Poppers’ ‘methodological falsificationism’.

Methodological falsificationist is basically Popperian and makes use of ‘basic statements’ to explain the falsifiability. Lakatos states,

Our revolutionary conventionalist (or "methodological falsificationist") makes unfalsifiable by fiat some (spatio-temporally) singular statements which are distinguishable by the fact that there exists at the time a "relevant technique" such that "anyone who has learned it" will be able to decide that the statement is "acceptable." Such a statement may be called an "observational" or "basic" statement.11

While taking this stand the methodological falsificationist is aware of the fact that experimental techniques to reach the basic statements are again theory dependent, but he takes them as unproblematic background knowledge. Lakatos argues that the demarcation of this unproblematic background knowledge and the theory in question is a characteristic feature of methodological falsificationism. The methodological falsificationist separates between rejection and disproof. Lakatos states,
Only those theories that is, non-‘observational’ propositions—which forbid certain ‘observable’ states of affairs, and therefore may be ‘falsified’ and rejected, are ‘scientific’; or, briefly, a theory is ‘scientific’ (or ‘acceptable’) if it has an ‘empirical basis.’ This criterion brings out sharply the difference between dogmatic and methodological falsificationism.\textsuperscript{12}

With this, methodological falsification leads from dogmatic falsification. Now there are lot of observational theories and basic statements with increases the empirical basis of a theory in question. The methodological falsificationism further develops by introducing the concept of crucial experiment to test whether a theory is progressing or not. The anomalies are converted to explanations only if this explanation results in a crucial experiment which if goes wrong will reject the theory.

Methodological falsificationism has an upper hand over dogmatic falsificationism, but according to Lakatos both dissonant with the actual history of science. He argues that both rest on two important roots. The first one is that, both consider a ‘two-cornered fight between theory and experiment’ and they suppose that in the final confrontation only these two face each other. The second is that the outcome of such a confrontation is falsification; discoveries are refutations of scientific theories. Against these two roots history gives examples that the tests are at least three cornered fights between two rival theories and an experiment; and experiments results in confirmation rather than refutation. With this background
Lakatos brings out the sophisticated version of the methodological falsification inherent in Popper’s philosophy.

**4.1.iv Sophisticated Methodological Falsificationism**

Sophisticated falsification differs from naive version of methodological falsification both rules of acceptance and rules of elimination. For sophisticated falsificationist a theory is acceptable or scientific if it has more corroborated empirical content over its predecessor or rival. According to sophisticated falsificationist a theory $T_1$ is falsified by a theory $T_2$ if $T_2$ has excess empirical content over $T_1$ means, it predicts corroborating novel facts which was not possible with $T_1$ and may be even $T_1$ has forbidden it; and $T_2$ explains all the previous success of $T_1$. In analysis it is clear that a theory $T_1$ is appraised with its auxiliary hypotheses, initial conditions and together with the rival $T_2$. That is to say that one apprise is a series of theories rather than isolated theories. Lakatos states,

...one of the crucial features of sophisticated falsificationism is that it replaces the concept of *theory* as the basic concept of the logic of discovery by the concept of *series of theories*. It is a *succession of theories and not one given theory which is appraised as scientific or pseudo-scientific*. But the members of such series of theories are usually connected by a remarkable *continuity* which welds them into *research programmes*. This *continuity-reminiscent* of Kuhnian "normal science" -plays a *vital* role in the history of science; the main problems of the
logic of discovery cannot be satisfactorily discussed except in
the framework of a *methodology of research programmes*.\textsuperscript{13}

Thus the Sophisticated falsification becomes the basis of research programme or
rather to say sophisticated falsificationism itself is research programme. Here one can
see how Lakatos analyzes Popper’s falsification to reach at his research programmes.

4.1.v Research Programme and its Components

Lakatos develops his methodology of science as a criticism of Popper’s falsification. He gives improvements and corrections to Popper’s idea of falsification
to account the history of science into his theory thus by giving proper representation
of the growth of scientific knowledge. Lakatos defines the research programme as,

I have discussed the problem of objective appraisal of scientific
growth in terms of progressive and degenerating problem shifts
in series of scientific theories. The most important such series
in the growth of science are characterized by a certain
*continuity* which connects their members. This continuity
evolves from a genuine research programme adumbrated at the start. The programme consists of methodological rules: some
tell us what paths of research to avoid (*negative heuristic*), and
other what paths to pursue (*positive heuristic*).\textsuperscript{14}
He further states,

*It is a succession of theories and not one given theory which is appraised as scientific or pseudo-scientific. But the members of such series of theories are usually connected by a remarkable continuity which welds them into research programmes.*\(^{15}\)

Lakatos concept of research programme contains many components and the methodology is an internal structure of the research programme. He argues against Popper that the main problems of the logic of scientific discovery can only be discussed inside a research programme. He states, “…the main problems if the logic of discovery cannot be satisfactorily discussed expect in the framework of a methodology of research programmes.”\(^{16}\)

When he coins the word research programme Lakatos makes sure that he is not taking science as a whole in the concept of research programmes. He points out that what is in his mind is particular research programmes. In the whole of science there can be many research programmes and when one research programme competes with other, according to the rules of the comparison of research programmes, one takes over the other and thus the growth of scientific knowledge is assured. Here he reminds that the science as a whole can be taken as a research programme. He states,

Even science as a whole can be regarded as a huge research programme with Popper’s supreme heuristic rule: ‘devise conjectures which have more empirical content that their predecessors.’ Such methodological rules may be formulated,
as Popper pointed out, as metaphysical principles. For instance, the *universal* anti-conventionalist rule against exception-barring may be stated as the metaphysical principle: ‘Nature does not allow exceptions.’ This is why Watkins called such rules ‘influential metaphysics’.17

Lakatos argues that viewing science as a single research programme is not going to help us explain the growth of science. The attempts to show science as a single research programme are not able to account for the historical developments in science and its growth. He argues that the methodological rules in such a research programme remains as metaphysical principles. He further clarifies his use of the term metaphysics in the foot notes of ‘Methodology of Scientific Research Programmes’. He states, “I use ‘metaphysical’ as a technical term of naive falsificationism: a contingent proposition is ‘metaphysical’ if it has no ‘potential falsifiers’.”18 With this background Lakatos stresses that his concept of research programmes does not contain the whole of science in a single research programme. He further states,

But what I have primarily in mind is not science as a whole, but rather *particular* research programmes, such as the one known as ‘Cartesian metaphysics’. Cartesian metaphysics, that is, the mechanistic theory of the universe--according to which the universe is a huge clockwork (and system of vortices) with push as the only cause of motion-functioned as a powerful heuristic principle. It discourages work on scientific theories-like (the ‘essentialist version of) Newton’s theory of action at a
distance—which were inconsistent with it (*negative heuristic*). On the other hand, it encourages work on auxiliary hypotheses which might have saved it from apparent counterevidence-like Keplerian ellipses (*positive heuristic*).\(^{19}\)

It can be observed from the example of the ‘Cartesian metaphysic’ that there are certain essential ingredients for a research programme. ‘Hard core’, ‘auxiliary hypotheses’, ‘protective belt’, ‘positive heuristic’ and ‘negative heuristic’ are the main components of a research programme.

4.1.v.a Hard core

Within the concept of research programmes Lakatos analyses that all part of a science are not equally important. For him in a research programme some laws or principles act as more basic than others. They are so basic such that they become the defining feature of a research programme. When a theory in question finds incompatible with one or many observation instances, the theory in question which is part of a research programme should not be refuted, this is opposite to the case of falsification, if the theory in question is a fundamental part of the research programme. The blame of the failure should be placed on less fundamental components of the research programme. With this notion, process of science can be seen as a development of the implications of the fundamental principles of a research programme. Here the scientists try to solve the problems in a research programme by modifying more peripheral assumptions compared to the fundamental theories in a research programme. Their efforts to deal with the peripheral theories of a research
programme can be taken as an act in the process of the development of the research programme. Lakatos refers to the fundamental principles of a research programme as the ‘hard core’ of the research programme. Lakatos states, “All scientific research programmes may be characterized by their ‘hard core’. The negative heuristic of the programme forbids us to direct the *modus tollens* at this ‘hard core’.”

Lakatos considers Newton’s gravitational theory as the most successful research programme ever. Lakatos argues that the hard core of this research programme consists of Newton’s three laws of dynamics and his Law of Gravitation. He writes,

> In Newton’s programme the negative heuristic bids us to divert the *modus tollens* from Newton’s three laws of dynamics and his Law of Gravitation. This ‘core’ is ‘irrefutable’ by the methodological decision of its proponents.²¹

So according to Lakatos hard core is more than anything else, the defining characteristic of a research programme. It takes the form of a very general hypothesis, theories and principles that from the basis from which a research programme develops. In the history of science we can find lot of research programmes with the essential characteristics of a research programme proposed by Lakatos. The assumption that the earth and planets orbit a stationary sun and earth spins on its own axis taking one day to complete a spin works as the hard core for Copernican research programme in astronomy. Even in the field of social sciences one can find the research programme. Alan Chalmers while explaining the research programmes of Lakatos gives the example of Marx’s historical materialism as a research programme. He writes,
The hard core of Marx’s historical materialism would be something like the assumption that major social change is to be explained in terms of class struggle, the nature of the classes and the details of the struggle being determined, in the last instance, by the economic base.\textsuperscript{22}

4.1.v.b Auxiliary Hypotheses, Protective Belt and Initial Conditions

According to Lakatos the hard core of the programme must be protected from any sort of refutation in the process of science. In order to protect the hard core there are a set of hypotheses which takes in the refutations such that the hard of is unaffected. Such a hypothesis is named as ‘auxiliary hypothesis. The set of auxiliary hypotheses protecting the hard core and other supplementary assumptions in the working of the hard core are named as the ‘protective belt’. Lakatos states,

All scientific research programme may be characterized by their ‘hard core’. The negative heuristic of the programme forbids us to direct the \textit{modus tollens} at this ‘hard core’. Instead, we must use our ingenuity to articulate or even invent ‘auxiliary hypotheses’, which form a \textit{protective belt} around this core, and we must redirect the \textit{modus tollens} to these. It is this protective belt of ‘auxiliary hypotheses’ which has to bear the brunt of tests and get adjusted and re-adjusted, or even completely replaced, to define the thus-hardened core.\textsuperscript{23}
He further states, “…anomalies must lead to changes only in the ‘protective’ belt of auxiliary, ‘observational’ hypotheses and initial conditions.”

The protective belt consists the explicit assumptions and laws supplementing the hard core. In the statement of observation and experimental results some particular situations and theories are presupposed which are called the ‘initial conditions’. The assumptions underlying the initial conditions are also part of the protective belt. Any inadequacy in the comparison with the research programme and an observed phenomenon is attributed to the supplementary assumptions, the protective belt. The Copernican research programme in astronomy takes in lot of supplementary assumptions to support its hard core, ‘the assumption that the earth and planets orbit a stationary sun and earth spins on its own axis taking one day to complete a spin’. The circular orbits, the estimates of the distance of stars from earth and the assumption that naked eye gives real accurate information concerning the position, size and brightness of the stars and planet are some of the assumptions with are around the hard core of the Copernican research programme. These auxiliary hypotheses change in order to accommodate any anomalies or counter examples. The circular orbits give way to elliptical orbits, the estimates of the distance of stars from earth changed and the assumption that naked eye gives real accurate information concerning the position, size and brightness of the stars and planet is refuted and replaced by another assumption that they can be measured using reliable instruments like telescope. Lakatos gives the example of Newton’s research programme of the
gravitational theory to show how the auxiliary hypotheses help the research programme to stand against anomalies. He writes,

When it [Newton’s research programme of the gravitational theory] was first produced, it was submerged in an ocean of ‘anomalies’ (or, if you wish, ‘counterexamples’), and opposed by the observational theories supporting these anomalies. But Newtonians turned, with brilliant tenacity and ingenuity, one counter-instance after another into corroborating instances, primarily by over-throwing the original observational theories in the light of which this ‘contrary evidence’ was established. In the process they themselves produced new counter-examples which they again resolved. They ‘turned each new difficulty into a new victory of their programme’. 25

Lakatos states that the hard core of a research programme does not come up as it is in the process of science. It takes a lot of time to formulate the hard core of a research programme. In a foot not of ‘The Methodology of Scientific Research Programmes’, Lakatos makes this point very clear. He states, “The actual hard core of a programme does not actually emerge fully armed like Athene from the head of Zeus. It develops slowly, by a long, preliminary process of trial and error.” 26 Lakatos calls this process as the initial conditions. From the initial conditions we slowly proceed to the fundamental characteristics of a research programme called the hard
core. Lakatos explains this with the help of the development of Newtonian research programme.

…Newtonian ‘puzzles’, leading to a series of new variants superseding each other, were foreseeable at the time of Newton’s first naïve model…Newton must have been fully aware of the blatant falsity of his first variants…this is why one speaks of ‘models’ in research programmes. A ‘model’ is a set of initial conditions (possibly together with some of the observational theories) which one knows is bound to be replaced during the further development of the programme.\(^{27}\)

4.1.v.c Positive heuristic and negative heuristic

Lakatos uses the term heuristic to denote methodological characteristic of research programmes. A heuristic is a set of rules or hints which help a scientist working in a research programme to make a new discovery or invention. According to Lakatos these methodological rules, heuristics are internal part of research programmes. He states, “The programme consists of methodological rules: some tell us what paths of research to avoid (negative heuristic), and others what paths to pursue (positive heuristic).”\(^{28}\) The negative heuristic of a research programme guides a scientist working within that research programme what are not advised to do. It is already seen that within a research programme one is not allowed to change the hard core of the research programme. If anyone tries to go against the hard core, that person will be opted out of the research programme. The negative heuristic is the set
of instructions to the scientists working within a research programme such that their work does not go against the hard core. In the history of science, when Tycho Brahe proposed a solar system where only the planets other than earth revolves around the sun and the sun revolves around the earth, he was actually going against the negative heuristic of the Copernican research programme in astronomy and thus opting out of the Copernican research programme.

Lakatos, in the discussions on the negative heuristic, claims that the negative heuristic of a research programme rationalizes the classical conventionalism. He argues that the negation of the refutations of the hard core can be rationally explained with the negative heuristic of the research programme. He states,

We may rationally decide not to allow ‘refutations’ to transmit falsity to the hard core as long as the corroborated empirical content of the protecting belt of auxiliary hypotheses increases. But our approach differs from Poincare’s justificationist conventionalism in the sense that, unlike Poincare, we maintain that if and when the programme ceases to anticipate novel facts, its hard core might have to be abandoned: that is, our hard core, unlike Poincare’s, may crumble under certain conditions. In this sense we side with Duhem who thought such a possibility must be allowed for; but for Duhem who thought that such crumbling is purely aesthetic, while for us it is mainly logical and empirical.29
The positive heuristic on the other hand, is the set of methodological rules which guides scientists to know what all things are advisable to do in a research programme. The positive heuristic gives guidance to scientists working within a research programme on how to protect the hard core from anomalies. They contain the instructions on how the hard core is to be supplemented with auxiliary hypothesis to strengthen the protective belt, how to modify the protective belt in order to provide explanations and predictions of the observable phenomena. Lakatos states,

…the positive heuristic consists of a partially articulated set of suggestions or hints on how to change, develop, the ‘refutable variants’ of the research program, how to modify, sophisticate, the ‘refutable' protective belt’.30

Lakatos argues against Kuhn that the refutations are negated or explained with the change in the protective belt, in an order with the aid of positive heuristics. Here he suggests that the heuristics of the research programme are long term research policy adopted in the process of science. He further states,

…it should not be thought that yet unexplained anomalies- ‘puzzles’ as Kuhn might call them- are taken in random order, and the protective belt is built up in an eclectic fashion, without any preconceived order. The order is usually decided in the theoretican’s cabinet, independently of the known anomalies...They have a long-term research policy which anticipates these refutations. This research policy, or order of
research, is set out – in more or less detail – in the *positive heuristic* of the research programme.$^{31}$

Developments of adequate experimental and mathematical techniques are part of the positive heuristic along with the development of suitable auxiliary hypotheses. In the Copernican research programme, the mathematical techniques to accommodate the epicycles and the improvement in the observational techniques for the observation of the positions of the planets are included as methodological rules in the internal positive heuristic sense. Lakatos explains the positive heuristic sense in which it applies in the research programmes with the help of the work within Newton’s research programme of the gravitational theory. Lakatos explains that the positive heuristic involved in this research programme works with the idea that one should start with simple and idealized cases. After understanding and explaining them thoroughly a scientist can go for more complicated and realistic cases. Newton first considered the elliptical motion of the earth around the sun and formulated mathematically the inverse square law of attraction. It considered the elliptical motion of the earth around a stationary sun. It is very clear that now if Newton wants to apply it to more realistic ones then it needs to be developed further and that requires a lot of theoretical work.

Newton’s positive heuristic of the programme guides him to solve from simple cases to complicated cases. Lakatos states,

*The positive heuristic sets out a programme which lists a chain of ever more complicated models simulating reality:* the
scientist’s attention is riveted on building his models following instructions which are laid down in the positive part of his programme.\textsuperscript{32}

In the Newtonian research programme, the theoretical framework of the earth moving around the sun is further developed. Newton has taken the consideration that all planets move under the mutual attraction between them and sun. With this idea he took the finite size of planets and treated them as spheres. With this theoretical frame he solved the mathematical problem involved with the motion of the planets. Now he takes into account, the possibility of planets’ spin and the gravitation forces between the individual planets and as well as the individual planets and sun. With this improved frame he has to again get the mathematical formulations to explain such considerations. Now he has to look for the match between this theory and observation. As the match was not accurate he has to change slightly the theoretical frame, here it is the auxiliary hypothesis, by adding the non-spherical planets in place of the spherical planets. The positive heuristic of the Newtonian research programme contains, along with these kinds of theoretical programmes, some experimental programmes. It includes the development of more accurate telescopes and this intern includes the auxiliary theories to accommodate the refraction of light in the earth’s atmosphere to explain the working of the telescopes. Thus the positive heuristic of the Newtonian research programme works as internal methodological rules which guide the total work within the research programme’s theoretical as well as the experimental frames.
The positive heuristic of a research programme should allow the programme to realize its full potential. A suitable and adequate protective belt is constructed with auxiliary hypotheses such that the research programme is given sufficient time to realize its potential rather than being taken out because of initial refutations. When a programme is developed, it needs to be subjected to experimental tests. The experimental tests are done not to refute the research programme rather to find the confirmations. The worth of a research programme is measured according to the extent it provides novel predictions which are confirmed. Further the positive heuristic of the research should guide future research by mapping out a program.

4.1.vi Theory dependent observation and the language of the theory

In Lakatos’ analysis the falsificationism of Popper contains three notions, dogmatic, methodological and sophisticated methodological falsificationism. It is seen how the transition of dogmatic falsification to methodological and to sophisticated methodological falsificationism has been analyzed. This transition clearly shows how the theory dependent observation is analyzed by Lakatos in the process of arriving at research programmes. The dogmatic falsificationist could not proceed because there was no way of providing an empirical basis for the ‘observational’ statements which refutes a theory. In methodological falsificationism this difficulty is taken away by providing the acceptance of theory dependent nature of observation statement to falsify a theory in question, if the theory that guides the observation is testable. The same stand is taken in the sophisticated falsificationism which further develops as research programmes.
In sophisticated falsificationism or research programmes there are a series of theories thus there are a lot of observational statements (which is basic statements as connoted by Popper). Now these basic statements are guided by theories within a research programme. Now the basic statements get meaning only within the ‘language of a research programme’. Lakatos in the foot notes of ‘The Methodology of Research Programmes’ indicates the presence of a scientific language. Here he defines the history of science as the conceptual frameworks or of scientific languages. He states,

One may point out that the negative and positive heuristic gives a rough (implicit) definition of the ‘conceptual framework’ (and consequently of the language). The recognition that the history of science is the history of research programmes rather than of theories may therefore be seen as a partial vindication of the view that the history of science is the history of conceptual frameworks or of scientific languages.\(^{33}\)

Lakatos holds all the Popperian notions of the theory dependent observation and makes them as part of a particular scientific language. The basic statements are interpreted in the light of this language. In research programme any number of basic statements are allowed and they are interpreted in the light of the given research programme.

4.1.vii Lakatos foundational problems: A critique

Lakatos in his historicist account of philosophy of science considered that in philosophy of science the methodology of science offered by one should be tested
against the history of science. So from his own position, it becomes necessary for one to ask the question whether his methodology is descriptively adequate in checking its methodology with science. A lot of confirmations of Lakatos methodology of science adequately describing the history of science are given by Lakatos himself and his students and supporters, but one who is keen to analyze the methodology of research programmes can come up with historical evidences against the methodology of science. In the history of science as Lakatos rightly points out the scientists make adjustments in their theories to stand up to some unexpected anomalies, but in this regard the Lakatos’ concept of hard core is sometimes misleading. In the history of science one can see instances where scientists make adjustments within the fundamentals of theories or programmes to stand up to certain anomalies or inconsistencies. One such example is that of Copernicus. In his theory of planetary motion he has made a lot of adjustments. Alan Chalmers explains this as,

Copernicus himself, for example, moved the sun a little the side of the centers of planetary orbits, had the moon orbit the earth rather than the sun, and came to use all sorts of devices to adjust the details of the epicyclical motions, to the extent that those motions ceased to be uniform.34

In the Newtonian research programme of planetary motion, there were attempts to modify the inverse square law of attraction to cope up with the problems such as the motion of planet Mercury. These historical examples question the Lakatos’ concept of hard core and thus criticize the very fundamental part of his research methodology. This criticism is very vital because this is the defining nature of research programmes
which differentiates it from Kuhn’s paradigms. In his essay ‘Replies to Critics’, he did not make any acknowledgement to such criticism.

4.2 Analysis of Methodological Problems

In this section Lakatos’ has been analyzed to find how work with in a research programme and comparison of competing research programmes are methodologically explained in the methodology of research programmes. How work within a research programme and comparing the merits of competing research programme works as the methodological rules of research programme is analysed. Work within a research programme, progressive and degenerative research programmes, testing the methodology against history and a critical analysis of the methodology of research programmes are included in this section.

4.2.i Work within a research programme

Work within a research programme involves the expansion and modification of the protective belt in order to account for anomalies or counter examples, by the introduction of auxiliary hypotheses. Lakatos beautifully analyses Bohr’s research programme of light emission to explain the work within a research programme. The work within a research programme is understood within the framework of the characteristics of the programme. Lakatos points out five characteristic features of the Bohr’s research programme as,

(1) Its initial problem; (2) its negative and positive heuristic; (3) the problems which it attempted to solve in the course of its
development; and (4) its degeneration point (or, if you wish, ‘saturation point’) and, finally, (5) the programme by which it was superseded.35

Lakatos states consistency as an important regulative principle and must be seen as a problem. He argues that if science aims at truth then it must aim at consistency. If science loses its consistency then it loses truth. In each of the characteristic features of the above mentioned research programme try to formulate consistency in the research programme, but when an inconsistency stems up it must not trigger the research programme to stop its further development. According to Lakatos, it may be rational to put the inconsistency into some temporary, ad hoc quarantine, and carry on with the positive heuristic of the programme.

The inconsistencies are allowed to be explained away by making modifications or additions of the protective belt of a research programme, but the modifications or additions must be independently testable. In addition to this the modifications should lead to new tests and thus providing the opportunity for novel predictions. Taking the example of Newtonian research programme of planetary motion, the troublesome orbit of the Uranus was an anomaly. Some scientists modify the protective belt of the Newtonian research programme by proposing the possibility of another planet near Uranus. Some scientists modify the protective belt by blaming the aberrations of the telescope. The modifications were on par with Lakatos concept of the work within a research programme because both provided more testable instances; the presence of a new planet can be put into test and the aberration of the
telescope also can be put into test. Thus they have increased the chances of success of the research programme; which means the confirmation of novel predictions, resulted by the modifications.

The work within a research programme involves another move which is closely connected with its negative heuristic. Any kind of move to depart from the hard core are ruled out. Alan chalmers explains the Lakatos position regarding his as,

Making such a move [departing away from hard core] destroys the coherence of a program and amounts to opting out of that program. For instance, a scientist attempting to cope with Uranus's orbit by suggesting that the attraction between Uranus and the Sun was something other than the inverse square law would be opting out of the Newtonian research program.36

4.2.ii Progressive and Degenerative Research Programmes

Lakatos initially used the term ‘progressive problem shift’ and ‘degenerative problem shift’ in order to explain the process of science, but in later stage he has started to use ‘progressive research programme’ and ‘degenerative research programme’ for ‘progressive problemshift’ and ‘degenerative problemshift’ respectively. He notes this in a foot note in ‘The Methodology of Scientific Research Programmes’ as,

The appropriateness of the term ‘problemshift’ for a series of theories rather than of problems may be questioned. I chose it
partly because I have not found a more appropriate alternative – ‘theoryshift’ sounds dreadful – partly because theories are always problematical, they never solve all the problems that they have set out to solve. Anyway, in the second half of the paper, the more natural term ‘research programme’ will replace ‘problemshift’ in the most relevant contexts.37

The positive heuristic of the programme guides the future research by mapping a program (a program of research) within the research programme. A progressive research programme retains its coherence and at least intermittently leads to novel predictions. These novel predictions are confirmed such that the research programme is corroborated to a higher degree. Lakatos states,

Let us say that such a series of theories is theoretically progressive (or ‘constitutes a theoretically progressive problemshift’) if each new theory has some excess empirical content over its predecessor; that is, if it predicts some novel, hitherto unexpected fact.38

Here Lakatos asserts that a theoretically progressive research programme is also empirically progressive. This means that a research programme which progress theoretically predicts novel phenomenon which is corroborated. Thus Lakatos states, “...that is, if each new theory leads us to the actual discovery of some new fact. Finally, let us call a problemshift progressive if it is both theoretically and empirically progressive.”39
A degenerating research programme on the other hand loses its coherence and fails to provide corroborating predictions. Lakatos states,

But temerity in proposing wild inconsistencies did not reap any more rewards. The programme lagged behind the discovery of ‘facts’. Undigested anomalies swamped the field. With ever more sterile inconsistencies and ever more ad hoc hypotheses, the degenerating phase of the research programme had set in: it started – to use one of Popper’s favorite phrases – ‘to lose its empirical character’. So according to Lakatos a degenerating research programme sums up a lot of changes in the protective belt and adds up a lot of ad hoc modifications without finding any corroborating prediction. A degenerating research programme will soon find a competing research programme and xbe replaced.

4.2.iii Testing the Methodology Against History

In this regard Lakatos put forwards the idea that, different methodologies of science can be analyzed by critically comparing the methodologies with history as a test of its rational reconstruction. Lakatos states,

The basic idea of this criticism is that all methodologies function as historiographical or meta-historical theories or research programmes and can be criticized by criticizing the rational historical reconstructions to which they lead.
With this background Lakatos criticize positivists and falsificationist on the grounds that in the history of science these methodologies fail to make sense of the progress of science and proceeds to show that his methodology of research programmes satisfies the criterion of facing the history of science to explain the progress in science. Alan Chalmers analyses the virtue of such a methodology as,

Lakatos came to see the main virtue of his methodology to be the aid it gives to the writing of the history of science. The historian must attempt to identify research programs, characterize their hard cores and protective belts, and document the ways in which they progressed or degenerated. In this way, light can be shed on the way science progresses by way of the competition between programs.\(^{42}\)

4.2.iv Lakato’s methodology: A Critique

The main criticisms against Lakatos methodology is put forward by Feyarbd and Kuhn. Their main criticism centers on the problem that Lakatos failed to give proper method by which a degenerative and progressive phase of research programme can be separated. According to Kuhn, “[Lakatos] must specify criteria which can be used at the time to distinguish a degenerative from a progressive research programme; and so on. Otherwise, he has told us nothing at all.”\(^{43}\) In this regard Feyerabend in his 1975 essay ‘How to Defend Society Against Science’, states,

A decisive feature of Lakatos’ methodology is that such evaluations are no longer tied to methodological rules which
tell the scientist either to retain or to abandon a research programme. Scientists may stick to a degenerating programme; they may even succeed in making the programme overtake its rivals and they therefore proceed rationally whatever they are doing (provided they continue calling degenerating programmes degenerating and progressive programmes progressive). This means that Lakatos offers words which sound like the elements of a methodology; he does not offer a methodology.

Lakatos in his essay ‘History of Science and its Rational Reconstruction’ acknowledges the criticisms of Feyerabend and Kuhn on his methodologies. Lakatos argues that one may rationally stick with a research programme in its degenerating phase until it is over taken by another on or even after the overtake. He states, “It is perfectly rational to play a risky game: what is irrational is to deceive oneself about the risk.” He states that this does not provide the ultimate license for a research programme to continue with its work even if it is not been able to produce corroborating novel predictions. He further states that

This does not mean as much licence as might appear for those who stick to a degenerating programme. For they can do this mostly only in private. Editors of scientific journals should refuse to publish their papers which will, in general, contain either solemn reassertions of their position or absorption of
counterevidence (or even of rival programmes) by *ad hoc*,
linguistic adjustments.\textsuperscript{46}

It is very clear that Lakatos could not give a sufficient methodology to segregate the progressive and degenerative phase of a research programme. He tries to explain the rationality of holding this position. Feyerabend criticizes Lakatos’ this position. Feyerabend with his analysis of the Lakatos’ methodologies, states, “…measured by the standards of the methodology of research programmes the conservative attitude expressed by the [Lakatos’] suggestion is neither rational nor irrational.”\textsuperscript{47}

4.3 Analysis of Axiological Problems

In this section an analysis of the axiological problems associated with Lakatos’ research methodology is analyzed. Progress associated with research programmes, and the concept that no research programme is degenerated beyond hope, are discussed.

4.3.1 Progress associated with Research Programmes

The progress of science in Lakatos’ methodology of research programmes has to be understood as two parts; the progress made by a research programme within itself and progress made by science with the competition among different research programmes.

In the methodological part it is already seen how the work within a research programme is done. Work within a research programme tries to say the hard core of the research programme, thus the research programme itself by making use of its
positive heuristic to explain away the anomalies. In this phase a research programme progresses to develop as a fully potential research programme. Further development within the research programme is associated with its expansions of protective belt in such a way that it produces novel predictions which becomes corroborated. In this regard Lakatos finds the negation of refutations transform to verifications. He states,

Our considerations show that the positive heuristic forges ahead with almost complete disregard of ‘refuations’: it may seem that it is the ‘verifications’ rather than the refutations which provide the contact points with reality. Although once must point out that nay ‘verification’ of the \( (n+1) \)th version of the programme is a refutation of the \( n \)th version, we cannot deny the some defects of the subsequent versions are always foreseen: it is the ‘verifications’ which keep the programming going, recalcitrant instances notwithstanding.48

Thus in one way, Lakatos attaches the progress of science as the development of research programmes within itself by the work of the positive heuristic.

According to Lakatos the contact of two research programmes in the field of science constitutes progress. The contact can be of two different types; one is that of grafting a new research programme on an old research programme and the second type is that of competition between two rival research programmes.
During the process of science a new research programme may sometimes be grafted on some old research programmes with which the new research programme is highly inconsistent. Lakatos states,

Indeed, *some of the most important research programmes in the history of science were grafted on to older programmes with which they were blantly inconsistent*. For instance, Copernican astronomy was ‘grafted’ on to Aristotelian physics.\(^{49}\)

He further argues that as the grafted programme gets strengthened, the co-existence of the new research programme which was grafted on the old research programme comes to an end and now the new programme tries to replace the old programme. Lakatos points out three different positions with regard to grafted research programme. First one is the conservative position. Lakatos argues that,

The *conservative position* is to halt the new programme until the basic inconsistency with the old programme is somehow repaired: it is irrational to work on inconsistent foundations. The ‘conservatives’ will concentrate on eliminating the inconsistency by explaining the postulates of the new programme in terms of the old programme.\(^{50}\)

The second one is that of anarchist position. Lakatos states: - “The *anarchist position* concerning the grafted programmes is to extol anarchy in the foundations as a virtue and regard [weak] inconsistency either as some basic property of nature or as an ultimate limitation of human knowledge.”\(^{51}\) The third position with regard to the
grafted programme is that of rational position. Lakatos further states, “The rational position with regard to ‘grafted’ programmes is then to exploit their heuristic power without resigning oneself to the fundamental chaos on which it is growing.”

The second type of interactions of research programmes occur when two rival research programmes come to compete for dominance. This is regarding the appraisal of research programmes. A degenerative research programme takes over by a new progressive research programme. In his essay, ‘Replies to Critics’, Lakatos argues against Noretta Koertge’s criticisms that his research programme has a mono-theoretical approach. Lakatos’ response to Koertge is in resonance with his view on how competing research programmes interact. He states,

She might have meant that my appraisal of a scientific research programme R₁ is completely independent of a rival R₂; that is, my appraisal of whether R₁ is progressive or degenerating depends only and exclusively on R₁. But this is not so. If R₂ progresses, it is bound to slow down the progress of R₁; since R₂ will anticipate some novel facts faster than R₁. Indeed, R₁ without R₂ may be seen as progressive but against the background of R₂ it may be degenerating, the signposts of progress are anticipated novel facts: a rival programme may eat them away.

This interaction between the research programme depicts that the progress in science is what gives the science its character. According to Lakatos’ the scientific nature of a
theory can be understood from its methodology and especially by analyzing how it is progressing. The appraisal of a research programme over another with the methodological rules provided by Lakatos; sanctions scientific status to the field of inquiry.

4.3.ii No programme is degenerated beyond hope

According to Lakatos when two rival theories compete for dominance, the degenerating research programme loses its dominance to a new and progressive research programme, but Lakatos does not consider the old theory as refuted. He suggests that the degenerative phase of the research programme at any point of time may be replaced by a progressive phase by the prediction of a novel phenomenon, which gets corroborated. In this sense no research programme is degenerate beyond hope.

4.3.iii Lakatos axiological stand point: A Critique

Lakatos linked the central point of his philosophy, demarcating scientific theories from others with the progress of theories. He states, “central problem in the philosophy of science is - the problem of stating universal conditions under which a theory is scientific.” According to him this problem was linked with the problem of rationality of science. He thought the solution of the problem of rationality will provide guidance to decide when the acceptance of a scientific theory becomes rational or not. He proposed the methodology of research programme as a solution to these problems. He states, “I give criteria for progression and stagnation within a
program and also rules for the ‘elimination’ of whole research programs.55 He did not give proper rules to eliminate a research programme, he thought rationally one can maintain the work within a degenerated (and thus over thrown by another research programme) research programme as the possibility of the revival of a research programme is always possible. This position of Lakatos made it difficult to demarcate science from non-science. He believed that there is no ‘instant rationality’ to reject a whole research programme. He suggested that the history only will decide the fate of such research programme. Only in long run one will know whether a research programme is completely degenerated or not, still the Lakatos’ notion will help the research programme that it may revive in a later stage. This point makes the central point were Lakatos’ fails to account for his claim of demarcation of science from non-science.

4.4 Critical of Theory Dependent Observation and Methodology of Research Programmes

In the theory dependent observation debate, Lakatos stands along with Popper as his admirer. He admits Popper’s construction of basic statements and their role in the philosophy of science to represent the observational data. In the light of theory dependence of observation, Lakatos views the research programme as having a scientific language. Within this language the observation statements get meaning. As it is seen that all observational statements are theory dependent, and Lakatos along with Popper allow such observational statements or basic statements within the research programme. The language of the research programme guides one to analyse
the truth value of such basic statements. In this regard Kavany John analyses Lakatos as,

For Lakatos, the critical issue in how contradictions become refutations is that a problematic observation or fact does not determine which theory it refutes. Theories are always coordinated against a large background of undisputed knowledge—say, instrumentation, observational theories, or accepted approaches to a range of specialized problems. Schematically, if \( P_1 \land P_2 \land \ldots \land P_n \rightarrow Q \), but no \( Q \) is ‘observed’, then many subsets of the \( P \)’s might be taken as false on logical grounds, and in practice there often are several realistic alternatives to choose from.\(^{56}\)

Lakatos try to avoid such a problem by explaining the methodology of research programmes. He tries to solve this by putting the negotiations of truth as a pluralistic clash between observation statements and competing explanatory theories, but he could not give away with the initial problem which now entered into the field of theory appraisal. The problem with Lakatos’ theory appraisal has been already discussed.

The hard core of the research programme is accepted by Lakatos as irrefutable, but he does not provide any reason for the same. He defines that the methodological heuristic of the programme keeps the hard core as irrefutable. This
hard core takes up lot of back ground knowledge and theories as taken for granted. Now with this hard core when a research programme is evolving; this includes the observations, made with the irrefutable hard core, are dependent on the theories associated with this hard core. Thus the very foundation of the research programme rests with the theory dependence of observation. Now this problem leads to the kind as mentioned by Lakatos as,

We cannot avoid the decision which sort of propositions should be the ‘observational’ ones and which the ‘theoretical’ ones. We cannot avoid either the decision about the truth-value of some ‘observational propositions.’ These decisions are vital for the decision whether a problemshift is empirically progressive or degenerating.57

These notions make it clear that the main criticisms against Lakatos have a lot to do with the problem of theory dependent observation statements. Lakatos could not give solutions to the problems stemmed out of the theory appraisal, but his works in the field of philosophy of science consists remarkable depth and value. The historical account of science diverging away from Kuhn’s relativistic position with the background of Popper still provides guidelines for the methodologies adopted in many fields of inquiry.
Reference


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3. Ibid


6. Ibid 14

7. Ibid 16

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19. Ibid 47, 48
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30. Ibid 50
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55. Worrall and Curie 1978a p 112


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