CHAPTER ONE

INTRODUCTION

A. The Background of Study

There are at least two reasons, why in the contemporary era, studying natural science with the correct perspective[1] becomes important. **First,** from a historical standpoint, human understanding of nature influences daily life — how they define themselves, God, religion and society.[2] This means that natural science is one of the determinants of the development of the paradigm.[3] Transitions that occur in the realm of natural science circularly will result in a paradigm shift. The paradigm shift from geocentrism to heliocentrism in Western civilization has changed the landscape of theological, philosophical and scientific discourse.[4] **Second,** the development of natural science today, which is supported by disciplines such as physics, biology, chemistry, astronomy and astro-physics with all of its branches, tends towards materialism and new age[5] where in the context of religious

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[1] The correct perspective in this study refers to the Worldviewof Islam, namely how Muslims should view reality and truth. This issue will be described in more detail in later chapters.

[2] Isaac Wise, *The Cosmic God*, (Massacuhsetts: Applewoods Book, 2009) p. 135.

[3] Lodovico Galleni, "Teilhard de Chardin, Theoritical Biology and Theology", in *The Interplay Between Scientific and Theological Worldviews*, Part I, Edited by Niels Henrik Gregersen, Ulf Görman and Christoph Wassermannp, (Geneva, Switzerland: Labor Et Fides, S.A., 1999) p. 123; see also a more comprehensive description of how natural science, especially physics with the main figure Albert Einstein, can change the landscape of beliefs, paradigms, and worldview of Western scientists. Christoph Lehner, Jürgen Renn and Matthias Schemmel (Ed.), *Einstein and the Changing Worldviews of Physics*, (New York: Springer Birkhauser, 2012).

[4] Howard Margolis, *Paradigms and Barriers: How Habits of Mind Govern Scientific Beliefs*, (London and Chicago: University of Chicago Press, 1993) p. 137.

[5] New Age is a spiritual movement that was formed in the middle of the 20th century. New Age is a combination of Eastern and Western spirituality, as well as metaphysical

life can shake the principles of the faith. The materialisttendency leads to atheism, while the new age tendency leads to pluralism.[6] Scientists who frankly refer to themselves as atheists - to name a few prominent figures - include: Stephen Hawking,[7] Richard Dawkins,[8] Neils Bohr,[9] Francis Crick,[10]

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traditions which propose a human-centered philosophy. See Sutcliffe, Steven, The Origins of 'New Age' Religion Between The Two World Wars, dalam Daren Kemp and James R. Lewis (Ed.), *Handbook of New Age*, (Leiden-Boston: Brill, 2007) p. 55; compare with Nevill Drury, *The New Age: The History of a Movement*, (London: Thames & Hudson, 2004).

[6] It should be noted here, pluralism is the minimum impact of the new age, while the maximum is that it enters into the new age as a new religion. See, Thomas Banchoff, "Introduction", in *Democracy and the New Religious Pluralism*, Edited by Thomas Banchoff, (Oxford: Oxford University Press, 2007) p. 3; Colleen Windham-Hughes, "Relational and Procedural Literacies in the Study of Religion", in *Civility, Religious Pluralism and Education*, Edited by Vincent Biondo and Andrew Fiala, (New York and London: Routlegde, 2014) p. 160; see also Angela Rudert, "A Sufi, Sikh, Buddhist, TV Guru", in *Religious Pluralism, State and Society in Asia,* Edited by Chiara Formichi, (London and New York: Routledge, 2014) p. 253; see also Milda Alisauskiene, "The New Age Millieu in Lithuania: Popular Catholicism or Religious Alternative?", in *Religious Diversity in Post-Soviet Society: Ethnographies of Catholic Hegemony and the New Pluralism in Lithuania*, Edited by Ingo W Schröder, Milda Ališauskiene, (Farnham, UK: Ashgate, 2012) p. 151-169.

[7] Stephen William Hawking (1942-2018) is a theoretical physicist, cosmologist, author, and Research Director of the Center for Theoretical Cosmology at Cambridge University. Some of Hawking's best-known books include*: A Brief History of Time,* (New York: Bantam Books, 1988), *The Grand Design,* (New York: Bantam Books, 2010) and *The Theory of Everything*, (California: New Millennium Entertainment, 2002).

[8] Richard Dawkins (1941-) is an evolutionary ethologist and biologist, England. His famous works include:*The Selfish Gene*, (Oxford: Oxford University Press, 1976), *The Blind Watchmaker*, (New York: Norton & Company, Inc, 1986) and *The God Delusion,* (New York: Bantam Books, 2006).

[9] Niels Bohr (1885-1962) was a physicist who had won the Nobel Prize in Physics in 1922. In 1913, Bohr applied the concept of quantum mechanics to the atomic model that had been developed by Ernest Rutherford, who described that atoms are composed of atomic nuclei surrounded by by electron orbit.

[10] Francis Harry Compton Crick (1916-2004) was a British biologist. In the early 1950s together with James Dewey Watson he discovered the substance of the form of DNA. For this discovery, with JD Watson and MHF Wilkins he was awarded the Nobel Prize in

and Paul Dirac.[11] Meanwhile, New Age scientists included Fritjof Capra,[12] Ken Wilber,[13] Danah Zohar,[14] David Bohm,[15] Ilya Prigogine[16] and Gary Zukav.[17]

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medicine in 1962. His famous books include: *What Mad Pursuit*, (New York: Basic Books, 1988) and *Of Molecules and Men*, (Washington: University of Washington Press, 1966).

[11] Paul Adrien Maurice Dirac (1902-1984) was a British physicist. In 1928 Dirac studied the combination of the special theory of relativity with quantum theory so as to produce an electron theory that allowed the explanation of the spin and the magnetic moment of electrons and predicted the existence of positively charged electrons (positrons). In his discovery, he was awarded the 1933 Nobel Prize in Physics along with Erwin Schrödinger.

[12] Fritjof Capra (1939-) is an Austrian-born American physicist, systems theorist and deep ecologist. In 1995, he became the founding director of the Center for Ecoliteracy in Berkeley, California. Two of Capra's best-known books are *The Tao of Physics*, (California: Shambhala Publications, 1974) and *The Turning Point*, (New York: Bantam Books, 1982).

[13] Kenneth Earl Wilber II (1949-) is an American writer who focuses on the theme of transpersonal psychology and integral theory, a systematic philosophy that seeks to synthesize all human knowledge and experience. His famous books include: *The Spectrum of Consciousness*, (New York: Quest Books, 1977), *A Brief History of Everything*, (California: Shambhala, 1996) and *The Integral Vision*, (California: Shambhala, 2007)

[14] Danah Zohar (1945-) is an American-British writer and speaker on physics, philosophy, complexity, and management. Two of his famous books are: *The Quantum Self: Human Nature and Consciousness Defined by the New Physics*, (New York: Morrow, 1990) and *Quantum Society*, (New York: Morrow, 1993).

[15] David Joseph Bohm (1917 - 1992) was an American theoretical physicist who contributed innovative ideas to quantum theory. He is widely regarded as one of the most important theoretical physicists of the 20th century. Two of his important books are: *Wholeness and the Implicate Order*, (London: Routledge & Kegan Paul, 1980) and *Science, Order, and Creativity*, (New York: Bantam Books, 1987).

[16] Ilya Prigogine (1917-2003) is a Belgian physicist who received the Nobel Prize in Chemistry in 1977 for his contribution to unbalanced thermodynamics. Some important books include: *Order Out of Chaos*, (New York: Bantam Books, 1984), *The End of Certainty*, (New York: Simon and Schuster, 1997) and *From Being to Becoming*, (New York: WH Freeman, 1980).

[17] Gary Zukaf (1942-) is an American physicist who writes spiritual books. One of the books that catapulted his name was *Dancing Wu Li Masters: An Overview of the New Physics*, (New York: Morrow, 1979).

The rapid development of natural science discourse that gave birth to atheism and new age in the West received a serious response among theologians and scientists. The discourse of science and religion that began in the late 20th century by Pierre Teilhard de Chardin (1881 - 1955) [18] and Thomas F. Torrance (1913 - 2007)[19] was later systematized and popularized by Ian G. Barbour (1923–2013)[20] is a real form of theological response and Western scientists to answer the problematic claims of contemporary natural science.[21] Natural theology and theology of nature introduced by Barbour are alternative offers for natural sciences-friendly discourse on theology. Or instead try to present a theological model that is friendly to the development of science.[22] Even if examined further, science remains the dominant benchmark in the development of discourse.

In the contemporary Islamic world, there are several main figures

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[18] Pierre Teilhard de Chardin is a philosopher from France, who also works as a paleontologist, and Jesuit priest. His philosophy summarizes various themes, such as cosmology, biology, physics, anthropology, social theory, and theology. He is known as the originator of the discourse of science and religion through his two main works, Pierre Teilhard de Chardin, *The Phenomenon of Man,* (New York: Harper, 1959) and *The Divine Milieu: An Essay on the Interior Life,* (New York: Harper, 1960)

[19] Thomas Forsyth Torrance is a Scottish Protestant theologian. Torrance served for 27 years as Professor of Christian Dogmatics at the University of Edinburgh and New College, Edinburgh. In the discourse of science and religion he is known through three main works, namely: Thomas F. Torrance, *Theological Science*, (London: Oxford University Press, 1969); *Divine and Contingent Order*, (Oxford: Oxford University Press, 1981); *Reality and Scientific Theology: Theology and Science at the Frontiers of Knowledge*, (Edinburgh: Scottish Academic Press, 1985).

[20] Ian Graeme Barbour is an American scholar and Professor of Physics and Theology at Carleton College, U.S. In 1999 he was awarded the Templeton Prize for his services in the discourse of science and religion. Barbour's main work in the discourse of science and religion is Ian G. Barbour, *Issues in Science and Religion*, (Englewood Cliffs, NJ: Prentice-Hall, 1966). This book is considered to be a systematic foundation for the continued development of science and religious discourse.

[21] See Alister E. McGrath, *Science and Religion: A New Introduction*, Second Edition, (New Jersey: Blackwell Publishing, 2010) Chapter 4.

[22] Ian G. Barbour, *Nature, Human Nature, and God*, (Minneapolis: Fortress Press, 2002) p. 31-33.

who have taken part in the discourse of science and religion. They are Seyyed Hossein Nasr, Syed Muhammad Naquib Al-Attas, Isma'il R. Al-Faruqi, Ziauddin Sardar, Mehdi Gholshani and Nidhal Guessoum. These figures initiated the discourse of Islamic Science and the need for the Islamization of contemporary knowledge as an effort to answer the problems present in the Islamic world due to the crisis that occurred in modern science. In this research, the main figure whose thoughts will be elaborated is Syed Muhammad Naquib Al-Attas—hereinafter referred to as Al-Attas—with the main idea being the Islamization of contemporary knowledge.

The emergence of the idea of Islamization of contemporary knowledge was born due to two things. **First,** from the fact that there is secularization of science in the West.[23] In the context of the Islamic world, secularization of science—that is, the divorce of science from religious values has a negative impact. From the ontological aspect, science sees nature and its laws and patterns, including humans themselves only as material forms that exist without God's intervention. In the epistemological aspect, science overrides the text of revelation as a source of knowledge, so it is not in accordance with the views of Muslim communities who actually behave otherwise. Whereas the axiological aspect, the West does not link the development of science with values, morality, spirituality and religiosity.[24] **Second,** there is

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[23] That is a philosophical program that seeks to free humanity *'first the liberation of man from relegious and metaphysical tutelage, the turning of his attention from other world and toward this one'*. See Harvey Cox, *The Secular City*, (Princeton: Princeton University Press, 2013) p. 25

[24] See Mulyadi Kartanegara, *MengIslamkan Nalar: Sebuah Respon Terhadap Modernitas,* (Jakarta: Erlangga, 2007) chapters 1 and 3; In the context of education, one of the negative impacts is that secular Western sciences eventually replace the position of religious sciences in Islamic school curricula. The position of Western science that replaces the religious sciences today has resulted in many Islamic universities being established, but these institutions are only Islamic in their name, whereas their philosophy, content and educational objectives in no way reflect the Islamic worldview. See Ismail Fajeri al-Attas, *Sungai Tak Bermuara: Risalah Konsep Ilmu dalam Islam*, (Jakarta: Diwan Publishing, 2006) p. 73.

a hegemony of the paradigm of modern Western science.[25] It is well known that today's rapidly developing science is actually built on a foundation of Western philosophy, values and culture that has many conflicts with Islam.[26] This confirms that science is not neutral but values laden.[27] From this fact, contemporary science really needs to be Islamized.[28]

But the problem now is that, after more than four decades[29] of the discourse of the Islamization of science, it has been touted and tried to be applied in various tertiary institutions,[30] many people are of the opinion that

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[25] Prof. Wan Mohd Nor Wan Daud even stated: through its globalization project, especially through the concepts of modernization and development, democracy, freedom, and human rights, the West has established itself as the superior culture and civilization and hegemony of other cultures and civilizations. See Wan Mohd Nor Wan Daud, *Islamisasi Ilmu-Ilmu Kontemporer dan Peran Universitas Islam dalam Konteks Dewesternisasi dan Dekolonisasi,* Trans. Tim INSISTS, (Bogor: UIKA dan CASIS UTM, 2013) p. 13-14.

[26] For example the West formulates its views on reality and truth not based on revelation and the basics of religious beliefs, but based on cultural traditions reinforced by philosophical foundations. Where these philosophical foundations depart from speculation or conjecture relating only to secular life which is centered on humans as the physical self and rational power as the only force that will reveal all the secrets of nature and their relationship to existence. See Syed Muhammad Naquib Al-Attas, *Islam dan Sekularisme,* Trans. Dr. Khalif Muammar, M.A, (Bandung: PIMPIN, 2010) p. 171.

[27] For an explanation of this problem, please refer to Karl R. Popper, *Logika Penemuan Ilmiah*, terj. Armstrong Sompotan dkk. (Yogyakarta: Pustaka Pelajar, 2008); Jurgen Habermas, *Knowledge and Human Interest*, trans. Jeremy J. Shapiro, (Cambridge: Polity Press, 1968); F. Budi Hadirman, *Kritik Ideologi: Pertautan Pengetahuan dan Kepentingan*, (Yogyakarta: Kanisius, 1993); Mikhael Dua, *Filsafat Ilmu Pengetahuan*, (Yogyakarta: Penerbit Ledalero, 2009); A. Sonny Keraf dan Mikhael Dua, *Ilmu Pengetahuan: Sebuah Tinjauan Filosofis,* (Yogyakarta: Kanisius, 2001)

[28] See Husni, "Model-Model Integrasi Ilmu dalam Pemikiran Islam Kontemporer", *Tajdid: Jurnal Ilmu Ushuluddin,* Vol. 17, No. 1, 2010 (Jambi: Fakultas Ushuluddin IAIN Sulthan Thaha Saifuddin Jambi, 2010); Budi Handrianto, *Islamisasi Sains: Sebuah Upaya MengIslamkan Sains Barat Modern,* (Jakarta: Pustaka Al-Kautsar, 2010).

[29] This discourse began in the 70s with main figures including: Syed Muhammad Naquib al-Attas, Seyyed Hossein Nasr, Ismail Raji al-Faruqi, and Ziauddin Sardar.

[30] Some universities use different terms, but have the same goal, namely to form an

it seems that they are still at a philosophical level and have not yet touched the implementation level. One thing that might be overlooked in this discourse is translating it into systematic methods in research or scientific development activities.[31] In essence, contemporary challenges that need to be answered in the discourse of Islamization are methodological challenges, not philosophical.

Philosophical discussion, according to Muslim scientists, is considered too abstract and does not provide more practical and empirical guidance for scientific activities. The questions of Muslim scientists relate to: "How can we translate the Islamization of contemporary knowledge into the practice of study and teaching, especially if it is confronted with modern Western science which includes theories, methods, problem formulation, research agendas, reference books, scientific journals, handbooks, and so on? ". The point is, they ask: "How can we translate the philosophy of Islamic science into the practice of Islamic science?" So generally Muslim scientists who accept the idea of Islamization are enthusiastic, but they generally still haven't found clarity on how to translate that spirit into a more tangible form of scientific activity. The core problem—if they are assumed to understand well the idea of Islamization—is "How to execute the concept?".[32]

There are three reasons why questions such as "How to execute the

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alternative paradigm in scientific development. These universities include, among other things, Islamic Universities such as Universitas Darussalam (UNIDA) Gontor, UIN Syarif Hidayatullah Jakarta, UIN Sunan Kalijaga Yogyakarta or UIN Maulana Malik Ibrahim Malang, and also by General Universities (PTU) such as Universitas Gadjah Mada (UGM) Yogyakarta, Institut Teknologi Bandung (ITB) or Institut Teknologi Sepuluh November (ITS) Surabaya. See Abu Darda, "Integrasi Ilmu dan Agama: Perkembangan Konseptual di Indonesia", *At-Ta'dib: Jurnal Kependidikan Islam,* Vol. 10, No. 1 Juni 2015.

[31] Nurlena Rifai, Fauzan, Wahdi Sayuti dan Bahrissalim, "Integrasi Keilmuan dalam Pengembangan Kurikulum di UIN Se-Indonesia: Evaluasi Penerapan Integrasi Keilmuan UIN dalam Kurikulum dan Proses Pembelajaran", dalam *Tarbiya: Journal of Education In Muslim Society*, Vol. 1, No. 1, Juni 2014., p. 13.

[32] Adi Setia, "Rencana Penyelidikan Sains Islam", p. 372.

concept?" this comes up. **First,** when referring to the works of al-Attas, especially in Islam and the Philosophy of Science, al-Attas has provided a kind of clue on how to conduct a critical test of modern Western science—namely critically reviewing nine points[33] that exist in modern Western science. But the problem is al-Attas has not shown in detail, referring to the structure of modern Western science, what, where, and how the nine points work and influence the development of science, especially in scientific activities. **Second,** in the same book,[34] al-Attas also made a brief view of science as an *tafsir* and *ta'wil* of the universe[35]—that is, how the universe is viewed in the perspective of science without falling into scientism or secular science.[36] However, just like the first reason, Al-Attas has not provided a

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[33] The nine points include: (1) the methods of modern science; (2) its concepts, presuppositions, and symbols; (3) its empirical and rational aspects, and those impinging upon values and ethics; (4) its interpretation of origins; (5) its theory of knowledge; (6) its presuppositions on the existence of an external world, of the uniformity of nature, and of the rationality of natural processes; (7) its theory of the universe; (8) its classifica-tion of the sciences; (9) its limitations and inter-relations with one another of the sciences, and its social relations.. See Syed Muhammad Naquib al-Attas, *Prolegomena to The Metaphysics of Islam: An Exposition of The Fundamental Elements of The Worldview of Islam,* (Kuala Lumpur: ISTAC, 2001) p. 114; Idem *Islam dan Filsafat Sains*, Terj. Saiful Muzani, (Bandung: Mizan, 1995) p. 25-26; Idem *Tinjauan Ringkas Peri Ilmu dan Pandangan Alam,* (Kuala Lumpur: Ta'dib International, 2019) p. 2-3.

[34] See *Prolegomena,* p. 135-140; *Islam dan Filsafat Sains*, p. 66-70.

[35] This is because, according to Al-Attas, there is a parallel between the universe and the Al-Qur'an, that is, both of them are the signs of Allah. In order to obtain an essential meaning, the two types of signs must be *tafsir* and *ta'wil*, where the *ta'wil* activity must be based on *tafsir.* That is, *ta'wil* as an effort to understand verses that have vague and multiple meanings must be based on what has been clearly and surely understood. See, *Prolegomena*, p. 135-138; *Islam dan Filsafat Sains*, p. 66-67.

[36] Al-Attas mentions that science can actually be used as a tafsir and ta'wil of the universe—as tafsir and ta'wil are used to understand the Al-Qur'an. This is because, Al-Qur'an and the universe are both books that contain the verses of Allah. The first one as the Revelation Book, the latter as the Created Book. As a verse, the universe — as well as the Al-Quran — contains verses that are muhkamat and verses that are mutasyabihat. Tafsir is used to understand muhkamat verses while ta'wil is used to understand mutasyabihat verses. See Mohd. Zaidi b. Ismail, "Perihal Alam Semesta sebagai Kitab Kejadian dan Kesan Ilmiahnya pada Hala-Tuju Sains Tabi'i: Satu Liputan Ringkas Menurut Rencana Al-

more detailed description of what is meant by *tafsir* and *ta'wil* in the context of contemporary scientific discourse.

Third, in a more specific scientific context, especially in the natural science discipline, al-Attas is not a scientist who works in a unique atmosphere of thought, experience and scientific study—for example conducting experiments in the laboratory, or conducting field experiments and formulating mathematical rules such as physicists, biologist or chemist.[37] As a thinker, the focus of al-Attas is indeed to study the fundamental, philosophical, and complex issues that are the basis of the modern science family,[38] which many circles, especially scientists, have been neglected to study. It is in this context, perhaps, that al-Attas has no interest in writing textbooks and or research methodologies in the natural, social and humanities sciences.[39] In this context, unanswered questions about science as *tafsir* and *ta'wil* of the universe can be understood.

In the context of natural science, as will be the focus of study in this thesis, because Al-Attas is not a scientist — whether physicist, mathematician, or chemist, then he has no interest in estimating the

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Attas", dalam *AFKAR: Jurnal Aqidah dan Pemikiran Islam*, Bil. 8, April 2007., p. 108.

[37] Generally, a scientist, in carrying out scientific activities, especially in research, will carry out the following stages: (1) make preliminary observations—whether in the form of empirical or literate—from which will be done branstroming to raise identification of problems; after that, a scientist will conduct (2) the formulation of the problem, followed by (3) searching related literature, then (4) designing the research model, and (5) collecting the necessary data. After the data is collected, a scientist will do (6) data processing and analysis with various methods, lab testing, prototype and others. After the data is analyzed, it will be concluded that (7) research results. See, Ellen Ungaro, *Bridges: Inquiry and Investigation*, (New York: Benchmark Education Company, 2010) p. 18-23; see also Richard A. Schmuck, *Practical Action Research for Change*, (California: Corwin Press, 2006) especially chapter 3.

[38] The issues of why and how Al-Attas examines the philosophical problems which form the basis of modern Western science, critics and provides conceptual solutions will be explained further in Chapter 2.

[39] For what works written by Al-Attas, which will demonstrate his authority as a great 21st century Muslim thinker, will be shown in Chapter 2.

structure of natural science with all its details. Then the core problem is in the framework that clearly refers to the structure of natural science. This description of the structure of natural science in contemporary discourse enters the realm of the philosophy of science[40]—specifically the debate over scientific criteria and the development of science.[41] In the context of the description of the structure of natural science and its relation to the effort to formulate the methodology of Islamization of contemporary knowledge, there is an important figure who can answer a variety of previous questions. The figure is Imre Lakatos. There are two reasons why Lakatos has an important position in the discourse of methodology and philosophy of science—mainly in the methodology of scientific research program methodology. **First,** Lakatos is a scientist as well as a philosopher. As a mathematician who is also engaged in the field of philosophy, he has a role in the philosophy of science discourse. Through some of his work, he was able to bring together the ideas of Popper and Kuhn who were considered to be in conflict with one another before.[42] As a mathematician,[43]

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[40] See Alexander Rosenberg and Lee McIntyre,*The Philosophy of Science: A Contemporary Introduction*, Fourth Edition, (New York and London: Routledge, 2020 especially chapter 7 and 8; Allan Franklin, "The Role of Experiments in the Natural Sciences: Examples from Physics and Biology", in *General Philosophy of Science: Focal Issues*, Edited by Theo A.F. Kuipers, (Amsterdam: Elsevier, 2007) p. 219-275.

[41] Alexander Bird and James Ladyman (Ed.), *Arguing About Science*, (London and New York: Routledge, 2013)

[42] This issue will be described in more detail in Chapter 2; Samir Okasha, *Philosophy of Science: A Very Short Introduction,* Second Edition, (Oxford: Oxford University Press, 2016) especially chapter 5: Scientific change and scientific revolutions; for a more complete description of scientific criteria and the development of science, see Robert Audi, *Epistemology: A Contemporary Introduction to the Theory of Knowledge*, Third Edition, (New York and London: Routledge, 2011) especially chapters 8 and 9.

[43] This is because mathematics is the basic foundation in natural science, mainly in formulating postulates, logical frameworks and systematizing theories. All three are described in mathematical forms. See Robert L. Oldershaw, "Mathematics and Natural Philosophy", in Ronald E. Mickens (Ed.), *Mathematics and Science*, (Singapore: World Scientific Publishing, 1990) p. 136-154; also F. David Peat, "Mathematics and the Language of Nature", in Ronald E. Mickens (Ed.), *Mathematics and Science*, (Singapore: World Scientific Publishing, 1990) p. 154-173.

Lakatos knows very well the main framework of natural science and the problems in it, especially the problems related to postulation, verification and systematization in natural science.[44]

Second, in the discourse of methodology, Lakatos developed what he called the "the methodology of scientific research programmes", namely the idea of developing an alternative thought so that progress in scientific theories was guaranteed.[45] According to Lakatos, the main issues related to the logic of discovery cannot be discussed satisfactorily except in the framework of the methodology of scientific research programmes.[46] Islamic science, as a product of the Islamization of contemporary knowledge, which is a long-term study and research in translating Islamic values into scientific activities, must have a unique research program methodology. Without a unique research program methodology, what is claimed to be Islamic science, where science is different from modern science, will not develop and become established into a paradigm, family and scientific discipline. On this basis, the Lakatos research program methodology has a strategic role, namely as a bridge in applying Al-Attas's philosophical thinking.[47]

As mentioned earlier, the material objects in this study are the

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[44] These postulation, verification and systematic issues in natural science will be further elaborated in chapter 3.

[45] Imre Lakatos, "Falsification and the Methodology of Scientific Research Programmes", dalam *Criticism and the Growth of Knowledge,* Edited by Imre Lakatos and Alan Musgrave, (Cambridge: Cambridge University Press, 1970) p. 91-197.

[46] Imre Lakatos, *The Methodology of Scientific Research Programms*, Edited by John Worrall and Gregory Currie, (Cambridge: Cambridge University Press, 1989) p. 4-5; Robert Orton, "Lakatos' Model For Assessing A Research Program", *Journal of Thought*, Vol. 23, No. 3/4 (Fall/Winter 1988), p. 45-57.

[47] Lakatos was chosen in the mapping of Islamization of natural sciences because its research program methodology was the closest concept and in accordance with the Islamization of science as a long-term research program. This was recognized by Dr. Adi Setia in two of his works, "Three Meanings of Islamic Science", in Syamsuddin Arif (Ed.), *Islamic Science: Paradigma, Fakta dan Agenda*, (Jakarta: INSISTS, 2016) p. 50 and "Islamic Science As A Scientific Research Program: Conceptual and Pragmatic Issues", *Islam & Science*, Vol. 3 (Summer 2005) No. 1.

natural sciences. Natural sciences was chosen because this group of science, besides being very close to human life, also basic assumptions about the universe greatly affect social and religious life.[48] Key concepts such as the cosmos, creation, space-time, causation and the like are important references in understanding reality.[49] Understanding of reality based on several key concepts, in addition to influencing social life, also has an impact on the environmental crisis.[50] Because the main problem al-Attas's Islamization is how it can be applied methodologically, where the application of this methodology requires an understanding of maps and typologies of natural sciences, in this study Lakatos was chosen as a representation of scientists and philosophers who provided maps and typologies of natural sciences as well as bridges for the concept of Islamization of al-Attas.

B. Problems Formulation

From the background of study above, two academic problems can be formulated which will be the focus as well as the limitations of this study.

1. How to formulate Islamic natural science research program in the

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[48] Fritjof Capra, *Titik Balik Peradaban*, Trans. M. Thoyibi, (Yogyakarta: Bentang, 1999) p. 31.

[49] Ach. Maimun, *Seyyed Hossein Nasr: Pergulatan Sains dan Spiritualitas Menuju Paradigma Kosmologi Alternatif*, (Yogyakarta: IRCiSOD, 2015) p. 17.

[50] This environmental crisis is mainly caused by the enlightenment-style instrumental reasoning and the Cartesian-Newtonian dualistic-mechanistic view. See William Leiss, "Modern Science, Enlightenment, and the Domination of Nature: No Exit?", in *Critical Ecologies: The Frankfurt School and Contemporary Environmental Crises,* Edited by Andrew Biro, (Toronto: University of Toronto Press, 2011) p. 21-43; Arran Gare, *Postmodernism and the Environmental Crisis*, (London and New York: Routledge, 1995) p. 53; Fritjof Capra, "The New Vision of Reality: Toward a Synthesis of Eastern Wisdom and Modern Science", in *Ancient Wisdom and Modern Science,* Edited by Stanislav Grof, (New York, Albany: SUNY Press, 1984) p. 135-137; see also Joshtrom Isaac Kureethadam, *The Philosophical Roots of the Ecological Crisis: Descartes and the Modern Worldview*, (Newcastle: Cambridge Scholars Publishing, 2017); compare with Seyyed Hossein Nasr, *The Need for a Sacred Science,* (New York, Albany: SUNY Press, 1993) specially in chapter 9 and Seyyed Hossein Nasr, *Antara Tuhan, Alam dan Manusia,* Terj. Ali Noer Zaman, (Yogyakarta: IRCiSOD, 2003) specially in chapter 3.

conceptual framework of al-Attas' the Islamization of contemporary knowledge and Lakatos' the methodology of scientific research program?

2. How to apply the Islamic natural science research program which is useful for reading the structure of contemporary natural science and its problems and as a starting point in re-conceptualizing, redefining and re-formulating key concepts of contemporary natural science?

C. Purpose of Study

Based on the academic problem formulation above, this study has two objectives:

1. Finding the form of an Islamic natural science research program based on based on the conceptual framework of the al-Attas's Islamization of contemporary knowledge and Lakatos's methodology of scientific research programmes.
2. Finding ways to apply Islamic natural science research programs that are useful for reading contemporary natural science structures and their problems and as a starting point in re-conceptualizing, redefining and re-formulating key contemporary natural science concepts.

D. The Significance of Study

Based on the previous description, that the main problem of the Islamization of al-Attas is how it can be applied methodologically, where the application of this methodology requires an understanding of maps and typologies of natural sciences, this research will provide two major contributions. **First,** in the discourse of Islamization of contemporary knowlede, this research is expected to pave the way for the study of Islamization in natural science clusters such as Physics, Biology, Chemistry and all its derived disciplines. **Second,** in an effort to come up, to borrow the term Dr. Adi Setia, *Islamic Science Research Program*, which is a scientific work that seeks to reformulate the concept of contemporary science as a long-term research program based on the Islamic worldview, this research will open a new discourse in *the Islamic Natural Science Research Program*, which is a long-term research program based on the Islamic worldview in

the field of natural sciences.

E. Theoretical Framework

Because the main problem of Al-Attas's Islamization is how it can be applied methodologically, where the application of this methodology requires an understanding of maps and typologies of natural sciences, here, the Lakatos's methodology of scientific research programmes will be described which will provide maps and typologies of natural sciences as well as bridges for the concept of Al-Attas's Islamization. In the context of the Islamization of the natural sciences, the three stages of Islamization,[51] can only operate operationally if and only if the structure and typology of the natural sciences are known correctly. In this context the Lakatos research program methodology is important and relevant. The Lakatos's methodology of scientific research programmes contains three main elements, namely the hard core, the protective belt and the series of theory. **First,** Hard core. Hard-core, in this case the basic assumptions that characterize the scientific research program that underlies, which cannot be rejected or modified, must be protected from the threat of falsification. In methodological rules, this core point is referred to as negative heuristics, namely that the solid core of fundamental assumptions should not change, functioning as the basic core of the other elements. The core must be maintained as long as the program is still running, the consequences if a scientist makes modifications to the core, then he actually has quit the research program conducted.[52] **Second,** the protective-belt. The protective-belt, is a positive heuristic consisting of auxiliary hypotheses in initial conditions, in methodological rule.[53] **Third,** a series of theories. A series of theories is the link between one theory and

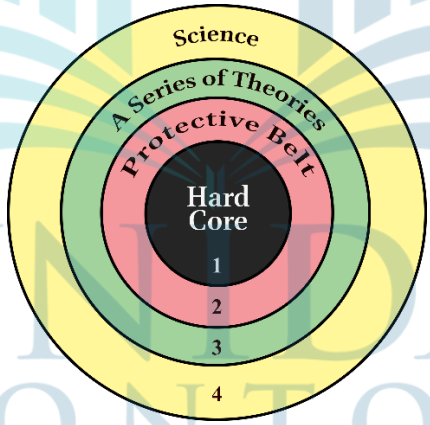
[51] The three stages are (1) de-westernization - the process of removing foreign concepts that are contrary to the Islamic worldview; (2) integration - the process of aligning and comparing the results of the modernization concepts with key concepts of the Islamic worldview; and (3) Islamization - the process of incorporating and absorbing key elements and concepts in the Islamic worldview. This issue will be explained in chapter 2.

[52] Imre Lakatos, "Falsification and the Methodology", p. 133-134.

[53] Imre Lakatos, "Falsification and the Methodology", p. 134-136.

another theory in which the next theory is the result of an auxiliary clause added from the previous theory.[54]

So in general it can be stated, the benefits of research programs are determined by how far scientists can develop their findings or even produce nothing. However, a degenerated program will pave the way for its more advanced rivals, just as Ptolemy's astronomy finally paved the way for Copernican theory. Then the program that continues to progress can continue to be followed up, both by himself and other parties, so that the problems that arise in science can be more recognized, can be further observed and then looked for solving the problem.[55] Thus, there are areas that are increasingly open to discussion, criticism, development and which have the side of "empirical content" is greater that this can lead to a better or superior theory. Because after all, the dynamics of science is the accumulation of theories that are always enriched with empirical results.[56] Therefore, the three main elements of the Lakatos research program above, the following scheme can be formulated:



[54] Imre Lakatos, "Falsification and the Methodology", p. 134-136.

[55] Herbert Horz, "Development of Science as a Change of Type", *in Imre Lakatos and Theories of Scientific Change*, Edited by Kostas Gavroglu, Yorgos Giudaroulis and Pantelis Nicolacopoulos, (Dordrecht/Boston/London: Kluwer Academic Publishers, 1986) p. 33-47.

[56] A.F. Chalmers, *Apa itu yang Dinamakan Ilmu?,* Terj. Redaksi (Jakarta: Hasta Mitra, 1983) p. 45.

The above scheme can be described as follows: **the first point**, namely the inner circle, refers to the metaphysical beliefs of scientists which can be called Hard core. This hard core is a truth that is believed to be just like that without question, it cannot even be falsified and contested, because it is the foundation of science. If the foundation is falsified, the building of science will be damaged, destroyed and can no longer operate. This metaphysical belief in the context of Islamization is an Islamic worldview that contains key concepts including: God, religion, ethics, science, reality, the universe, happiness, etc. **The second point** is the protective belt which in Thomas Kuhn's framework is parallel to the scientific paradigm, which contains scientific postulates where these postulates form the basis as well as a framework that directs a scientist in carrying out scientific activities. The scientific paradigm in al-Attas' thought refers to tauhid method of science. **The third point** is a series of theories, namely a series of variables, concepts, definitions and propositions as well as rules and regulations in a scientific discipline, in which al-Attas' thought is summarized in the term Science as a Ta'wil of the Universe. **The fourth point** is science with all its branches. These four points will be elaborated further in chapter 3, mainly to see in more detail the structure of natural science and its problems.

The above scheme illustrates the structure of science according to Lakatos, that is, every science — whether natural, social or human science — has at least four layers. Science which is generally understood by society in general is at the outermost layer. In this position many people assume that science is neutral, universal and free of values. However, if we enter a deeper layer, especially at the level of hard core the assumption that science is neutral, universal and free of values will be increasingly eroded. From here, the four layers of Lakatos science, mainly hard-core can meet with the formulation of the al-Attas's the worldview of Islam. Hard core are basic concepts in the worldview of Islam such as scientific concepts, reality and truth concepts, human concepts, natural concepts, justice concepts, happiness concepts and so on, which results in a scientific framework or

paradigm, where all these basic concepts are centered on the doctrine of the oneness of God or Tawhid. From these four levels of Lakatos science, we can carry out a scanning process in contemporary sciences—in this study referring to natural sciences. The scanning process[57] can be started from existing theories, then from that theory is tracked the type of paradigm used to find key concepts that reflect hard core or what kind of worldview that underlies the theory.

The main objective of this scanning process is to find key concepts in a theory that reflects the hard core of contemporary science. After the key concepts are discovered, what is done next is comparison and critical analysis, whether the key concepts are in accordance with the key concepts in the worldview of Islam If appropriate, the process of Islamization directly refers to the level of methodological praxis. If it turns out to be contradictory, it is necessary to analyze whether the concept is in complete contradiction, half or only a small part. This conflicting portion will determine the next process, which is the adoption and or adaptation or totally rejected.

F. Literature Review

Studies on the development of Islamic science, especially those that study the historical and philosophical aspects of natural science in Islamic civilization, must be acknowledged to have been widely produced. However, specifically studies that elaborate Al-Attas thought in terms of methodology, especially in the natural sciences cluster, the numbers are still very small. Especially for natural science studies in Islamic civilization, many have been published in book form. However, the Al-Attas Islamization thinking that focuses on the methodological side and relates to natural science is generally only in the form of articles or sub-chapters of a book.

The study of Islamic science in the earliest groups of natural sciences, in the context of the modern Muslim world written in Western languages, is the work of Seyyed Hossein Nasr, entitled *Introduction to*

[57] This process will be explained further in chapter 4.

Islamic Cosmological Doctrine.[58] Nasr's dissertation research at Harvard University in 1960 elaborated on the Islamic metaphysical system in viewing and studying nature. Nasr chose three main figures who were considered to represent the Islamic scientific tradition who worked in the Islamic metaphysical doctrine, namely Ikhwan al-Safa', Al-Biruni and Ibn Sina. Nasr's research concluded that cosmology in the perspective of Islamic scientists relies on tawhid doctrine which is reflected in the concept of the cosmos as a creation and manifestation of the attributes of God. Although initially cosmology entered the Islamic world through the translation of other civilizations such as Greece, India and Persia, the tawhid worldview of Muslim scientists rooted in the Holy Qur'an's revelations, can carry out amazing processes of adaptation, adoption and creation.

Despite providing a fairly detailed description of key concepts in Islamic cosmology, Nasr did not compare the core discourse in Islamic cosmology with modern cosmological discourse. Comparison of the core discourse between Islamic cosmology and modern cosmology is important to see, to what extent, key concepts in Islamic cosmology—such as the concepts of space, time, nature, motion and the like—can be relevant and answer problems in modern cosmology, primarily related with the basic assumptions of modern cosmologists in seeing the physical universe. Because Nasr did not compare with modern cosmology, this Nasr study was only relevant for readers who wanted to know the development of Islamic cosmological discourse in the 10th century AD. But for those who want to find out more about the relevance of the views, the methods of the scientists with modern cosmology, this work clearly has no direct relevance.

The next work that examines Islamic science which focuses on the philosophical, historical and methodological aspects, is in the book Osman Bakar, *Tawheed and Science: Islamic Perspectives on Religion and Science*.[59]

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[58] Seyyed Hossein Nasr, *An Introduction to Islamic Cosmological Doctrines*, (London: Thames and Hudson, 1978)

[59] Osman Bakar, *Tauhid and Science: Islamic Perspectives on Religion and Science*, (Selangor: Arah Pendidikan Sdn Bhd, 2008); this book has been translated

In this book, Bakar describes the relationship between the various sides of history and philosophy of Islamic science. In this book Bakar often writes the phrase "Islamic science" which refers to the totality of mathematics and natural sciences, including psychology and cognitive science, which grew in Islamic culture and civilization for more than a millennium starting from the 3rd century Islam.[60] A science, according to Bakr, is called Islamic not only because it is produced by Muslim scientists, but conceptually, it is closely related to Islamic fundamental teachings, the most important of which is the principle of tawhid[61]—this is because historical facts prove, in the period of 3 to 12 the century Islam, many non-Muslim scientists also contributed and contributed to the development of "Islamic science".

This book discusses four main themes, namely, (1) the epistemological foundation of Islamic science, (2) Human, Nature, and God in Islamic science, (3) Islamic and Western science, and (4) Islam and modern science. In connection with our research, specifically in Chapter 2 entitled "Methodological Problems in Islamic Science", Bakar outlines the basic methodologies used by Muslim scientists in carrying out scientific activities. According to Bakar, Islam accepts a variety of methodologies because the approached reality also has a diverse hierarchy of reality. However, the diversity of this methodology does not produce the relativity and plurality of truth.[62] Because ultimate reality is actually only one, referring to God. Although there is only one reality, Muslim scientists also acknowledge the hierarchy of reality, from the lowest, material reality to the highest,

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into Indonesian by Yuliani Liputo and M.S. Nasrullah with the title *Tauhid dan Sains: Perspektif Islam tentang Agama dan Sains*, (Bandung: Pustaka Hidayah, 2008). In this writing, what will be used as a reference source is the Indonesian translation.

[60] See Osman Bakar, *Tauhid dan Sains,* p. 17.

[61] Osman Bakar, *Tauhid dan Sains,* p. 17-18.

[62] This is different from modern Western science which only accepts one type of methodology known as the scientific method. Western scientists only accept one type of methodology because they only accept a single reality, namely material reality. For Western scientists, there is no reality — that can be known, measured and confirmed — except material reality. See, Osman Bakar, *Tauhid dan Sains,* p. 81-87.

namely God. The existence of this reality hierarchy has been studied by various schools of thought in the Islamic intellectual tradition, both in the philosophical, kalam and Sufism traditions.[63]

Although he has described various methodologies and approaches of Muslim scientists in Islamic intellectual traditions such as dialectics in the tradition of Kalam, rational in philosophy and intuition in Sufism, Bakar does not provide further description of how the various methodologies of Muslim scientists can be operated in a modern intellectual climate that is only accept one type of methodology. Bakar is merely describing what and how dialectical, rational and intuitive methods work along with the limits of their ability to perceive reality. Meanwhile, if drawn in a contemporary intellectual climate, especially in the tradition of contemporary natural science, how the three methods of Muslim scientists work to produce a scientific product—a theory or law for example—Bakar does not predict it well. From this it can be seen, Bakar's description of the methodology of Muslim scientists in the Islamic intellectual tradition has not been able to answer the previous question.

The two previous works—written by Nasr[64] and Bakar[65]—are the perspectives of a scientist who turns to philosophical studies. Although both of them have sufficient knowledge in the dark sciences such as mathematics, physics, astronomy and cosmology, they do not work professionally like mathematicians, physicists or astronomers. Therefore, in several aspects, both of them have not been able to make a meaningful connection between the

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[63] Osman Bakar, *Tauhid dan Sains,* p. 92.

[64] Seyyed Hossein Nasr initially studied Physics at the Bachelor level, then geology and geophysics at the Postgraduate level until he obtained his M.Sc. Both he completed at the Massachusetts Institute of Technology (MIT) USA. But in his Doctoral studies, Nasr then chose the field of history and philosophy of science at Harvard University, which eventually became the chosen field as his academic career.

[65] Likewise with Osman Bakar. He completed his Bachelor and Postgraduate studies in mathematics at the University of London. But in his Doctoral studies—following in the footsteps of Nasr who was also his supervisor— he turned to the field of history and philosophy of science, at Temple University.

philosophical discourse which they pursue on one side and the development of natural sciences on the other. Therefore, the work of the following three Muslim scientists—who do work professionally as scientists—needs to be considered. The first figure is Nidhal Guessoum[66] with his book *Islam's Quantum Question67 and a monograph of Kalam's Necessary Engagement with Modern Science*.[68] In Islam's Quantum Question, Guessoum examines, at least, three subjects: (1) philosophy of science, (2) history of science, and (3) multilevel reading of verses of the Qur'an related to science in which three languages this cones on the big theme of the integration of Islam and modern science. In the first and second languages, Guessoum began his thoughts related to the idea of integration of science with the foundation of monotheism and the Qur'an as an approach to the philosophy of science. The concept of God became Geussoum's first foundation in discussing the integration of science and Islam. Because there is no principle that is more central and central in Islam than the concept of God, and there are no more fundamental rules in the building of Islam than the Qur'an.[69] The principle of tawhid in Islamic theology will never change since Islam was revealed to the Prophet Muhammad. until the end of time. While the history of science shows that the principle of divinity in Western civilization is strongly influenced by scientific theories and their development. It is clear that the

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[66] Nidhal Guessoum s an Algerian astrophysicist. He is a professor at the American University of Sharjah, United Arab Emirates. He earned M.Sc. and Ph.D. degrees from the University of California, San Diego. His 1988 doctoral thesis, "Thermonuclear reactions of light nuclei in astrophysical plasmas". His research interests range from gamma-ray astrophysics, such as positron-electron annihilation, nuclear gamma-ray lines, and gamma-ray bursts, to Islamic astronomy, i.e. crescent visibility, Islamic calendar, and prayer times at high latitudes, problems that have yet to be fully resolved. He has published a number of technical works and lectured internationally at many renowned universities (Cambridge, Oxford, Cornell, Wisconsin, and others).

[67] Nidhal Guessoum, *Islam's Quantum Question: Reconciling Muslim Tradition and Modern Science*, (London: I.B. Tauris, 2010)

[68] Nidhal Guessoum, "Kalam's Necessary Engagement with Modern Science", *Kalam Research & Media,* Monograph Series No. 6, 2011.

[69] Nidhal Guessoum, *Islam's Quantum Question,* p. 20.

concept of God is very closely related and influences the development of science and philosophy.[70]

In the third section, Guessoum highlights the relationship between contemporary science and the Qur'an. For Guessoum, science in Islam is intended as an act of interpreting God's verses.[71] The Qur'an contains a wealth of scientific information and universal phenomena. But there were some mistakes in understanding the meaning of the verses of the Qur'an, as did the *i'jaz 'ilmy* group.[72] According to Guessoum the Qur'an is not an encyclopedia of science. Therefore, if someone wants to study a number of theories in science, it is not appropriate to prove that the theory is contained in the Koran or not, but rather by doing reflective, analytical and philosophical reading and interpretation of some true parts of the Qur'an completely consistent with the theory.[73]

If in the book *Islam's Quantum Question*, Guessoum examines the integration of science and religion with three subjects: scientific philosophy, the history of science, and multilevel readings of the verses of the Qur'an, then the *Kalam's Necessary Engagement with Modern Science* monograph, he only focuses on five main topics in modern science that are closely

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[70] Anik Damayanti, *Pemikiran Nidhal Guessoum dalam Integrasi Islam dan Sains Modern: Implementasi pada Pengembangan Modul Ajar IPA "Ekosistem" Untuk Kelas VII Tingkat Sekolah Menengah Pertama (SMP),* Publikasi Ilmiah Thesis Magister, (Surakarta: Program Studi Magister Pendidikan Islam, Sekolah Pascasarjana Universitas Muhammadyah Surakarta, 2017) p. 5-6.

[71] Nidhal Guessoum, *Islam's Quantum Question,* p. 56.

[72] Geussoum himself did not agree with the flow of *i'jaz*. He believes that the Qur'an has several levels of recitation so that there are many meanings that can be found in its verses. The difference in understanding this meaning depends on the level of education and development of one's life. One can be able to read some scientific facts in a verse, without having to lead to the claim of miracles of the Qur'an definitively. See Nidhal Guessoum, *Islam's Quantum Question,* p. 160.

[73] Geussoum provided two inputs for the wrong interpretation of the verses of the Koran relating to scientific phenomena, namely: (1) the text of the Koran allows for several levels of reading, (2) before making an interpretation of the text of the Qur'an related to science, must understand science and the related philosophy of science. See, Nidhal Guessoum, *Islam's Quantum Question,* p. 167.

related to Kalam. The five topics include:[74] (1) creation of the universe, (2) human position in the universe, (3) creation or evolution in life and humans, (4) God's actions in the physical realm, and (4) the question of miracles. As a monograph, Guessoum only briefly discusses the five topics to compare them in the perspectives of kalam and philosophy. For example how the concept of creation is understood in the perspective of modern science, Ibn Sina and the mutakalimun. The main purpose of writing this monograph, as delivered by Guessoum himself,[75] is to provoke Muslim clerics and philosophers to engage in constructive discussions on the major themes of modern science, such as the five topics he offers.

Although Guessoum—in the two works above—does not discuss a specific and detailed methodology of how Kalam or philosophy can contribute to natural science or how the Qur'an is carefully read to produce an established methodology to answer contemporary natural science problems—as will be studied in this research—however, Guessoum's brief description of the main problems in natural science and modern cosmology, especially the debate about the origin of the universe, is valuable information as material for further study in this study.

The second and third figures, after Guessoum are Ab. Nasir Jaafar and Mohamed Ridza Wahiddin, who collaborated to make one article with the title *A New Quantum Theory in Accordance with Islamic Science*.[76] As a professional physicist, Jaafar and Wahidin departed from a central issue in quantum physics, namely the problem of particle-wave duality which until now has not obtained a well-established new theory.[77] Taking inspiration

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[74] Nidhal Guessoum, "Kalam's Necessary Engagement with Modern Science", p. 8.

[75] Nidhal Guessoum, "Kalam's Necessary Engagement with Modern Science", p. 17.

[76] Ab. Nasir Jaafar and Mohamed Ridza Wahiddin, "A New Quantum Theory in Accordance with Islamic Science", in *Islamic Perspectives on Science and Technology: Selected Conference Papers*, Edited by Mohammad Hashim Kamali, Osman Bakar, Daud Abdul-Fattah Batchelor, and Rugayah Hashim, (Singapore: Springer, 2016)

[77] Ab. Nasir Jaafar and Mohamed Ridza Wahiddin, "A New Quantum Theory..", p.

from the verses of the Qur'an about "couples" for example in the letter Yasin: 36 and Az-Zariyat: 49 and five principles in Islamic science - namely (1) unity of natural law, (2) the universe is a verse Allah, (3) one-on-one correspondence; (4) couple concept; and (5) the principle of causality, Jaafar and Wahidin then offered a new hypothesis, namely a recent scientific analysis showing that electrons can consist of unit electric charges and permanent magnets, all of which reflect the behavior of particle-wave duality according to experimental observations. Although physicists currently only consider the existence of induced magnetic fields, whose existence is caused by electron spins, new theories postulate that permanent magnetic fields are also present. Furthermore, permanent electric and magnetic charges can be considered as potential energy, which is also believed to be zero-point energy whose existence has been observed, but has not been well explained. Based on this new theory, mathematical equations have been derived to calculate the potential energy postulated from an electron.

Although Jaafar and Wahidin's efforts are worthy of appreciation and material in further research, they are not included in the core discussion of quantum physics, namely the basic concepts of space-time and causality.[78] The fundamental problem that has been debated by physicists with regard to quantum physics is that there is no definitive agreement between physicists about what space and time are and how causality works in the quantum world.[79] This debate will be drawn far back to the origin of the universe.

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[78] See for example, Victor F. Lenzen, *Causality In Natural Science*, (Illionis: Charles Thomas, 1954); Phyllis Illari and Federica Russo, *Causality: Philosophical Theory Meets Scientific Practice*, (Oxford: Oxford University Press, 2014); Henry Mehlberg, *Time, Causality, and The Quantum Theory,* (London: D. Reidel Publishing Company, 1980); Jan Hilgevoord and David Atkinson, "Time in Quantum Mechanics", in *The Oxford Handbook of Philosophy of Time,* Edited by Craig Callender, (Oxford: Oxford Universitry Press, 2011)

[79] See for example, Rory Fox, *Time and Eternity in Mid-ThirteenthCentury Thought*, (Oxford: Oxford Universitry Press, 2006); Alan G. Padgett, *God, Eternity and the Nature of Time*, (London: Macmillan Press, 1992); Kip S. Thorne, *Black Holes and Time Warps: Einstein's Outrageous Legacy*, (New York: W. W.

What, why and how certain conditions must be fulfilled at the "beginning of time" after the big bang that made the universe exist up to the conditions that can be observed now.[80] This is because space-time and causality in the quantum world are very different from the way they work compared to the everyday world of humans. Therefore, the offer of Jaafar and Wahidin's hypothesis above, will not have a significant impact, before the basic things in quantum physics are solved. The solution is, before reviewing the theoretical formulation and mathematical schematic of the current quantum physics and then making comparisons on certain terms in the Qur'an, first and foremost is a philosophical review, by utilizing Islamic intellectual treasures, on themes the theme to be studied, for example is the concepts of space, time and causality. After that, it is necessary to compare the philosophical terms with contemporary terms to get a clear picture of the position of the term in the intellectual realm of Islam and modern science. By tracking the terms philosophically and historically, further research and development can be carried out. This is because, although the terms in science look technical, there is actually a philosophical modus in them.

In the context of the study of key concepts, a noteworthy description, especially in the context of a fundamental comparison of key concepts of contemporary natural science and Islamic intellectual traditions is *Al-Ghazali's Concept of Causality: With Reference to His Interpretations of Reality and Knowledge* and *"Knowledge and Knowing in Islam: A Comparative Study between Nursi and al-Attas"*, by Dr. Hamid Fahmy Zarkasyi.[81] The first

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Norton & Company, 1994)

[80] Stephen Hawking and Roger Penrose, *The Nature of Space and Time*, (Princeton and Oxford: Princeton University Press, 1996); Roger Penrose, *Cycles of Time: An Extraordinary New View of the Universe*, (London: The Bodley Head, 2010); Marcelo Gleiser, "Emergent Spatiotemporal Complexity in Field Theory", in *Complexity and the Arrow of Time*, Edited by Charles H. Lineweaver, Paul C. W. Davies and Michael Ruse, (Cambridge: Cambridge University press, 2013) p. 113-133.

[81] Hamid Fahmy Zarkasyi, *Al-Ghazālī's Concept of Causality: With Reference to His Interpretations of Reality and Knowledge*, (Kuala Lumpur: IIUM Press, 2010); Hamid Fahmy Zarkasyi, "Knowledge and Knowing in Islam: A

work, which is the result of this dissertation research is quite comprehensive in observing the concept of causality in the view of Al-Ghazali. This is because Dr. Hamid did not merely describe the concept of causality as other Al-Ghazali scholars, who only placed the discourse of causality in the kalam or philosophical debate, but examined beyond the classical debate. Namely studying causality through worldview theory, primarily - as stated in the main subtitles of the book - examines causality and its relationship to science and reality. The results of this book's study emphasize that the concept of Al-Ghazali's causality cannot be separated from his description of the concept of God which is at the core of his argument and why he is different from the falifa and mutakalim. The concept of God - based on worldview theory - will influence how Al-Ghazali views reality and science, which ultimately places his unique and original causal concept, that is causality in the phenomenal realm is possible, undoubtedly, because the inevitability of causality in the phenomenal realm only occurs by will God.[82]

In the second work, Dr. Hamid elaborates the concept of knowledge in Islam, referring to the two great thinkers of Islam in the 20th and 21st centuries: Nursi and Al-Attas. In his writings, Dr. Hamid stated that knowledge in Islam is very different in meaning from the science that is developing today. The difference between them is, in Islam—as Nursi and Al-Attas thought—the process of knowing involves a spiritual dimension, not just sensory observation and reasoning.[83] It does not stop there, knowledge is also a form of actualization of the primordial human agreement with God. Actualization will bring people to a high degree *(maqam),* namely al-nafs almuṭmainnah. Because knowledge is the actualization of the primordial agreement between human beings and God, in the process intellectual and spiritual preparation is highly considered. This sort of thing certainly does not

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[82] See conclusions in the book Hamid Fahmy Zarkasyi, *Al-Ghazālī's Concept of Causality.*

[83] See, Hamid Fahmy Zarkasyi, "Knowledge and Knowing in Islam", p. 38.

exist in Western intellectual traditions. Intellectual and spiritual preparation in the path of knowledge is a form of awareness, that knowledge is not only dwelling on the material world, but also the best means for humans to be able to return to their God.

Although in the book *Al-Ghazali's Concept of Causality* and *Knowledge and Knowing in Islam* Dr. Hamid did not discuss the methodological side or issues directly related to natural science, but this book became an important reference in this research, primarily formulating the concept of causality and the concept of knowledge that is appropriate in natural science discourse. Because the principle of kusalitas and the concept of knowledge is one of several fundamental principles in natural science. Without placing this principle correctly, mainly based on the Islamic worldview, the follow-up study of the Islamization of the natural sciences or the *Islamic Natural Science Research Program*, is only an extension of secular natural sciences.

Almost the same as the work of Dr. Hamid, there is a paper from Mohd. Zaidi b. Ismail with the title, *Perihal Alam Semesta sebagai Kitab Kejadian dan Kesan Ilmiahnya pada Hala-Tuju Sains Tabi'i: Satu Liputan Ringkas Menurut Rencana Al-Attas*.[84] In this paper, Mohd. Zaidi described the concept of the universe as a cosmos, which has physical and metaphysical dimensions. Referring to the thoughts of Al-Attas, Mohd. Zaidi explained that the universe has a position that is in line with the Qur'an, namely as the verses of Allah. Because he is in line, then to find out the essential meaning of physical universe phenomena, methods of *tafsir* and *ta'wil* are needed as is the Qur'an.[85] This method will produce a scientific impression for Muslim communities, ie there is no secularization in understanding physical phenomena; and that whatever happens in this physical universe is always

[84] Mohd. Zaidi b. Ismail,"Perihal Alam Semesta sebagai Kitab Kejadian dan Kesan Ilmiahnya pada Hala-Tuju Sains Tabi'i: Satu Liputan Ringkas Menurut Rencana Al-Attas", in *AFKAR: Jurnal Aqidah dan Pemikiran Islam*, Bil. 8, April 2007.

[85] Mohd. Zaidi b. Ismail,"Perihal Alam Semesta sebagai Kitab Kejadian..", p. 92-103.

connected to God, because like the Qur'an, the universe is also verses that display the Glory, Power and Wisdom of Allah.[86]

The concept of the cosmos and the universe was adapted by Mohd. Zaidi in his paper above provides a clear and firm perspective, especially when compared to modern science, that the universe is not a single being. In addition to showing a material form that can be explored through the investigation of the five senses, the universe also has a metaphysical form that needs to be explored through the medium of reason and intuition. Description of Mohd. Zaidi in the paper is quite comprehensive, although in his explanation of the *tafsir* and *ta'wil* taken from Al-Attas's thinking, he still cannot elaborate further at the methodological level.

Two other works related to the study of key concepts are the works of Syamsuddin Arif and Alnoor Dhani. The first work is entitled *Ibn Sina's Cosmology: A Study of the Appropriation of Greek Philosophical Ideas in 11th Century Islam*.[87] Ph.D thesis which was completed at ISTAC-IIUM explains the principles of Avicenna's cosmology and how the process of Islamization—or appropriation in the selected subtitles—takes place. Dr. Syamsuddin refuted many orientalist studies that Ibn Sina's philosophy in general, or his cosmology in particular, was only an extension of Greek philosophy, or in short, Greek philosophy in Arabic. The second work is entitled *The Physical Theory of Kalam: Atoms, Space, and Void in Basrian Mu'Tazili Cosmology* which is a revised and expanded edition of his Ph.D. thesis at Harvard in 1991. In this book Dhani examines the epistemological and ontological principles that embraced by Muslim theologians (*mutakallimun*), especially the Muutazilites,[88] he discussed the key terms atom, space, and voidness and then tried to explain the relationship between

[86] Mohd. Zaidi b. Ismail,"Perihal Alam Semesta sebagai Kitab Kejadian..", p. 103-106.

[87] Syamsuddin Arif, *Ibnu Sina's Cosmology: A Study of the Appropriation of Greek Philosophical Ideas in 14th Century Islam*, Ph.D. Desertation (Kuala Lumpur: International Institute of Islamic Thought and Civilizations, 2004)

[88] Alnoor Dhani, *The Physical Theory of Kalam,* p. 15-54.

the atom and the physical body.[89] In the last two chapters he broadens perspectives by enumerating the arguments of opponents who appeal to the infinity of separation and by considering questions about their historical and geographical origins.[90]

Although in their work they do not discuss the methodological side or issues directly related to contemporary natural science directly, this book is an important reference in this research, especially formulating the right concepts of matter, universe, space and time in natural science discourses. Because these concepts are among several fundamental concepts in natural science. Without placing this principle correctly, primarily based on an Islamic worldview, further studies on the Islamization of natural science or the Islamic Natural Science Research Program will not be successful.

The previous works which have been stated above, are generally divided into two types: (1) philosophical works with general themes - such as epistemology, cosmology and ethics - which are minus the methodological side; or (2) works that focus on specific themes but are not accompanied by adequate philosophical analysis. Mainly discussing Al-Attas's thoughts, such as Mohd. Zaidi above, the philosophical content is quite dominant. In conjunction with this research, the following two figures are sufficient to represent two types of previous works: to have sufficient philosophical analysis while providing methodological descriptions. The two figures are Dr. Adi Setia and Dr. Mohamamd Muslih. Adi Setia with his four papers,[91] focused on translating Al-Attas's philosophical thinking to be

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[89] Alnoor Dhani, *The Physical Theory of Kalam,* p. 90-140.

[90] Alnoor Dhani, *The Physical Theory of Kalam,* p. 141-181; 182-194.

[91] Adi Setia, "Islamic Science as A Scientific Research Program: Conceptual and Pragmatic Issues", *Islam and Science,* Vol. 3. No. 1., Summer 2005., p. 93-101; "Tiga Pengertian Sains Islam: Menuju Pengoperasionalan Islamisasi Sains", In *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam*, Vol. 3., No. 4.,2008, p. 46-60.; "Dewesternizing & Islamizing the Sciences: Operationalizing the Neo-Ghazalian, Attasian Vision", Paper presented at the One-Day Colloquium on Islam & Secularism organized by HAKIM and Curiosity Institute in Kelana Jaya, Selangor on July 24 2010; and Rencana Penyelidikan Sains Islam: Ke Arah Mengamalaksanakan Gagasan Pengislaman Sains

more methodological by borrowing Lakatos thoughts. Through deepening elaboration, Dr. Adi Setia offers a new concept, the *Islamic Science Research Program*, which can be developed by Muslim researchers, especially those who want to develop the Al-Attas's Islamization of contemporary knowledge to be more operational in their respective areas of expertise. Welcoming Dr. Adi Setia, Mohammad Muslih then did doctoral research[92] to follow up the concept of the *Islamic Science Research Program* by examining the development of the discourse of the integration of science and religion at UIN Malang and UIN Yogyakarta, through the works of lecturers at the two universities. Mohammad Muslin's research results show that Islamic science today - which is a product of the Islamization of contemporary science - is based on Islamic theology, in this case Islamic values including *aqidah, shari'ah* and *akhlak*, are possible to be used as a foundation in the development of science.

From the literature review described above, it can be seen that the operationalization of the Islamization of Al-Attas in the form of a methodology that focuses on the natural sciences cluster has never been done. This research, despite having close contact with Dr. Adi Setia and Dr. Mohammad Muslih, basically different and its nature is the development of the research of the two figures. If the work of Adi Setia and Mohamamd Muslih focuses on finding the best formulation that enables Al-Attas's philosophical thinking to be operational methodologically, and has not yet referred to specific studies in certain knowledge groups, then in this study, the study focuses on the application of the Islamic Science Research Program it's in the natural sciences family. So, this research can be said of

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Menurut Kerangka Faham Syed Muhammad Naquib Al-Attas", dalam *Adab Dan Peradaban: Karya Pengi'tirafan untuk Syed Muhammad Naquib al-Attas,* Edited by Mohd Zaidi Ismail and Wan Suhaimi Wan Abdullah, (Kuala Lumpur: MPH Publishing, 2012) p. 370-371.

[92] Mohammad Muslih, *Pengembangan Sains Islam Dalam Perspektif Metodologi Program Riset Lakatosian (Survei Kritis atas Karya Dosen UIN Malang dan UIN Yogya)*, Desertasi Doktor, (Yogyakarta: Pascasarjana UIN Sunan Kalijaga, 2017)

the development of previous studies, especially research Dr. Adi Setia and Dr. Mohammad Muslih, specifically in the formulation and development of the *Islamic Natural Science Research Program*.

G. Methodology of Research

In this research, to achieve the expected goals, the right methods and approaches are needed. Therefore, this research will use several methods and approaches, adapted to the type and or model of research.

1. Type of Research

   This research can be categorized as qualitative research in the form of library studies. This research was conducted by collecting non-numerical and mathematical data.[93] Data collection is done by understanding the material in the form of writing[94] from manuscripts, books, journals, articles and other research in accordance with the research theme.[95] In the next stage, the data will be analyzed in an inductive and textual[96] content based on the theoretical framework used.[97] Critical Discourse Analysis[98] and Discourse-historical approach[99] can be done in this research.

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[93] Bruce A. Chadwick, *Social Science Research Methods*, (New Jersey: Prentice Hall, 1984) p. 162.

[94] Scott W. Vanderstoep and Deirdre D. Johnston, *Research Methods for Everyday Life: Blending Qualitative and Quantitative Approaches*, (Jossey-Bass A Wiley Imprint: San Francisco, 2009) p. 168-169.

[95] Jeff Lenburg, *The Facts on File Guide to Research*, (Facts on File Inc: New York, 2005) p. 37-38 See also: Pamela Maykut and Richard Morehouse, *Beginning Qualitative Research a Philosophic and Practical Guide*, (The Falmer Press: London, 1994) p. 105-106.

[96] Lisa M. Given (editor), *The SAGE Encyclodpedia of Qualitative Research Methods*, (SAGE Publication Inc: California, 2008) p. 15 dan 865.

[97] Lisa M. Given (editor), *The SAGE Encyclodpedia of Qualitative Research Methods,* p. 209

[98] Ruth Wodak and Michael Meyer, *Methods of Critical Discourse Analysis*, (SAGE Publication: London, 2001) p. 14-15.

[99] This can be done in qualitative research, the aim being to uncover the philosophical orientation of thought or discourse in his theory. Some things that are in focus include:

The results of the analysis and interpretation[100] are described descriptively[101] in groups that are relevant to each chapter of the discussion then provides criticism and comparative analysis of the available data sources.[102]

2. Research Methods

In accordance with the type of research chosen, this study will use at least three methods. **First,** the descriptive method. Descriptive method is a method in examining the status of a group of people, an object, a set of conditions, a system of thought or a class of events.[103] The purpose of this descriptive study is to make a systematic, factual and accurate description or description of the facts, traits and relationships between the phenomena and or objects being studied.[104] In the context of this research, the researcher will describe the thoughts of the two figures: Al-Attas and Lakatos, with the aim of providing a complete picture of their two thoughts and their respective positions, especially those related to the research theme.

Second, analytical methods. Analytical method is a research

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a) the text or discourse in the argument both paradoxical and internal structure. b) the background of the contextual structure and knowing the relationship. See: Ruth Wodak and Michael Meyer, *Methods of Critical Discourse Analysis*, p. 64-65.

[100] Pamela Maykut and Richard Morehouse, *Beginning Qualitative Research a Philosophic and Practical Guide*, p. 112-115.

[101] Qualitative research uses data sources that are verbal and non verbal. Verbal data is if the data to be analyzed is in the form of words which are sourced from personal writing, letters, media reports, interviews or other notes. While non-verbal data can be in the form of photos, videos, diagrams, and other files. See: Lisa M. Given (editor), *The SAGE Encyclodpedia of …,* p. 186 lihat juga Beverley Hancock, *An Introduction to Qualitative…,* p. 12-13

[102] Pamela Maykut and Richard Morehouse, *Beginning Qualitative …,* p. 16-17; See also: Scott W. Vanderstoep and Deirdre D. Johnston, *Research Methods for Everyday Life…,* p. 7

[103] Rosemarie Rizzo Parse, *Qualitative Inquiry: The Path of Sciencing*, (London: NLN Press, 2001) p. 57.

[104] Mariano M. Ariola, *Principles and Methods of Research*, (Manila: REX Book Store, 2006) p. 47.

activity that consists of a series of activities to parse, differentiate, and sort out an object of research to be regrouped according to certain criteria and then look for its relation and then interpret its meaning.[105] In a series of activities to parse, differentiate, and sort out an object of research, the researcher will observe a research object in detail by outlining its constituent components or arranging these components for further study.[106] In this study, the thoughts of Al-Attas and Lakatos will be described, compared and linked based on the chosen theoritical framework.

Third, the critical method. The critical method is, in conducting research, researchers must first doubt what is obtained from research sources.[107] Researchers must question, compare, and postpone conclusions before strong evidence is obtained.[108] After the strong evidence is obtained, then the researcher can establish a hypothesis and or general conclusions.[109] In this study, the question, distinction and suspension of conclusions are primarily aimed at the paradigms, theories and methodologies of natural science, from which the critical process will be carried out a hypothesis and or general conclusions.

3. Research Approachs

Because this study examines the thinking of two

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[105] Gyung-Jin Park, *Analytic Methods for Design Practice*, (London: Springer, 2007) p. 6.

[106] Kenneth M. Sayre, *Plato's Analytic Method*, (Chicago: University of Chicago Press, 1969) p. 22-25.

[107] Robert D. Denham, *Northrop Frye and Critical Method*, (Pennsylvania: Pennsylvania State University Press, 1978) p. 57; Arthur John Alfred Waldock, *Hamlet a Study in Critical Method*, (Cambridge: Cambridge University Press, 1931) p. 1-10.

[108] Colleen Reid, Lorraine Greaves and Sandra Kirby, *Experience Research Social Change: Critical Methods,* Third Edition, (Toronto: University of Toronto Press, 2017) p. 20-21.

[109] Alex Rosenberg and Lee McIntyre, *Philosophy of Science: A Contemporary Introduction*, Fourth Edition, (New York and London: Routledge, 2020) p. 36-54.

philosophers who are used to read problems in natural science, the approach in this study uses a philosophical and historical approach. The philosophical approach referred to here is a set of instruments used to analyze, compare and critically test concepts in natural science with the aim of discovering their central problems. The instruments used in this philosophical approach are metaphysics:[110] to read paradigms and metaphysical beliefs in natural science; epistemology:[111] to read theories and methodologies in natural science; ethics: to read the relationship between basic assumptions in natural science with the resulting environmental and social problems; and logic:[112] to read the flow of arguments and establish a conclusion on the premises used.

Then, in a historical approach, the origins of the character's thought will be examined, how a theory can emerge, how the social background that makes thought emerge and so on.[113] The historical approach is mainly used to examine natural science in the historical development of human beings and the thinking of their characters.[114] Also the thoughts of two figures whose thoughts are used as a

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[110] James Ladyman, "Ontological, Epistemological, and Methodological Positions", in *General Philosophy of Science: Focal Issues*, Edited by Theo A.F. Kuipers, (Amsterdam: Elsevier, 2007) p. 303-337.

[111] Allan Franklin, "The Role of Experiments in the Natural Sciences: Examples from Physics and Biology", in *General Philosophy of Science: Focal Issues*, Edited by Theo A.F. Kuipers, (Amsterdam: Elsevier, 2007) p. 219-225.

[112] Jerome R. Ravetz, *Scientific Knowledge and Its Social Problems*, (London and New Brunswick: Transaction Publisher, 1996); Mark D. Goldfein and Alexey V. Ivanov, *Applied Natural Science: Environmental Issues and Global Perspectives,* (Waretown, New Jersey: Aple Academic Press, 2016)

[113] Jorge J. E. Gracia, *Philosophy and Its History: Issues in Philosophical Historiography*, (Albany: SUNY Press, 1992) p. 235; Mark Day, *The Philosophy of History: An Introduction*, (London: Bloomsbury Academic, 2008) p. 69.

[114] A. Kadir Cucen, "The Distinction between the Historical and the Systematic Approaches to Philosophy", *International Journal of Humanities and Management Sciences (IJHMS)* Volume 5, Issue 1 (2017), p. 96-97.

theoretical framework in this study — the origin of their thoughts, the social setting that influenced them and how their main thoughts were formulated.

4. Data Sources

In library research, data sources that can be used as literature are data in the form of personal texts (diaries) or written documents in book form (both manuscripts or the latest version), autobiographies, writing in print media (articles or opinions), to literature discussing the person being studied — so far as it has a connection to the research topic.[115] In this study the main data sources refer to the work of Al-Attas and Lakatos as well as works related to natural science discourse. Data sources in this study are categorized into three: primary, secondary and tertiary.

First, primary sources. Primary data in this study refer to the work of Al-Attas and Lakatos with the following details. Al-Attas's works include: *Some Aspect of Ṣufism as Understood and Practised Among the Malays*, (Singapore: Malaysian Sociological Research Institute, 1963); *Rānīrī and the Wujūdiyyah of 17th Century Acheh,* (Singapore: Monograph of the Royal Asiatic Society, 1966); *The Origin of Malay Shā'ir*, (Kuala Lumpur: DBP, 1968); *Preliminary Statement on a General Theory of the Islamization of the Malay-Indonesian Archipelago,* (Kuala Lumpur: DBP, 1969); *The Mysticism of Ḥamzah Fanṣūrī,* (Kuala Lumpur: University of Malaya Press, 1970); *Islam dalam Sejarah dan Kebudayaan Melayu*, (Kuala Lumpur: Universiti Kebangsaan Malaysia Press, 1972); *Risalah untuk Kaum Muslimin,* (Kuala Lumpur: ISTAC, 2001); *Comment on the Re-examination of al-Rānīrī Ḥujjat al-Ṣiddīq: A Refutation*, (Kuala Lumpur: Museums Departement, 1975); *Islam: Faham Agama dan Asas Akhlak*, (Kuala Lumpur: IBFIM, 2012); *Islam dan Filsafat Sains,* Terj. Saiful Muzani (Bandung: Mizan, 1995); *Ma'na Kebahagiaan dan Pengalamannya dalam*

[115] Pamela Maykut and Richard Morehouse, *Beginning Qualitative …,* p. 105-106.

Islam, Terj. M. Zainy Uthman, (Kuala Lumpur: IBFIM, 2013); *Islam and Secularism,* (Kuala Lumpur: ISTAC, 1993); *The Concept of Education in Islam,* (Kuala Lumpur: Ta'dib International, 2019); *A Commentary on the Ḥujjat al-Ṣiddīq of Nūr al-Dīn al-Rānīrī,* (Kuala Lumpur: Kementerian Kebudayaan, 1986); *The Oldest Known Malay Manuscript: A 16th Century Malay Translation of the 'Aqā'id of al-Nāsāfī,* (Kuala Lumpur: Universiti Kebangsaan Malaysia Press, 1988); *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam,* (Kuala Lumpur: ISTAC, 1995); *Tinjauan Ringkas Peri Ilmu dan Pandangan Alam,* (Kuala Lumpur: Ta'dib International, 2019); *Historical Fact and Fiction,* (Johor Bahru: UTM Press, 2011); *On Justice and the Nature of Man: A Commentary on Surah Al-Nisa' (4):58 and Surah Al-Mu'minun (23):12-14*, (Kuala Lumpur: IBFIM, 2015)

While Lakatos works include: *The Methodology of Scientific Research Programmes,* Edited by Gregory Currie and John Worrall, (Cambridge: Cambridge University Press, 1989); *Mathematics, Science and Epistemology*, Edited by Gregory Currie and John Worrall, (Cambridge: Cambridge University Press, 1997); *Proofs and Refutations*, Edited by Elie Zahar and John Worrall, (Cambridge: Cambridge University Press, 2005); (with Paul Feyerabend) *For and Against Method,* Edited by Matteo Motterlini, (Chicago and London: The University of Chicago Press, 1999); (Editors) *Problem in the Philosophy of Mathematics*: Proceedings of the International Colloquium in the Philosophy of Science, London, 1965, Volume 1, (Amsterdam: North-Holland Publishing Company, 1967); (Editors) *The Problem of Inductive Logic:* Proceedings of the International Colloquium in the Philosophy of Science, London, 1965, Volume 2, (Amsterdam: North-Holland Publishing Company, 1968); (Editors) *Problem in the Philosophy of Science*: Proceedings of the International Colloquium in the Philosophy of Science, London, 1965, Volume 2, (Amsterdam: North-Holland Publishing Company, 1968); (Editor with Alan Musgrave) *Criticism and the Growth of Knowledge:* Proceedings of the International Colloquium in the Philosophy

of Science, London, 1965, Volume 4, (Cambridge: Cambridge University Press, 1970).

Second, secondary sources. Secondary data here is data that supports primary data. Secondary data in this study mainly refers to works that examine the thoughts of the two main figures in this study. Secondary works that examine Al-Attas's thoughts refer to the work of Wan Mohd Nor Wan Daud, student and former deputy director of ISTAC, as the most authoritative figure who interprets Al-Attas's thoughts. Wan Daud's works include: *Konsep Pengetahuan dalam Islam,* Terj. (Bandung: Penerbit Pustaka, 1997); *The Beacon on the Crest of a Hill,* Kuala Lumpur: ISTAC, 1991); *The Educational Philosophy and Practice of Syed Muhammad Naquib alAttas: An Exposition of the Original Concept of Islamization,* (Kuala Lumpur: ISTAC, 1998); *Rihlah Ilmiah Wan Mohd Nor Wan Daud: dari Neomodernisme ke Islamisasi Ilmu Kontemporer*, Edited by Adian Husaini, (Kuala Lumpur: CASIS-UTM, 2012); (Editors with Muhammad Zainiy Uthman) *Knowledge, Language, Thought and the Civilization of Islam: Essays in Honor of Syed Muhammad Naquib al-Attas*, Johor Bahru: UTM Press, 2010); "Al-Attas: True Reformer," in *Knowledge, Language, Thought and the Civilization of Islam: Essays in Honor of Syed Muhammad Naquib al-Attas*, Johor Bahru: UTM Press, 2010); *Budaya Ilmu dan Gagasan 1Malaysia: Membina Negara Maju dan Bahagia*, (Kuala Lumpur: Akademi Kenegaraan BTN, 2011); "Al-Attas: Ilmuwan Penyambung Tradisi Pembaharuan Tulen," in Mohd Zaidi Ismail dan Wan Suhaimi Wan Abdullah (Ed.), *Adab dan Peradaban: Karya Pengi'tirafan untuk Syed Muhammad Naquib al-Attas,* (Kuala Lumpur: MPH Publishing, 2012); "Konsep al-Attas tentang Ta'dib," di in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam,* Vol. 1., No 6, Juli-September 2005, ms. 76-85; "Epistemologi Islam dan Tantangan Pemikiran Ummat," in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam*, Vol. 2., No 5, April-Jun 2005, ms. 81-92; "Iklim Kehidupan Intelektual di Andalusia, Satu Cerminan Islamisasi Dua-Dimensi," in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam,* Vol.

3., No. 4., 2008, ms. 76-93; "Kemerdekaan dalam Islam: Memahami Kasus Malaysia," in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam,* Vol. 2., No 3, Desember 2005, ms. 94-103; "Tafsir dan Ta'wil sebagai Metode Ilmiah," in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam,*Vol. I, No. 1 Maret 2004, ms. 54-85; "ISTAC: Bangunan Budaya Ilmu," in *ISLAMIA: Jurnal Pemikiran dan Peradaban Islam,*Vol. 3., No. 3, 2008, ms. 32-49; *Islamisasi Ilmu-Ilmu Kontemporer dan Peran Universitas Islam dalam Konteks Dewesternisasi dan Dekolonisasi,* Terj. Tim INSISTS, (Bogor: UIKA dan CASIS UTM, 2013).

Whereas secondary works which examine Lakatos thinking include: Brendan Larvor, *Lakatos: An Introduction*, (London and New York: Routledge, 1998); John Kadvany, *Imre Lakatos and the Guises of Reason*, (Durham and London: Duke University Press, 2001); *Imre Lakatos and Theories of Scientific Change*, Edited by Kostas Gavroglu, Yorgos Goudaroulis, and Pantelis Nicolacopoulos, (Dordrecht/Boston/London: Kluwer Academic Publishers, 1986); Joseph Agassi, *Popper and His Popular Critics: Thomas Kuhn, Paul Feyerabend and Imre Lakatos*, (New York: Springer, 2014); dan Essays in memory of Imre Lakatos, Edited by R. S. Cohen, P. K. Feyerabend and M. W. Wartofsky, (Dordrecht-Boston: D. Reidel Publishing Company, 1976).

Third, tertiary sources. This tertiary data is used as needed to support the existence of primary and secondary data. Tertiary data related to research topics can be referenced from books, papers, articles, and official websites.

H. Systematics of Research

This research will be written in five chapters. To be able to achieve the objectives—as outlined above—in this study, there needs to be a brief description of how this research will be presented. This research will be presented in the following format:

Chapter I Introduction: In this chapter, the background of the problem, the formulation of the problem, the purpose of the study, the benefits of the research, the theoretical basis, the literature review, the research methodology and the systematic writing will be explained.

Chapter II Al-Attas and Lakatos On Scientific Research Programs: In this chapter, we will describe a brief biography and the thoughts of Al-Attas and Lakatos mainly referring to the concept of Islamization of contemporary knowledge and the methodology of scientific research programs—its history, position and the process of formulation.

Chapter III Structure of Natural Sciences and Problems: In this chapter the researcher will describe the structure of natural sciences and the main problems, which include metaphysical, epistemological and ethical problems; also the paradigm, the principle of the formulation of theories and key concepts.

Chapter IV Islamic Natural Science Research Program: In this chapter, researchers will try to formulate a methodology for Islamic scientific research programs in natural sciences based on the theoretical framework that has been chosen. This formulation begins with the formulation of the basis for the Islamization of natural sciences, the formulation of paradigms, the formulation of theories and methodologies, and ends with the re-conceptualization of key contemporary natural science concepts.

Chapter V Closing: This chapter contains conclusions of research that has been done as well as providing advice and recommendations for further research.