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TOWARD A THOMISTIC EPISTEMOLOGY OF SCIENCE

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Introduction

If one considers the epistemology of science as a special branch of human knowing, then it makes sense that philosophers of science have sought grounds for their epistemology of science in broader traditions of epistemology. For example, Nancy Cartwright, philosopher of science, acknowledges that the structure of her position follows a Kantian line.[1] Given that other noted philosophers of science have unabashedly claimed epistemological kinship with modern and contemporary thinkers, the question occurs to this author: what happens if one is driven, in one's more general epistemology, by the philosophical intuitions in the tradition of St. Thomas Aquinas?[2] The following is my attempt to answer such a question.

Part I: Epistemological Principles in the Thomist Tradition

The purpose of this first part is to bring together some salient epistemological principles from the Thomist tradition. I will argue that there are features of Thomistic epistemology that are still relevant to contemporary philosophy of science, and this can be shown by wedding these Thomistic epistemological principles with a brand of Epistemic Structural Realism.[3] This chapter will show that John Worrall's explication of ESR can be situated in a broader Thomistic epistemology and therefore serve the Thomist as a starting point for an eclectic epistemology of science. Worrall himself is not attempting to elucidate an overarching epistemological position. Instead, he is merely trying to give a faithful philosophical account of scientific revolutions, especially in the history of physics (particularly optics). It is my contention here that what he intends regarding the history of science can be situated in a Thomistic context such that his position follows epistemologically. In doing so, we can see how an overarching Thomistic commitment can yield positions in the philosophy of science like Worrall's ESR. Since Thomism is not a majority position even among Christian philosophers, let alone philosophers in general, I will not begin by assuming my reader has a working familiarity with his concepts.

Thomism versus Modernism

It must be noted that epistemological principles in Thomism differ radically with those that are rooted in modernity. Fredrick Wilhelmsen comments,

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[1]See Nancy Cartwright, "Fundamentalism vs. The Patchwork of Laws," in *Oxford Readings: The Philosophy of Science*, ed. David Papineau (Oxford: Oxford University Press, 1996), 314-326.

[2]I write, "In the tradition of" because many of the following citations will be from Thomists and their development of St. Thomas' thought and not merely Aquinas himself. Though Thomists may differ among themselves on some minor points, they share an overall common perspective when compared with various thinkers from modern and contemporary philosophy.

[3]See John Worrall, "Structural Realism: The Best of Both Worlds?" in *Oxford Readings: The Philosophy of Science*, ed. David Papineau (Oxford: Oxford University Press, 1996), 139-165.

> Historically the term 'epistemology' has come to mean the ways in which philosophers have met the so-called 'critical' or 'epistemological problem.' Very briefly, we can describe the critical problem as follows: How does the mind move from an understanding of itself and its own operations, to an understanding of things? How does the mind know that it really knows things, not simply its own knowing?[4]

In modern philosophy (at least from Descartes to Hume) the philosophical propensity in epistemology was to treat sense cognition as suspect and call on the intellect to provide a critical justification for what is delivered by the senses.[5] This has created an investigation of knowledge of a very specific type. Wilhelmsen summarizes this mode of investigation thusly:

> Concentrate for a moment on the fact that you are here and knowing this piece of paper before your eyes. The situation involves three elements: (1) the piece of paper (2) being known (3) by you. Now suppress the first and third elements; that is, the fact that there is a piece of paper and that you – a flesh and blood human being – know the piece of paper. Retain only the act of knowing, without referring to the thing known or to you – the subject – exercising the act. Once you have done this, you are in the position of the critical philosopher after he has established the starting point of his critique of knowledge. You and what you know have dropped out of the picture. There remains only pure knowing or thinking, knowing or thinking itself to be knowing or thinking.[6]

Suffice it to say for the moment that in the Thomistic tradition, sense cognition is not treated as a suspicious, error-inducing component of human knowledge but as the beginning of the search for that which is true. As Wilhelmsen has pointed out, the nature of man as a knowing subject and respect for the nature of the object of knowledge has all but dropped out of contemporary discussions of epistemology. Space does not allow for a thorough investigation of the Thomistic tradition against neo-Thomism or the early modern tradition. This preset section is merely concerned with presenting epistemological principles from the Thomistic tradition to show how a Thomist might build a type of eclectic realism in the philosophy of science.[7]

Any Thomist epistemology, then, will take account, not just of the act of knowing, but the nature of the object known and the nature of the knowing subject. This means that Thomistic epistemology will have inextricable metaphysical components bound up with its theory of knowledge.

The Nature of Truth

Wilhelmsen has established the general components of knowing (object, act, subject). L. M. Regis comments on their interrelation and the nature of truth. He writes,

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[4]Frederick D. Wilhelmsen, *Man's Knowledge of Reality: An Introduction to Thomistic Epistemology* (Englewood Cliffs, NJ: Prentice-Hall, 1956), 4.

[5]Arguably, the failure of this approach ended in Hume's skepticism.

[6]Ibid., 27.

[7]See Etienne Gilson, *Thomistic Realism and the Critique of Knowledge* (San Francisco: Ignatius Press, 2012); Joseph Hassett, Robert Mitchell, and J. Donald Monan, *The Philosophy of Human Knowing: A Text for College Students* (Westminster, MA: The Newman Press, 1961); and Scott MacDonald, "Theory of Knowledge" in *The Cambridge Companion to Aquinas*, eds. Norman Kretzmann and Eleonore Stump (Cambridge: Cambridge University Press, 1993), 160-195. See also as the other works from Aquinas and the Thomist philosophers utilized here.

> Let us look at the nature of truth. It is essentially an accord between that which is known and that which is. This means that it is a relation. More specifically, it is a relation of measure and thing measured, the act of knowledge being the thing measured and the reality the measure. . . . Both together constitute the whole of the relation and without each other are unintelligible; so much so that if you change the measure element you change the relation. Now what are the elements in the present case? They are: reality, on the one side; and human knowledge, on the other, the latter being measured by the former.[8]

In this dense quotation we have outlined the nature of truth and the components and relationships in knowledge. Regis has beautifully summarized a realist position: knowledge is a relation, an "accord" between reality as the standard of measurement and human knowing as the thing measured. his is why the nature of the object is so crucial for a Thomistic epistemology. Before this quotation Regis had taken pains to explain that other epistemologies (e.g., Cartesian and Kantian) rely on what he calls "epistemological monism."[9] That is, they make knowledge all one type and exclude all other realities that present them to human consciousness as false or inferior. But the human mind is presented with sensible, intelligible, universal and particular objects, and a true epistemology will unify these diverse objects while respecting their diversity, allowing always that the reality of the object will be the measure and human knowledge the thing measured. Truth, then, is the degree to which human knowledge conforms to reality. Thomistic epistemology respects the nature of the object. For Thomistic epistemology, the real object is the standard for human knowledge. Correspondence between the two constitutes the nature of truth and the relation we call 'knowledge'.

The Nature of Human Knowledge

It may seem a strange locution to use the phrase 'human' knowledge, but it is the imbalance of epistemologies in modernity and beyond that disregard the nature of the subject. So it reminds us that humans have certain cognitive powers and abilities and that our knowledge of the world comes to us through these potential avenues of knowing. Regis serves us well in juxtaposing a Thomistic view of man with those of Descartes and Kant. He writes, "Cartesian idealism makes [man] a thinking substance, with a body thrown in as a kind of useless appendage. Kantian idealism makes [man] a pure reason chained by sensibility, which it informs without knowing the why, or how, and of which it is, in truth, a prisoner."[10] Thomism, on the other hand sees man as "placed on the confines of two orders, he is related to spirits and to bodies without being one or the other exclusively. He is a substantial composite of flesh and spirit, a hylomorphic creature, which means that his oneness is not the oneness of simplicity but of composition."[11] With this view of the nature of man, Regis will go on to explain how it is that this subject (a hylomorphic composition) can receive objects of knowledge of various types. He writes,

> The object is not external reality taken in the absolute, but external reality in so far as it bears a relation to the knowing subject, in so far as it exists in the soul. For since the soul is endowed with sensibility and intelligence, it has two possible existences of things in it, two objects of knowledge specifically distinct: sensible objects and intelligible objects; whence arises the two major categories of truth: *sensible truths* which are essentially contingent and changeable; and *intelligible truths* which are necessary and unchangeable. The confusion of these two kinds of truth leads to skepticism; the denial of one or the other leads to idealism; but *the acceptance of both, while their distinction is still maintained, is the very essence of the Thomistic epistemology,*

[8]Regis, *St. Thomas and Epistemology*, 47-48.

[9]Ibid., 44-45.

[10]Regis, 50-51.

[11]Ibid.

its basic realism, and the only realism that truthfully takes account of the complexity of human knowledge.[12]

These two avenues of knowing are, therefore, open to our nature, knowledge by way of the senses, which gives us contingent and changeable truths about reality; and intelligible truths that which are necessary and unchangeable. These truths exist together simultaneously in the human as the knowing subject. It is not the intellect that knows or the senses that know; it is the individual who knows by means of his intellect and senses. Human knowledge comes by way of sense cognition and intellection**.** Only these two acting together simultaneously allows for the complexity of different types of knowledge of different types of objects (e.g., metaphysical, mathematical, and empirical).

Empiricism

Empiricism is fundamentally the principle that our ideas come from experience. Almost every philosopher has admitted to some degree or another that human knowledge derives at least partially from our sense experience, but there is that grand tradition beginning with Platonic rationalism and finding its more modern form in Descartes and Leibniz that affirms that at least some of our ideas about the world are innate. In this section I will not indulge in a lengthy comparison between these two major schools of thought. Here it is enough to establish that Aquinas was classical empiricist in the tradition of Aristotle. Joseph Owens writing about the similarity between Aristotle and Aquinas says, "Both clearly distinguish the material from the immaterial, sensation from intellection, the temporal from the eternal, the body from the soul. Both ground all naturally attainable human knowledge on external sensible things, instead of on sensations, ideas, or language."[13] This last sentence is very important because it makes clear what was implicit above and that is, though knowledge comes to the human through two modes of cognition (sense cognition and intellection), it is not 'sensation' that is the ground for knowledge but rather "external sensible things." What makes Aquinas' empiricism a part of his *realism* is that the human knows things in the world by means of his senses and intellect, and it is the thing in the world that measures our concepts and judgments about the way things are. This is also why, in the quote above, Regis talks about different kinds of things existing in the soul. Because what knowledge is, for Aquinas, begins with the senses and, through the two avenues of human cognition, it ends with the concept of the thing in the mind that exists immaterially in the soul as it exists materially in the world.

Substantial/Accidental Forms, Nature, and the Categories of Being

As mentioned earlier, Thomistic epistemology is inextricably linked with metaphysics. This short digression into metaphysics will be important for later discussion. A possible misperception of Thomistic realism is that it is identical to an immediate, comprehensive, and infallible perception of the object. But to say that the mind perceives/knows directly the extra-mental thing through the senses is not to say that we have an immediate, comprehensive or infallible knowledge of the object. To see this we must take a look at Aristotelian-Thomistic metaphysics, but space permits only the briefest sketch.

Aquinas writes on the relationship between substances and accidents saying, "Now there are two ways of existing in act: to exist essentially or substantially (as when a man exists), and to exist accidentally (as when a man exists as white). The former is to exist without qualification, whereas the latter is to exist in a qualified way. . . . Hence, simply put, form makes matter exist, whereas an accident does not make a subject exist. The subject, however, makes an accident exist."[14] Accidents, then, for

[12]Regis, 53-54; emphasis added.

[13]Joseph Owens, "Aristotle and Aquinas," in *The Cambridge Companion to Aquinas*, ed. Norman Kretzmann and Eleonore Stump (Cambridge: Cambridge University Press, 1993), 38.

[14]St. Thomas Aquinas, *The Principles of Nature, I.2*, trans. Robert P. Goodwin (Indianapolis: The Bobbs-Merrill Company, 1965), 7-8.

Aquinas are acts of being by which a substantial thing is made to exist in one of several ways appropriate to its being. The example he uses is that of color. The human essence of a particular man makes him what he is substantially, but the color of the individual (e.g., white) is something that is accidental; it is one way that this substance can be with respect to the quality of its color. Colors are accidents in that they do not exist of themselves but must inhere in a subject. The subject itself exists independently as a particular *kind* of being, this 'kind' is picked out by the substance.

Eleonore Stump's explanation of substantial as opposed to accidental forms and Aquinas's view of Aristotle's categories of being is helpful. Stump explains,

> On Aquinas's views, every substance is a member of exactly one lowest species or primary kind. . . . Configuration by an accidental form, on the other hand, brings it about only that an already existing thing comes to have a certain property, without ceasing to be the thing it was. Accidental forms are thus responsible for the non-essential properties of a thing; the addition or removal of an accidental form does not alter the species to which the whole belongs or the identity of the whole.[15]

For Aquinas, then, every existing particular thing has a substantial form that makes it a member of a certain kind of thing and accidental forms that give it its non-essential properties.

Stump goes on to relate these terms to a thing's 'nature'. She writes, "Aquinas designates the collection of species-specific properties with the Latin term translated 'nature': the nature of a thing is what is signified by the species name of the thing, and a thing's nature is given by its substantial form."[16] So the nature of a thing is given by its substantial form, which confers on it its unique species-specific properties. Stump's use of 'collection' here should not be confused with any sort of bundle theory of properties. A theory such as this would be like David Hume's view of properties, that is, there is no underlying substance that makes a thing what it is.[17] On his view, we perceive only of bundle of properties with no underlying metaphysical unity. As Stump points out, Aquinas' view is just the opposite. We perceive that the substance "bread" is not like the substance "wood" because there is a "collection of species-specific properties" that makes up these different natures. The way to account for the endurance of these collections is they inhere as accidental properties in some more fundamental underlying unity.

Finally, she brings the idea of accidental forms together with Aristotle's categories of being. She writes,

> Aquinas thinks that properties other than those which are part of the nature of a thing are accidents. Only the nature is conferred by substantial form, but since *this* substantial form is sufficient for the existence of *this* thing, any other properties are such that the thing can gain or lose them and remain the same thing. On the other hand, it is also clear that anything which has a substantial form necessarily has accidents, as a quick survey of the nine Aristotelian categories of accidents makes evident; nothing that has a substantial form can be without any accidents at all.[18]

Stump has just verified that any actually existing particular thing will have some accidents that inhere in it as in a substance. Briefly, the substantial form makes a thing what it is, this is delineated in its nature, and

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[15]Eleonore Stump, *Aquinas* (New York: Routledge, 2003), 38.

[16]Ibid., 47.

[17]See David Hume, *An Enquiry Concerning Human Understanding* (Indianapolis: Hackett Publishing, 1977); especially § 4 "Sceptical Doubts Concerning the Operations of the Understanding."

[18]Ibid., 49.

along with its nature it has accidents that range across the Aristotelian categories of accidents.[19] These constitute the variations or non-essential properties that a substance can possess. For later discussion, one should note that quantity, time, place, and position are given as some of the accidental forms that a substance may possess. Having briefly discussed these metaphysical elements, we now turn back to a more epistemological vein.

Knowledge of Natures by their Accidents and Effects

Now that we have the meaning of the terms of substance, accident, and nature, squarely in view, it is important to note that for Aquinas we come to know the essence or nature of a sensible thing, not all at once but gradually and through knowing first its accidents. We become aware, through our senses, of some object or its effects, and we move from the accidental forms and effects to the object itself and the species-specific properties it possesses. This becomes clear in a discussion of the difference between angelic knowledge and human knowledge. Aquinas writes, "[Angelic] cognition is also immutable, because they see directly the pure truth about things by a simple intuition, not by discursive movement from effects to causes or the reverse. . . . We, however, make guesses as to the quiddities of things from their accidents and effects."[20] Aquinas is talking about how we come to know things that are sensible in nature. He says elsewhere, "Even in the case of sensible things we do not know their essential differences; we indicate them through the accidental differences that flow from the essential differences, as we refer to a cause through its effect."[21] And again, "But, since we do not know essential difference, sometimes, as is said in the *Metaphysics*, we use accidents or effects in their place, and name a thing accordingly."[22]

The point to be made here is that there is a process of coming to know what sensible objects are essentially or what Aquinas calls their 'specific difference', which makes the object intelligible as a thing of a certain kind. For deeper human knowing, what needs to occur is a process of induction by which the mind is exposed to the same kind of thing multiple times in order to come to understand its nature. A more superficial knowledge will be based on a partial understanding of the object by some of its accidents and effects. This leads us to explore the Thomistic notions of induction and abstraction.

Induction and Abstraction

As said earlier, Thomistic epistemology entails elements of metaphysics and psychology. This is not clearer than in the process of induction that Aquinas espouses. Induction, for Aquinas, is not merely the enumeration of individuals in order to draw probable conclusions; it is a way in which the universal comes to be known by experience of particulars of the same kind. Aquinas writes,

> Demonstration proceeds from universals, but induction from particulars. Therefore, if any universals from which demonstration proceeds could be known without induction, it would follow that a person could acquire science of things of which he does not have sense experience. But is it impossible that universals be known scientifically without induction. This is quite

[19]Aristotle gave ten categories of being. The first is substance and answers the question "what is it?" and correlates with what Stump has called 'substantial form'. The other nine categories are: quality, quantity, relation, place, time, position, possession, acting, and being acted upon. See Robin Smith, "Logic," in *The Cambridge Companion to Aristotle*, ed. Jonathan Barnes (Cambridge, UK: Cambridge University Press, 1995), 27-65.

[20]St. Thomas Aquinas*, Summa Contra Gentiles, Book III, Part II, Q. 91, a.5*, trans. Vernon J. Bourke (Garden City, NY: University of Notre Dame Press, 1975), 41.

[21]St. Thomas Aquinas, *On Being and Essence*, trans. Armand Mauer (Toronto, Ontario: Pontifical Institute of Medieval Studies, 1968), 63.

[22]St. Thomas Aquinas*, On Truth, Q.4,a.1 ad 8*, trans. Robert W. Mulligan, S.J. (Indianapolis: IN, Hackett Publishing Company, 1994), 175.

> obvious in sensible things, because we receive the universal aspect in them through the experience which we have in regard to sensible things, as is explained in *Metaphysics I.*[23]

Aquinas has in mind an act of human knowing that takes place spontaneously in the experience of individuals of a kind. The mind comes to receive the universal concept or quiddity of a thing by exposure to particulars; this is the process of induction. Obviously this use of the term 'induction' is a far cry from a simple mode of logical inference. Taken logically, induction can only lead to probable conclusions. In this more metaphysical way, it is the very source of our knowledge about universals from which we draw demonstrative conclusions. The process of induction is the actual sensible exposure to things of the same kind and the process of abstraction is the way in which the universal is seen in the particular. This is why Aquinas, *contra* most modern and contemporary philosophers, thinks we can have necessary and demonstrative knowledge about, say, the mortality of humans.

Peter Kreeft elaborates on this process with an analogy that many will find helpful. He discusses the relationship that induction and abstraction have with each other by using the imagery of a hunter seeking his prey,

> All of our knowledge is dependent on its beginning: our experience and observation. As Aristotle said, there is nothing in the intellect that was not first in the senses, or derived from sensation. . . . And since experience is the basis of all our knowledge, and since induction reasons from experience, induction is the chronologically first step in reasoning. . . .
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> Abstraction is similar to induction. Abstraction is the operation of the first act of the mind [simple apprehension] which leads us from a sensory awareness of particular things to an intellectual awareness of a universal nature or essence…
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> Both abstraction and induction are like a hunter (the mind) entering a jungle (reality) to find a tiger (a universal). As the tiger lives in the jungle, the universal exists in its particulars: justice exists in just persons and acts, redness in red things, humanity in humans. As the hunter immobilizes and cages the tiger and takes it out of the jungle into a city zoo, the mind abstracts the unchanging universal from the changing concrete things and events it is involved in (the jungle), confines it to a concept (the cage), and places it in the mental realm (the city zoo, full of caged beasts) where it can be safely and objectively studied and compared with other universals.[24]

This is probably the most helpful description of the processes of induction and abstraction for those who are unfamiliar with Thomistic terminology. Here Kreeft presents the dual aspects of induction, by which the mind is exposed to the accidents and effects of a specific kind of thing, here the tiger. Through many exposures, the mind is able to abstract the nature of the thing such that all of these accidents hang together in one specific way that makes a thing intelligible as what it is (its nature or quiddity).

Imagination and the Phantasm (Sense Image)

The last component of our Thomistic psychology is the role of the imagination and the phantasm or sense image. These can be distinguished since the imagination is technically a power of the mind and the phantasm refers to a particular object of the imagination. The important thing to note here is that the phantasm in the imagination plays a middle role between the sensible particular and the wholly immaterial quiddity or intelligible species, which is the nature of the thing retained in the intellect. For Aquinas, it is the intellect's role to know or retain only the intelligible species (universal/concept) of a particular. The senses know only individual particulars. The question then arises: how is the transition between knowing the particular through the senses and knowing the universal in the intellect made? The

[23]St. Thomas Aquinas, *Commentary on the Posterior Analytics of Aristotle, I.30*, trans. F. R. Larcher (Albany, NY: Magi Books, 1970), 99.

[24]Peter Kreeft, *Socratic Logic, ed. 3.1*, ed. Trent Dougherty (South Bend, IN: St. Augustine's Press, 2010), 314-315.

answer is through the sense image or phantasm under the illuminating power of the agent intellect. Aquinas writes,

> Colours [sic] as existing in individual corporeal matter, have the same mode of existence as the faculty of sight. Consequently, they can impress their likeness on sight. Sense images, on the contrary, since they are likenesses of individuals and exist in corporeal organs, do not have the same mode of existence as the human intellect—as is obvious from what has been said. Consequently, they cannot, of their own power, make an impression on the possible intellect.[25]

Aquinas here makes it clear that the image of the imagination is something that comes from the senses and is retained in physical organs. As such, it is not yet of the kind of thing that could be retained in the intellect. Aquinas divides the powers of the intellect into the possible and the agent intellect. The former is the ultimate end of the intelligible species or universal, the latter is the power in the intellect by which the universal is abstracted from the sense image. It is this power that transforms the corporeal sense image into a wholly intelligible species. Regis says that "the intelligible species is the joint effect of the agent intellect and the phantasm."[26] This means that in order to have the universal in the possible intellect, we need both the sense image and the agent intellect that makes it intelligible. Regis also writes,

> Since the agent intellect gives luminosity, or intelligible being, and the phantasm furnishes the natures to the intellect, or—what amounts to the same thing—since the natures presented by the phantasms are intelligible only insofar as they are illumined by the agent intellect, we must conclude that the formal element in the intelligible species is given by the agent intellect, whereas the material factor, i.e. the nature of things, is provided by the phantasm.[27]

It is important that we understand that to have a clear universal in the intellect, that is, to have a clear concept of a thing's quiddity, we must have some sensible knowledge of it. If we do not have a sense image of something, our understanding of its nature is hindered. As Aquinas concludes, "Our intellect both abstracts [intelligible] species from sense images—insofar as it considers the natures of things as universal—and yet, at the same time, understands these in sense images, since it cannot understand even the things from which it abstracts [intelligible] species without turning to sense images. . . ."[28] All of this will have a crucial bearing on a Thomistic philosophy of science, especially as we discussion a form of realism regarding things that we cannot sense (e.g., sub-atomic particles).

Demonstration

Aquinas, following Aristotle, thinks that there are two types of demonstrations that one might have given *a posteriori* reasoning, such as is employed in the natural sciences. He writes,

> After determining about demonstration *propter quid*, the Philosopher here shows the difference between demonstration *quia* and demonstration *propter quid*. And he does two things about this. First, he states the twofold difference between the two in the same science. Secondly, he clarifies this with examples.
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> He says therefore first (78a22) that, as said above, demonstration is a syllogism causing scientific knowledge and proceeds from the causes both first and immediate of a thing. Now this is to be understood as referring to demonstration *propter quid*. But there is a difference between

[25]St. Thomas Aquinas, *Summa Theologiæ, Ia.85.2*, trans. Paul T. Durbin (Cambridge: Cambridge University Press, 2006), 57.

[26]Regis, *Epistemology*, 236.

[27]Ibid. 239.

[28]St. Thomas Aquinas, *Summa Theologiæ,* Ia.85.2, 57.

> knowing *that* a thing is so and *why* it is so. Therefore, since demonstration is a syllogism causing scientific knowledge, as has been said, it is necessary that a demonstration *quia* which makes one know that a thing is so should differ from the demonstration *propter quid* which makes one know why.[29]

One may have qualitative knowledge and therefore, reasoning from effects to the cause, may establish a demonstration of the *quia* (qualities) but without understanding the essence of the phenomenon in question. In contrast to *quia* demonstrations, there are demonstrations *propter quid,* or demonstrations of the effects from knowledge of the cause or the essence of the object in question. Aquinas says that if we know the "first and immediate" principles of an object, we are engaged in a *propter quid* demonstration because we know the ultimate 'why' of the causes involved and their effects.[30] If we are unaware of the ultimate first principles of a cause but only of its mediate and secondary principles, we can at most say that the thing is but are unable to demonstrate why it is; this is a *quia* demonstration. It is important to note that quia demonstration are a part of how we reason about things *a posteriori* and are therefore a part of how we reason in the natural sciences. It is part of our discovery of the changes in the natural world that they occur before our investigation of the details reveals to us how and why they occur. We will see later that some of this bears on our scientific understanding of quantum mechanics and it is also relevant to understanding the nature of ID science.

Summary of Thomistic Epistemology

I should end the Thomistic Philosophy section with a rundown of what Thomistic epistemology entails regarding empirical studies. The mind is made aware through the senses of some object or change. This object or change is a cause of a question or wondering. We focus on reproducing contact with objects of the same kind or changes of the same kind over and over again until we begin to see what it is that being that sort of object entails (e.g., being a tree or dog) or what the change entails (e.g., water, when heated to a certain point boils). In this process of induction and abstraction, the senses constantly give the intellect access to sensible particulars by way of the phantasm (imagination) such that it develops a concept of what specific properties are assigned to that thing. The intellect perceives in other things of the same kind (or other processes of the same change) an essential similarity. This goes beyond mere inferential induction. It is induction as a metaphysical act by which the intellect sees in the particulars what the universal nature of a thing is. In these processes, the intellect must make use of the sense image or phantasm, which is then illumined by the agent intellect. Without the phantasm, our understanding of the nature of the object is limited.

This is a concise statement of Thomistic epistemology. It is what grounds our metaphysical and epistemological realism.Where induction breaks down, human knowing breaks down. Were the imagination is stifled regarding sensible objects, human knowing is stifled. Where sense data can give no information, the intellect cannot know. This is not to say that there are not objects of the sciences (e.g., mathematics) which are properly rational (non-sensible) in nature, but even here the concepts are made clear by graphs and drawings. As Stump comments, "It is not the case, then, that every act of intellect is accompanied by an act of phantasia; rather, as a part of perception phantasms are necessary for acts of cognition that use or depend on perception. Even many apparently purely intellectual acts will rely on perception and phantasms indirectly, since they will rely on inspection of examples drawn from things perceived or imagined."[31] In what follows we will begin to see how these epistemological principles shape our philosophy regarding mathematical physics and thus begin to construct a uniquely Thomistic epistemology of science.

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[29]Aquinas, *Commentary on the Posterior Analytics of Aristotle,* I.23, 74.

[30]For discussion see also Joseph Owens, *Cognition* (Houston, TX: Center for Thomistic Studies, 1992).

[31]Stump, *Aquinas*, 262.

The epistemology of science seems, given the current literature, to boil down to the philosophy of physics or the philosophy of quantum mechanics. A more comprehensive epistemology of science will encompass many more of the sciences. If one wants to bring the philosophy of a thirteenth century thinker to bear on twenty-first century science, however, one should begin with quantum mechanics or not begin at all. This next section will therefore show how one might have a Thomistic philosophy of microphysics. From this starting point we will build a more comprehensive model.

In his book, *The Degrees of Knowledge*, Maritain explains what can and cannot be known about an object given certain levels and types of abstraction about an object and the level of intelligibility that can be obtained regarding the object. Before describing distinctions in our ways of knowing, Maritain says of the sciences, "It must be kept in mind that every science has to answer two questions: first, the question, AN EST– whether the thing exists; and then the question, QUID EST – what is its nature."[32]

Concerning mathematical physics, Maritain notes,

> In the physico-mathematical sciences, deductive theory and the system of notions they elaborate hark back to experimental results to verify whether that theory is apt accurately to express those experimental results in an appropriately technical vocabulary. Here the substitute for the ontological *quid est* is not an inductively established law, but a mathematical *quid est*, an algorithm of the physical real. . . .

The point here is that there is a significant distinction in obtaining a true ontological knowledge of an object's nature and allowing, for the purpose of scientific circumscription, a mathematical description to *stand for* the ontological nature of a thing.

Maritain elaborates this distinction:

> A physic-mathematical theory will be called "true" when a coherent and fullest possible system of mathematical symbols and the explanatory entities it organizes coincides, throughout all its numerical conclusions, with measurements we have made upon the real; . . . The need for causal physical explanation, still immanent to the mind of the physicist finally issues (in the highest of his syntheses) in the construction of a certain, number of beings of reason based on the real and providing an image (or a shadow of an image) apt to support his mathematical deduction. . . . The conceptions introduced by Einstein must accordingly be admired to the extent that they constitute a powerful physico-mathematical synthesis, but it must be rejected if given a properly philosophical meaning.[33]

By placing 'true' in quotation marks, Maritain is reminding us that the precise mathematical description of any object in realty is not its genuine ontology but a substitute. Further, the best the physicist can do is to create a mathematical model of some aspect of phenomena that best coincides with our experimental measures and admits of no internal failing.

Elsewhere, Maritain has said of the quantification of nature: "In the latter case, mathematical knowledge, the mind grasps entities it has drawn from sensible data or which it has built on them. . . . These things in the real (when they are *entia realia*) are accidents or properties of bodies."[34] In the physico-mathematical sciences, what guides deduction is the coherence of the mathematical theories. This certainly is true, at least, of micro-physics. The mathematics is given status, in the science, of a *quid est*, that is a description of the essence or nature of the phenomena, but Maritain has just said that in reality the quantifiable elements of an object are not its substantial form, but they are "accidents or properties."

[32]Maritain, *The Degrees of Knowledge*, 57.

[33]Maritain, *The Degrees of Knowledge*, 59, and 66-68.

[34]Ibid., 35.

In a similar vein, writing on the nature of modern physics, Regis comments,

> The law of probability refers simultaneously to a property grafted on to realities because of their great number and to an attribute of our knowledge. Just as it designates a property of *things that does not make them known in themselves but known by reason of their number* and of the relations existing between the individuals of a group, so is our knowledge of them concerned with the number and relations of the individuals in a group.[35]

In this passage Regis is commenting on the fact that modern physics (e.g., quantum mechanics) has given up trying to get at the causal determinations in micro-physics in favor of probabilities and statistical models. It is in this context that he writes the above, saying that what we know of these objects is not their nature but their number and interactions. That is, these measurements give us quantitative descriptions of these particles and how they interact with one another, but modern physics cannot reveal their essential nature.[36]

Another point to keep in mind at this stage of our discussion is that these particles with which the physics deal are actual individuals with unique properties. Stanley Jaki is adamant about this when he writes, "Anyone who delved into technical books and articles on those 'simple' particles can quickly register the overriding features in them. They show time and again that those particles have sharp numerical properties and also that their very specific interactions can only be expressed in formulas that should appear the very opposite to simplicity."[37] In the original work, Jaki is making this point to show that there is nothing ultimately generic about the particles with which physicists deal. His point about the specificity of these objects is to call our attention to the philosophical point of their individuality and contingency. It is important to our present discussion because he points out that these particles are known by their "sharp numerical properties" and "specific interactions." Keeping this in mind, we now have three important guides (Maritain, Regis, and Jaki) all telling us that what is known in micro-physics is not the nature of the things but by way of their quantitative features and interactions.

We can see an example of this in how we understand or point to the existence of a particle like a neutrino. John Losee explains,

> There is a very small probability that a neutrino, passing through a vat of dilute cadmium chloride solution, will interact with a hydrogen nucleus of a water molecule to produce a neutron and a positron. The positron is annihilated at once upon collision with an electron, producing two oppositely directed γ-rays of .51 mev. energy apiece. The neutron travels a short distance before being absorbed by a cadmium ion. The capture is accompanied by a release of three or four γ-rays with total energy of 9 mev. Given an appropriate sequence of events – two .51 mv. Oppositely directed γ-rays followed shortly by three or four γ-rays of total energy 9 mev. – physicists conclude that a neutrino has struck a hydrogen nucleus, and hence that neutrinos exist. The rationale for this existence-claim is that no other known nuclear reactions produce precisely this configuration and sequence of γ-rays.[38]

Losee's real-world example as to how a particle physicist comes to believe in the existence of something like a neutrino bears out the philosophical reasons of the above scientifically-minded Thomists. What we know of the particle is not based on direct perception (it is non-observable in this sense), but we are not wholly unaware of its existence since it leaves behind it, in the wake of its movements, a specific series of effects that can be recorded due to the precise mathematical nature of the objects involved. There is, however, a difference between one having knowledge of dogs, trees, and tables on the one hand, and

[35]Regis, *Epistemology*,71; emphasis in original.

[37]Stanley L. Jaki, *God and the Cosmologists* (Washington, DC: Regenery Gateway, 1989), 39.

[38]John Losee, *A Historical Introduction to the Philosophy of Science,* 4th ed. (New York: Oxford University Press, 2001), 255.

having knowledge of the existence of neutrinos on the other. To explore what type of realism we may hold to regarding the latter, we must begin exploring John Worrall's position of Epistemic Structural Realism.

Part II: Epistemic Structural Realism

In the preceding section we were concerned with the task of bringing together relevant aspects of Thomistic epistemology with modern physics, specifically those aspects that differ from modern/contemporary philosophical approaches that will bear on scientific epistemology. This present section is concerned to explain, briefly, the position of John Worrall termed Epistemic Structural Realism (ESR). In what follows, we will look at a summary of Worrall's position and how it deals with current quantum mechanical data. Perhaps a more comprehensive account of ESR would deal with variations of the position, objections in the current debate, and responses by realist detractors and supporters, respectively. It falls outside the scope of this current article, however, to offer such an account since the main purpose is to present how Worrall's ESR can be interpreted under broader Thomistic epistemological principles. With these delimiters in place, we will move on to Worrall's explanation of ESR and the problems in the philosophy of science that it solves.

'No Miracles' and 'Scientific Revolutions'

In the philosophy of science there is a perennial debate between realists and anti-realists philosophers regarding how they view the aim of science and/or the cognitive status of scientific theories. For various reasons, realists believe that our best scientific theories give us a true or approximately true picture of the way the world really is. Anti-realists, for various reasons, reject this claim in favor of some other position (e.g., science as problem solving [*a la* Laudan] or science as empirically adequate constructs [*a la* van Fraassen]). In this debate there are two dominant driving arguments that tend to push a thinker toward one position or the other.

The first argument is what Worrall calls the 'No Miracle' argument. He summarizes,

> Very roughly, this argument goes as follows. It would be a miracle, a coincidence on near-cosmic scale, if a theory made as many correct empirical predictions as, say, the general theory of relativity or the photon theory of light *without* what that theory says about the fundamental structure of the universe being correct of 'essentially' or 'basically' correct. . . . So it is plausible to conclude that presently accepted theories are indeed 'essentially' correct. After all, quantum theory gets certain phenomena, like the Lamb shift, correct to, whatever it is, 6 or 7 decimal places; in the view of some scientists, only a philosopher, overly impressed by merely logical possibilities, could believe that this is compatible with the quantum theory's failing to be a fundamentally correct description of reality.[39]

The 'no miracles' argument does indeed have a powerful influence over thinkers toward a realist position on scientific theories. But, as we will see, the anti-realist has some compelling counter evidence that needs to be taken into account, namely events in the history of science.

The second argument, which would make a thinker tend toward anti-realism, is the recognition of scientific revolutions in the history of science. Worrall writes,

> [If the] realist is forced to concede that there has been *radical* change at the theoretical level in the history of even the mature sciences, then he surely is in deep trouble. Suppose that there are cases of mature theories which were once accepted, were predictively successful, and whose underlying theoretical assumptions none the less now seem unequivocally false. . . . Why should

[39]John Worrall, "Structural Realism: Best of Both Worlds?" 140-141.

> not his proposed judgement [sic] about presently accepted theories turn out to be similarly mistaken?
>
> The chief argument against realism—the argument from scientific revolutions—is based precisely on the claim the revolutionary changes have occurred in accepted scientific theories. . . .[40]

David Papineau calls this same argument "the pessimistic meta-induction from past falsity." He catalogs some of the radical changes at the theoretical level of writing,

> If we survey cases where scientists have embraced their best explanations as true, these explanation have normally turned out false: consider, for example, Ptolemaic astronomy, the caloric theory of heat, the ether theory of electromagnetism, and so on. Given this poor past record of best explanations, ought we not conclude that inference to the best explanation will in general lead us to falsehoods, rather than truths?[41]

The historically verified instances of scientific revolutions wherein a theory is not incrementally improved but wholly discarded in favor of another poses a significant challenge to a realist view of scientific theories.

Worrall's Epistemic Structural Realism

John Worrall wants to develop a view of science that allows one to hold that there is something true in a scientific theory that transcends scientific revolutions and yet allows that these revolutions were genuine and radical changes (as is sometimes avoided by realists). He calls his position "structural realism" which, due to its decisively epistemological nature, has been dubbed Epistemic Structural Realism (ESR).

Worrall takes a paradigm case, one mentioned above by Papineau as supporting an anti-realist view of scientific theories, from the history of optics. Augustin Fresnel's theory was that light moved like a wave through a mechanical ether. This theory was replaced by James Clerk Maxwell's theory of electromagnetism,[42] which stated that the basic structure of light was "a series of wave-like changes in a disembodied electromagnetic field."[43] We now accept electromagnetic fields as entities of themselves and light as a photon particle that displays both characteristics of a wave and a particle. These radical differences on the nature of light pose a problem for the realist. Worrall, however, explains how this historical data supports his realist view:

> There *was* an important element of continuity in the shift from Fresnel to Maxwell—and this was much more than a simple question of carrying over the successful *empirical* content into the new theory. At the same time, it was rather less than a carrying over of the full theoretical content or full theoretical mechanisms. . . . There was a continuity of accumulation in the shift, but the continuity is one of form or structure, not of content. . . .This largely forgotten thesis of

[40]Ibid., 146.

[41]David Papineau, "Introduction," in *Oxford Readings in Philosophy: The Philosophy of Science*, ed. David Papineau (New York: Oxford University Press, 1996), 10.

[42]For more on Fresnel and Maxwell, see Jed Z. Buchwald, "Sadi Charnot and Augustin Fresnel" in *The Oxford Guide to the History of Physics and Astronomy*, ed. John L. Heilbron (Oxford: Oxford University Press, 2005), 41-42; P. M. Harman, "James Clerk Maxwell," in *The Oxford Companion to the History of Modern Science*, ed. J.L. Heilbron (Oxford: Oxford University Press, 2003), 499-500; and Stephen F. Mason, *A History of the Sciences* (New York: Collier Books, 1962), especially chapters 37 and 38, "The Wave Theory of Light" and "The Development of Electricity and Magnetism," respectively.

[43]Worrall, "Structural Realism," 147.

> Poincaré's seems to me to offer the only hopeful way of *both* underwriting the 'no miracles' argument *and* accepting an accurate account of the extent of theory change in science. Roughly speaking, it seems right to say that Fresnel completely misunderstood the nature of light; but, none the less it is no miracle that his theory enjoyed the empirical predictive success that it did; it is no miracle because Fresnel's theory, as science later saw it, attributed to light the right *structure*.[44]

For a thinker who has strong realist tendencies, Worrall's position offers an attractive middle ground between realist view, which demand that one give metaphysical descriptions of things like quantum phenomena (which potentially defy these descriptions) and anti-realist views, which seem to accurately take historical factors into consideration.

Finally, Worrall summarizes how his view fits with modern quantum mechanics, when he writes,

> The rule of the history of physics seems to be that, whenever a theory replaces a predecessor, which has however itself enjoyed genuine predictive success, the 'correspondence principle' applies. This requires the *mathematical equations* of the old theory to re-emerge as limiting cases of the mathematical equations of the new. . . . But the principle applies *purely* at the mathematical level, and hence is quite compatible with the new theory's basic theoretical assumptions (which *interpret* the terms in the equations) being entirely at odds with those of the old. . .
>
> [The structural realist] view would simply be that quantum mechanics does seem to have latched on to the real structure of the universe, that all sorts of phenomena exhibited by micro-systems really do depend on the system's quantum state, which really does evolve and change the way quantum mechanics describes. . . .
>
> The structural realist simply asserts, in other words, that, in view of the theory's enormous empirical success, the structure of the universe is (probably) something like quantum-mechanical. It is a mistake to think that we need to understand the nature of the quantum state at all. . . .[45]

It is helpful that Worrall has not left aside how his position deals with the phenomena of quantum mechanics since there are some prominent philosophers of science (*a la* van Fraassen) who believe that quantum mechanical data leads directly to a rejection of realism.[46] Having recapped Worrall's ESR, this article will now attempt to bring his insights under the umbrella of Thomistic realist principles presented in Part I.

Part III: Thomistic Structural Realism?

Thomism and Epistemic Structural Realism

Given what has been said above, this last portion of the essay will bring the two preceding sections (Part I and II) together in a way that is natural and consistent. This present section is concerned to point out areas of affinity between Thomistic epistemological principles and the structural realism of John Worrall. Having done this, I will show how this sort of philosophy of science clarifies the intuitions of J.P. Moreland and Alvin Plantinga.[47] Moreland and Plantinga want an epistemology of science that is

[44]Worrall, "Structural Realism," 157.

[45]Worrall, 160-163.

[46] See Bas C. van Fraassen, "The Charybdis of Realism: Epistemological Implications of Bell's Inequality," in *Philosophical Consequences of Quantum Theory: Reflections on Bell's Theorem*, eds. James T. Cushing and Ernan McMullin (Notre Dame, IN: University of Notre Dame Press, 2003), 97-113.

[47]See FN 6 in chapter 1.

consistent with theism. If the Thomistic view of ESR is coherent, then we have the beginnings of an epistemology of science that is also consistent with theism.[48]

Thomistic Structural Realism among Versions of Structural Realism

Before getting into the precise nature of a Thomistic Structural Realist position, it is important to show how this version is distinct from Worrall's position and a structural position attributed to Bertrand Russell. Ioannis Votsis, in an article commenting on Stathis Psillos' treatment of structural realism, writes,

> Although Russell's structuralist inclinations can be seen as early as *The Problems of Philosophy* (1912), a fully-fledged account first emerged in *The Analysis of Matter* (1927). There he argued that we only have direct epistemic access to percepts, i.e. the basic units of perception. These lie at the end of causal chains which originate in the external world…. More precisely he [Russell] argued that all that we can guarantee is that the structure of our perceptions is at most isomorphic to the structure of the physical world.[49]

Here it is clear that the 'structuralism' of Russell is much more wide ranging than Worrall's claims.For Russell, it is all of our knowledge that is merely structural in nature not simply the epistemic access we have to reality at the level of microphysics and due to the natural limitations of human sense cognition. Votsis continues,

> Psillos calls the Russellian approach the 'upward path' to structural realism, in contrast to the Poincaréan/Worrallian approach or 'downward path' to structural realism. The difference primarily lies in the way the two views are motivated. The Poincaréan approach takes the preservation of structure through theory change as indicative of its truth/approximate truth. The Russellian approach looks not in history but in perception to provide a reconstruction of our non-perceptual knowledge.[50]

Given the potentially different motivations for differing types of structural realism it behooves us to look at what type of structural realism Thomistic Structural Realism might be.[51]

It seems that it is altogether a third and unique type. It is similar to Russell's version in that it is tethered to a more comprehensive epistemology and not merely a theory that supports particular data in the history of physics. It is not, however, compatible with the Russellian type, since the two epistemologies espoused are radically divergent. No Thomist would concede that all we are aware of in the world are structures in the mind that are potentially isomorphic with their extra-mental objects. The Thomistic version is also distinct from Worrall's version in the way just mentioned, namely, as rooted in an overarching epistemology. But unlike Russellian structural realism, a Thomistic Structural Realism

[48]This assumes, of course, that one considers St. Thomas' philosophical-theology orthodox.

[49]Ioannis Votsis, "The Upward Path to Structural Realism" (2002) http://philsci-archive.pitt.edu/2186/1/Votsis-PSA04.pdf (accessed May 15, 2012).

[50]Ibid.

[51]I am aware of the version of Ontic Structural Realism espoused by Steven French and James Ladyman as well as variations of OSR. See Steven French, "On the Withering Away of Physical Objects," in *Interpreting Bodies: Classical and Quantum Objects in Modern Physics*, (1998): 93–113; and Steven French and James Ladyman, "Remodeling Structural Realism: Quantum Physics and the Metaphysics of Structure," *Synthese* 136, (2003): 31–56. For an overview of the developments of structural realism, see http://plato.stanford.edu/entries/structural-realism/ (accessed June 26, 2012). I consider the variations of OSR incompatible with the deeper commitments of Thomistic realism. However, a discussion of them is outside the scope of this article.

finds fruition and not conflict with Worrall's thesis. That is, given one's commitment to the Thomistic epistemological principles elucidated above, a natural extension of these is something like Worrall's ESR. The Thomistic epistemology converges on the same truth as Worrall's thesis espouses, but it is motivated by different philosophical concerns. The Thomist wants to keep in mind the limitations of our realism as an object is less and less available to the senses, and as Votsis states, Worrall is motivated to develop a position that "takes the preservation of structure through theory change as indicative of its truth/approximate truth."

It was mentioned by Regis that the object will stand as the measure of the thing known. A natural corollary to this is that when the nature of the object becomes obscure, due to spatio-temporal features (it is too small, moves too fast, it is too far away or too far back in time), then our knowledge of the object suffers under these limitations. Similarly, Worrall has stated that what we know of these objects is their *structure* without knowing their *nature*. This means that the limitation of our knowledge is of the mathematical representations that stand for the thing itself.

On this note, Maritain has said that in the physico-mathematical sciences, the equations are allowed to stand for the *quid est* of the objects. That is, though we have only the mathematical structure of the object, this is known with some precision and is allowed to represent the nature of the object. As Aquinas said, "We make guesses as to the quiddities of things from their accidents and effects." And Jaki has pointed out that particles have specific quantitative features and interactions. In quantum mechanics, then, we allow some of the accidents (e.g., quantity, time, position), and the experimental effects stand for the quiddities of things that are non-observables. We cannot have normal, simple apprehension of quantum phenomena, but our realism need not be discarded because of this, only properly qualified.

I mentioned above that the normal process of abstraction relies on the sensible giving way to the phantasm in the imagination, which allows for abstraction by the agent intellect. In the realm of quantum mechanics one is dealing with non-observable phenomena and this process breaks down. The consequence of this is that we have a difficult time literally *imagining* how these objects move in their micro-physical environs. Again, what we have is, as Maritain indicates, mathematical equations that track the intelligibility of the objects and some coherent descriptions regarding the effects of our experiments. With the imagination sufficiently diminished and the inherent strangeness of quantum phenomena, is one not justified in leaving aside a precise metaphysical description of these objects?[52]

It is my contention that Worrall's Epistemic Structural Realism can find a home within a broader Thomistic epistemology/ metaphysics. By viewing structural realism through the lens of Thomistic principles, it grounds Worrall's position in a broader realism that can justify why one should be agnostic about human knowledge concerning the quiddities of the non-observables of quantum mechanics. And if Worrall's position is consistent with Thomism, it gives the Thomist a representative position in the contemporary debate among philosophers of science.[53] Further, not only does it give the Thomist a philosophical position in modern philosophy of science, but it can provide an adequate guide for the relationship between science and theism, inasmuch as Aquinas' philosophy is a Christian philosophical-theology. Having shown that it is possible to bring Thomistic epistemological principles to bear on

[52]Some philosophers of science interested in quantum mechanics believe that one simply must attempt a metaphysical description of quantum mechanical phenomena. See "A Quantum-Theoretic Argument against Naturalism," in *The Nature of Nature*, ed. Bruce Gordon and William Dembski (Wilmington, DE: ISI Books, 2011), chapter 8. In this article, Gordon, having said that the science of quantum mechanics is long on description and prediction and notoriously silent on explanation, goes on to demand that the philosopher of science give a metaphysical account of this data. The Thomist, from his approach to natural theology, is already familiar with the type of qualified agnosticism espoused by Worrall and should embrace it as consistent with our natural epistemic limitations.

[53]Notice that with a Thomistic rendering, ESR cannot possibly be modified into forms of Ontic Structural Realism, which take the structures (accidents/effects) to be the basic ontology of the objects of micro-physics. The Thomist recognizes these features as accidental, which means they must inhere in a substance with a proper substantial form. The Thomist structural realist would defend against such moves.

contemporary microphysical data, we are in a position to sketch out the principles of a more comprehensive epistemology of science.

Conclusion

Thomistic realism allows for a realist epistemology that applies to 'normal' objects of human perception and things down to the quantum level. It merely states that we must be content with mathematical representation and experimental verification and leave aside questions that bear on the essential natures of the objects in question. This is merely a natural limitation of human knowledge. This chapter has demonstrated that one can be a Thomist in his epistemological commitments and remain conversant with twenty-first-century science. Worrall's attempt simply to give an accurate account of theory change in the history of physics is, unbeknownst to him, an extension of a centuries old philosophical tradition as it might articulate with modern science. In a broader Thomistic philosophical-theology one adopts a qualified agnosticism regarding the nature of God since His nature surpasses evidence that can be derived from the senses, and it appears that something similar can be said regarding the nature quantum mechanical phenomena. This present article is just the first stop toward a more comprehensives Thomistic philosophy of science.