

# The Two Uses of Reason

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Phillip Thompson's recent work on science and religion,<sup>1</sup> surpassing and updating Don O'Leary's,<sup>2</sup> begins with a striking contrast between the First Vatican Council and the Second Vatican Council regarding the relationship between faith and reason, between the Church and science.<sup>3</sup> Winning unanimous approval of the fathers of the First Vatican Council, *Dei Filius*<sup>4</sup>—which includes both the famous canon on the ability of natural reason to come to know God's existence<sup>5</sup> and a chapter entitled "On Faith and Reason"<sup>6</sup>—says:

Therefore all faithful Christians are not only forbidden to defend, as legitimate conclusions of science, such opinions as are known to be contrary to the doctrines of faith, especially if they have been condemned by the Church, but are altogether bound to account them as errors which put on the fallacious appearance of truth.<sup>7</sup>

The Second Vatican Council's *Gaudium et Spes*,<sup>8</sup> implicitly referring to the "Galileo affair" by citing Msgr. Pio Paschini's *Life and Works of Galileo Galilei*,<sup>9</sup> says:

May the faithful, therefore, live in very close union with the other men of their time... Let them connect [*coniungant*] new sciences and theories and the understanding of the most recent discoveries with Christian morality and the teaching of Christian doctrine, so that their religious culture and morality may keep pace with scientific knowledge and with the constantly progressing technology.<sup>10</sup>

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1 Phillip Thompson, *Between Science and Religion* (Lanham, MD: Lexington Books, 2009).

2 Don O'Leary, *Roman Catholicism and Modern Science: a History* (New York: Continuum, 2006).

3 Thompson, *Between Science and Religion*, vi.

4 Philip Schaff, *Creeds of Christendom, with a History and Critical Notes. Volume II. The History of Creeds.*, vol. 2, 1876, 234, <http://www.ccel.org/ccel/schaff/creeds2 ff>.

5 Schaff, *Creeds of Christendom, with a History and Critical Notes. Volume II. The History of Creeds.*, 2:252. Canon II. 1.: "Si quis dixerit, Deum unum et verum, Creatorem et Dominum nostrum, per ea, quæ facta sunt, naturali rationis humanæ lumine certo cognosci non posse: anathema sit." ("If any one shall say that the one true God, our Creator and Lord, can not be certainly known by the natural light of human reason through created things: let him be anathema.")

6 Ibid., 2:247 ff. (Chapter IV.)

7 Ibid., 2:249., Cardinal Manning's translation. Latin: "Quapropter omnes Christiani fideles hujusmodi opiniones, quæ fidei doctrinæ contrariæ esse cognoscuntur, maxime si ab Ecclesia reprobatae fuerint, non solum prohibentur tanquam legitimæ scientiæ conclusiones defendere, sed pro erroribus potius, qui fallacem veritatis speciem præ se ferant, habere tenentur omnino."

8 Pope Paul VI, *Pastoral Constitution on the Church in the Modern World: Gaudium et Spes*, 1965, [http://www.vatican.va/archive/hist\\_councils/ii\\_vatican\\_council/documents/vat-ii\\_const\\_19651207\\_gaudium-et-spes\\_en.html](http://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html). Latin version: [http://www.vatican.va/archive/hist\\_councils/ii\\_vatican\\_council/documents/vat-ii\\_const\\_19651207\\_gaudium-et-spes\\_lt.html](http://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_lt.html)

9 Pio Paschini, *Vita e opere di Galileo Galilei* (Rome: Herder, 1965), <http://books.google.com/books?id=K2U7AQAAIAAJ>. Cited in *Gaudium et Spes* sec. 36. Cf. also: Maurice A Finocchiaro, *Defending Copernicus and Galileo Critical Reasoning in the Two Affairs* (Dordrecht; New York: Springer, 2010), 216–20, <http://dx.doi.org/10.1007/978-90-481-3201-0>.

10 Pope Paul VI, *Gaudium et Spes*, sec. 62. "Fideles ergo coniunctissime cum aliis suae aetatis hominibus vivant... Novarum scientiarum et doctrinarum necnon novissimorum inventorum notitias cum christianis moribus christianaque doctrinae institutione coniungant, ut religionis cultus animique probitas apud ipsos pari gressu procedant cum scientiarum cognitione et cotidie progredientibus technicorum artibus."

How, practically, does a modern scientist “connect new sciences and theories” “with Christian morality and the teaching of Christian doctrine” while still being “altogether bound to account” “as errors” “such opinions as are known to be contrary to the doctrines of faith”? Thompson studies four men who tackled this problem:

1. Jacques Maritain (1881-1955), in his *Degrees of Knowledge*,<sup>11</sup> sought to show that there is a continuum of knowledge between “empirical science” like modern physics all the way up to metaphysical and ultimately mystical knowledge. However, he thought that “empirical sciences” (e.g., modern physics) and natural philosophy are distinct disciplines, having different objects of study,<sup>12</sup> thereby disconnecting metaphysics and natural theology from modern scientific discoveries.<sup>13</sup>
2. Pierre Teilhard de Chardin (1881-1955), a Jesuit anthropologist, conflated science with theology; hence, some, including the Holy Office, suspected him of the heresy of pantheism.

Pius XII’s encyclical *Humani Generis* (1950) completely rejected the Teilhardian position on evolution. Teilhard was furious and he accused the encyclical of exhibiting a “masochism and sadism of orthodoxy.” The encyclical appeared to require the faithful to “swallow the truth under its crudest and stupidest forms.” The Church failed to recognize that the theories of relativity and evolution were as critical to understanding God as the constant refinement of dogmas.<sup>14</sup>

De Chardin ultimately sought to explain how all of creation relates to Christ’s Incarnation, how matter relates to spirit. He posited that matter evolves until it becomes living (reaching the “Biosphere”), self-conscious (reaching the “Noosphere”), spiritual, and then ultimately God (reaching the “Omega Point”). His most famous work is *The Phenomenon of Man*.

3. Bernard Lonergan (1904-1984) is considered a “Transcendental Thomist” and is often associated with Karl Rahner. He focused more on how we know than what we know. Lonergan advocates a new methodology for philosophy and theology that would replace that of

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11 Jacques Maritain, *Distinguish to Unite, or, The Degrees of Knowledge*, trans. Gerald B. Phelan (Notre Dame, Ind.: University of Notre Dame Press, 1995). See also: Jacques Maritain, *Philosophy of Nature*, trans. Yves Simon (New York: Philosophical Library, 1951), 33–4, <http://archive.org/stream/philosophyofnatu00mari/>: “In the optimistic view of the ancients, who were prone to arrive quickly at what were often-times very hypothetical or fallacious explanations as concerned the detail of phenomena, philosophy and the experimental sciences were one and the same science and all the sciences concerned with the material world were subdivisions of *one unique specific science* which was called ‘philosophia naturalis’...” Maritain considers the ancients’ failure to distinguish multiple sciences in the first degree of abstraction a defect of the ancients; however, John of St. Thomas argues that a science is not specifically distinct from another science by being more concrete than general, since every science proceeds from generality to concretion, just as our understanding passes from potentiality to actuality. Cf. *infra* fn. 13.

12 That they are not specifically distinct, *pace* Maritain, see Bernard I. Mullahy, C.S.C., “Thomism and Mathematical Physics,” 1946, 105–7, <http://archive.org/details/ThomismAndMathematicalPhysics>. or Bernard I. Mullahy, C.S.C., “Subalternation & Mathematical Physics,” *Laval Théologique et Philosophique* 2 (1946): 89–107. For how “a plurality of sciences in the first degree of abstraction is incompatible with basic Thomistic epistemological principles” (Bernard I. Mullahy, C.S.C., “Thomism and Mathematical Physics,” 107.), see John of St. Thomas, *Cursus philosophicus thomisticus: secundum exactam, veram, genuinam Aristotelis et Doctoris Angelici mentem* (Parisii [Paris]: Ludovicus Vivès, 1883), 14–6. (q. 1 a. 2). For more references on how “‘a unifying physical theory’ that would include both the philosophy of nature and the empirical or experimental sciences... [would] constitute one specific discipline, both materially and formally,” see fn. 7 of Thomas Aquinas, *The Division and Methods of the Sciences: Questions V and VI of His Commentary on the De Trinitate of Boethius*, trans. Armand A. Maurer (Toronto: Pontifical Institute of Mediaeval Studies, 1963), 24, <http://dhspritory.org/thomas/BoethiusDeTr.htm#L21>.

13 For a criticism of Maritain’s philosophy of science, see William A. Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis* (Washington, D.C.: The Catholic University of America Press, 1996), 224–7, <http://books.google.com/books?id=ohxdaJqcRf8C&pg=PA224>.

14 Thompson, *Between Science and Religion*, 74.

Scholasticism and Aristotle's *Posterior Analytics* (cf., e.g., his *Method in Theology: Volume 14*).<sup>15</sup> In a chapter of his *Insight: A Study of Human Understanding* entitled "Isomorphism of Thomist and Scientific Thought," Lonergan sought to show the methodological similarities between Thomism and modern science, viz., that, "through an 'analogy of proportion'," "scientific hypothesis stood to verification as Thomist definitions stands to judgment." Thompson makes a useful table summarizing these similarities:<sup>16</sup>

| <b>Thomism</b>   | <b>Science</b>   |
|--|--|
| Desires to determine what God created;   | Desires to determine what is correct in nature;  |
| Verified definition by judgment;   | Empirically verified any hypothesis;   |
| Thomist abstraction is independent of a spatio-temporal framework;   | Einstein's theories of relativity are invariant in regards to a spatio-temporal framework; |
| The inner word or definition is reached with much difficulty, but is never perfected until beatitude;      | Seeks ever greater approximation through testing but ultimate knowledge is never reached;  |
| Seeks definite knowledge of essence in form and matter and there is a difference between essence and form. | Scientists seek definite function in forms and matter which measurements.                  |

4. Thomas Merton (1915-1968) was a Trappist contemplative. Initially a Luddite (one who opposes technology) who despised the sound of airplanes flying over his monastery in Kentucky and who thought technology is inimical to the contemplative life, he began to understand that the technology which resulted from modern scientific advances cannot be avoided. Unlike the other three intellectuals Thompson treats, Merton ponders the ethical issues of technology. He was a controversial thinker for paralleling, during the Cold War era, the United States's and the U.S.S.R.'s cultures' emphasis on mechanism and materialism.

Unfortunately, these four men did not offer concrete, practical solutions to the problem of the rapport between faith and modern reason because they were unfamiliar with the details of modern science, although they certainly were familiar with Catholic faith and theology.

## Natural Sciences are Theology's Handmaidens

"Other sciences [e.g., the natural sciences] are called the handmaidens of this one [*sacra doctrina*]: 'Wisdom sent her maids to invite to the tower' (Prov. 9:3)." —*Summa Theologica* I<sup>a</sup> q. 1 a. 5 s. c.

A very promising, practical, modern solution to this problem rests is the return to a realistic philosophy that respects the order in which the sciences are learned and emphasizes the study of the natural sciences.<sup>17</sup> Christian von Wolff (1679-1754) equated all of philosophy with metaphysics and placed metaphysics first in the order of learning or discovery (*in via inventionis*). St. Thomas, however,

15 Gerald A. McCool, S.J., *Nineteenth-century Scholasticism the Search for a Unitary Method* (New York: Fordham University Press, 1989), 260–1.

16 Thompson, *Between Science and Religion*, 89.

17 Benedict M. Ashley and John N. Deely, *How Science Enriches Theology* (South Bend, Ind.: St. Augustine's Press, 2012).

following Aristotle and Boethius,<sup>18</sup> places the natural sciences before metaphysics.<sup>19</sup> This latter ordering of the sciences, not being *a priori* “and *a priori* in a way that reeks of heresy,”<sup>20</sup> rejects “that old opinion which held as irrelevant for the faith what anyone thinks about creatures, if he thinks rightly about God—since an error on the nature of creatures originates false knowledge of God.”<sup>21</sup>

Thus, in what follows we study the fruitful correspondences between the French “*Æterni Patris*”<sup>22</sup> physicist<sup>23</sup> Pierre Duhem (1861-1916),<sup>24</sup> who once said one does not understand modern physics until he spends at least a decade as a physicist,<sup>25</sup> and Pope John Paul II’s thesis advisor Réginald Garrigou-Lagrange, O.P. (1877-1964).<sup>26</sup> When Garrigou-Lagrange was writing his famous work on God’s existence, *Dieu: son existence et sa nature* in 1914,<sup>27</sup> he took seriously Pope St. Pius X’s advise about how a neglect of the study of creatures results in false knowledge of God. Thus, he contacted a physicist, Duhem, to check how his arguments for proving God’s existence appear to a modern scientist. We present translations and commentaries of all Garrigou-Lagrange’s letters to Duhem and show their crucial importance for the modern Church.

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18 Aquinas, *The Division and Methods of the Sciences: Questions V and VI of His Commentary on the De Trinitate of Boethius*.

19 Benedict M. Ashley, *The Way Toward Wisdom an Interdisciplinary and Intercultural Introduction to Metaphysics* (Notre Dame, Ind.: University of Notre Dame Press, 2006), 146–63, <http://books.google.com/books?id=HQjXAAAAMAAJ>. Pages 146-63 are available here: <http://bit.ly/tyAnqd>

Cf. St. Thomas’s *Sententia Ethic.* lib. 6 l. 7 n. 17, in which boys must learn the sciences in the following order:

1. logic (the method of all of philosophy)
2. mathematics (within inexperienced boys’ imagination)
3. natural philosophy (requires experience)
4. ethics (requires an experienced soul free of passions)
5. metaphysics (exceeds the imagination)

Cf. also *Super Boethium De Trinitate* q. 5 a. 1 obj. 9 et ad 9 and q. 2 a. 3 ad 7.

20 Pope St. Pius X, “Encyclical of Pope Pius X on the Doctrines of the Modernists: Pascendi Dominici Gregis,” September 8, 1907, sec. 33, [http://www.vatican.va/holy\\_father/pius\\_x/encyclicals/documents/hf\\_p-x\\_enc\\_19070908\\_pascendi-dominici-gregis\\_en.html](http://www.vatican.va/holy_father/pius_x/encyclicals/documents/hf_p-x_enc_19070908_pascendi-dominici-gregis_en.html).

21 Pope St. Pius X, “Doctoris Angelici,” June 29, 1914, para. 2, <http://maritain.nd.edu/jmc/etext/doctoris.htm>.

22 Pope Leo XIII, “*Æterni Patris*: Encyclical on the Restoration of Christian Philosophy,” August 4, 1879, [http://www.vatican.va/holy\\_father/leo\\_xiii/encyclicals/documents/hf\\_l-xiii\\_enc\\_04081879\\_aeterni-patris\\_en.html](http://www.vatican.va/holy_father/leo_xiii/encyclicals/documents/hf_l-xiii_enc_04081879_aeterni-patris_en.html).

23 R. N. D. Martin, *Pierre Duhem Philosophy and History in the Work of a Believing Physicist*, 1991, 38–49, <http://catalog.hathitrust.org/api/volumes/oclc/24143109.html>. Martin discusses Duhem with respect to Leo XIII’s Thomistic revival and Pope St. Pius X’s condemnation of Modernism in *Pascendi Dominici gregis* and *Lamentabili sane*.

24 Stanley L. Jaki, *Uneasy Genius: The Life and Work of Pierre Duhem* (Boston: The Hague, 1984), <http://link.springer.com/book/10.1007/978-94-009-3623-2/>. Donald G. Miller, “Duhem, Pierre-Maurice-Marie,” ed. Charles Gillispie, *Complete Dictionary of Scientific Biography* (Scribner & American Council of Learned Societies, 1970), [http://www.encyclopedia.com/topic/Pierre\\_Maurice\\_Marie\\_Duhem.aspx#1](http://www.encyclopedia.com/topic/Pierre_Maurice_Marie_Duhem.aspx#1). Duhem’s most famous philosophy of physics work is Pierre Maurice Marie Duhem, *La théorie physique: son object, sa structure*, 2nd ed., Bibliothèque de philosophie expérimentale 2 (Paris: M. Rivière, 1914), [http://www.ac-nancy-metz.fr/enseign/philo/textesph/Duhem\\_theorie\\_physique.pdf](http://www.ac-nancy-metz.fr/enseign/philo/textesph/Duhem_theorie_physique.pdf). Translated in Pierre Maurice Marie Duhem, *The Aim and Structure of Physical Theory*, trans. Philip P. Wiener (Princeton: Princeton University Press, 1991), <http://books.google.com/books?id=5mVPK7QBdTkC>.

25 Jaki, *Uneasy Genius: The Life and Work of Pierre Duhem*, 133–4.

26 Richard Peddicord, *The Sacred Monster of Thomism : an Introduction to the Life and Legacy of Reginald Garrigou-Lagrange* (South Bend, Ind.: St. Augustine’s Press, 2005). Aidan. Nichols, *Reason with Piety : Garrigou-Lagrange in the Service of Catholic Thought* (Naples, FL: Sapientia Press of Ave Maria University, 2008). Thomas Crean, “A Saint in Heaven,” February 8, 2009, <http://www.christendom-awake.org/pages/thomas-crean/saint-in-heaven.htm>.

27 Réginald. Garrigou Lagrange, *God, His Existence and His Nature a Thomistic Solution of Certain Agnostic Antinomies*, trans. Bede Rose (St. Louis, Mo.: B. Herder Book Co., 1934), <http://catalog.hathitrust.org/api/volumes/oclc/1543761.html>. Originally published as *Dieu, son existence et sa nature solution thomiste des antinomies agnostiques* (Paris: G. Beauchesne, 1914), <http://catalog.hathitrust.org/api/volumes/oclc/10358267.html>.

## The Garrigou-Lagrange–Duhem “correspondence...treats and involves a very important and decisive period of the modern Church”

Although Garrigou-Lagrange published the last of Duhem’s letters to him in an appendix of his *Dieu: son existence et sa nature* entitled “Note on the Validity of the Principles of Inertia and Conservation of Energy;”<sup>28</sup> as of 1987 none of the letters of Garrigou-Lagrange to Duhem have been entirely published.<sup>29</sup> This is because—as Rev. Fr. Castaño, O.P., Rector of the Angelicum, wrote on April 4, 1987—

the “letters” of the most Rev. Fr. Garrigou-Lagrange...constitute a *special archive* which is still under the pontifical care and secret, since the correspondence of Fr. Garrigou-Lagrange treats and involves a very important and decisive period of the modern Church and, in particular, of the Holy See. Thus, some time will have to pass before this “material” can be placed at the disposition of scholars.<sup>30</sup>

Garrigou-Lagrange’s correspondence “treats and involves a very important and decisive period of the modern Church” because Duhem’s philosophy of science appears in Garrigou-Lagrange’s controversial *Angelicum* papers, in which he argues that the “New Theology,”<sup>31</sup> whose proponents included Maurice Blondel, leads directly back to Modernism,<sup>32</sup> the “synthesis of all heresies,” as Pope St. Pius X called it.<sup>33</sup>

### Duhem’s philosophy of physics

Duhem—drawing on his experience of being a physicist, philosopher,<sup>34</sup> historian of physics,<sup>35</sup>

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- 28 Garrigou Lagrange, *God, His Existence and His Nature a Thomistic Solution of Certain Agnostic Antinomies*, 447–52. Also: Pierre Maurice Marie Duhem and Réginald Garrigou-Lagrange, “Note on the Validity of the Principles of Inertia and Conservation of Energy (Note Sur La Valeur Des Principes de L’inertie et de La Conservation de L’énergie),” accessed April 4, 2013, <http://bit.ly/KjobxM>.
- 29 Stanley L. Jaki, “Le physicien et le métaphysicien. La correspondance entre Pierre Duhem et Réginald Garrigou-Lagrange,” *Actes de l’Académie Nationale des Sciences, Belles-Lettres et Arts de Bordeaux* 12 (1987): 93–116. Translated as Stanley L. Jaki, “The Physicist and the Metaphysician,” *The New Scholasticism* 63 (1989): 183–205. Jaki was unable to obtain Duhem’s letters to Garrigou-Lagrange, but he quotes important sections of Garrigou-Lagrange’s letters reproduced here *infra*.
- 30 Jaki, “The Physicist and the Metaphysician,” 195 fn. 33., my translation of the Italian: “le ‘carte’ del Rev. mo Padre Garrigou-Lagrange ... costituiscono un *archivio speciale*, il quale è ancora sotto la cura e il segreto pontificio, in quanto la corrispondenza del Padre Garrigou-Lagrange tratta e coinvolge un periodo molto importante e decisivo della Chiesa moderna e in particolare della Santa Sede. Dovrà, quindi passare alcun tempo prima che tal ‘materiale’ possa essere messo a disposizione degli studiosi.”
- 31 Jürgen Mettepenning, *Nouvelle Théologie - New Theology Inheritor of Modernism, Precursor of Vatican II* (London; New York: T & T Clark, 2010), <http://public.eblib.com/EBLPublic/PublicView.do?ptiID=601873>.
- 32 Réginald Garrigou-Lagrange, “Where Is the New Theology Leading Us?,” trans. Suzanne M. Rini, *Angelicum* 23 (1946): 126–45, <http://www.cfnews.org/gg-newtheo.htm>.
- 33 Pope St. Pius X, “Pascendi,” para. 39.
- 34 Pierre Duhem, “Logical Examination of Physical Theory,” trans. Peter Barker and Roger Ariew, *Synthese* 83, no. 2 (May 1, 1990): 183–188, doi:10.1007/BF00413755., Duhem’s own summary of his philosophy of physics for his candidacy in the Académie des Sciences, originally published as *Notice Sur Les Titres et Travaux Scientifiques de Pierre Duhem Rédigée Par Lui-même Lors de Sa Candidature à l’Académie Des Sciences*, vol. 1, 7 (Paris: Gauthier-Villars, 1917), 151–7.
- 35 Pierre Duhem, “Research on the History of Physical Theories,” trans. Peter Barker and Roger Ariew, *Synthese* 83, no. 2 (May 1, 1990): 189–200, doi:10.1007/BF00413756., Duhem’s own summary of his history of physics for his candidacy in the Académie des Sciences: *Notice Sur Les Titres et Travaux Scientifiques de Pierre Duhem Rédigée Par Lui-même Lors de Sa Candidature à l’Académie Des Sciences*, 1:158–69.

and founder of the discipline of the history of medieval physics<sup>36</sup>—argues that physical theories are classifications of physical laws that experiments discover. This is a key aspect of Duhem’s philosophy of physics:

A physical theory...is an abstract system<sup>37</sup> whose aim is to *summarize* and *classify logically* a group of experimental laws without claiming to explain these laws.<sup>38</sup>

Just as there are many ways to classify seashells or bodily organs, so there are also many ways to classify physical laws; and just as classifications *per se* do not explain what they classify, so also physical theories do not explain physical laws. Physical theories are not, as Newton thought about his theory of gravitation, uniquely deduced from experience; other theories (e.g., Einstein’s theory of gravitation) can equally, if not better, “save the phenomena”<sup>39</sup> of experience.

This seemingly positivist, nominalist, anti-realist understanding of the explanatory power of physical theories and the relation of physics to metaphysics<sup>40</sup> led Duhem’s contemporary, the Catholic civil engineer Eugène Vicaire, to attack him for drinking “the poison of skepticism.”<sup>41</sup> Vicaire writes:

It is not true that when constructing its theories, positive science has as its object simply to classify experimental laws; its proper object is the discovery of causes. To deny this is to maintain a suspect doctrine of positivism, and one capable of leading to skepticism. That doctrine, condemned by the whole tradition of great physicists, is dangerous, for it destroys scientific activity.<sup>42</sup>

In response to Vicaire, Duhem argues<sup>43</sup> that “The subordination that a theory establishes among various

36 Pierre Maurice Marie Duhem and Roger Ariew, *Medieval Cosmology: Theories of Infinity, Place, Time, Void, and the Plurality of Worlds* (Chicago: University of Chicago Press, 1985), a partial translation of the seminal work of the field of the history of medieval physics: Pierre Maurice Marie Duhem, *Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols. (Paris: A. Hermann, 1913).

37 Duhem, *La théorie physique: son objet, sa structure*, 24. gives a more specific definition of physical theory in terms of the “abstract system” of mathematics: “Une théorie physique n’est pas une explication. C’est un système de propositions mathématiques, déduites d’un petit nombre de principes, qui ont pour but de représenter aussi simplement, aussi complètement et aussi exactement que possible, un ensemble de lois expérimentales.” Translated in Duhem, *The Aim and Structure of Physical Theory*, 19.: “A physical theory is not an explanation. It is a system of mathematical propositions, deduced from a small number of principles, which aim to represent as simply, as completely, and as exactly as possible a set of experimental laws.”

38 Duhem, *The Aim and Structure of Physical Theory*, 7. Originally published as: Duhem, *La théorie physique: son objet, sa structure*, 3. “Une théorie physique...est un système abstrait qui a pour but de résumer et de classer logiquement un ensemble de lois expérimentales, sans prétendre expliquer ces lois.”

39 Pierre Maurice Marie Duhem, *To Save the Phenomena, an Essay on the Idea of Physical Theory from Plato to Galileo*, trans. Edmund Doland and Chaninah Maschler (Chicago: University of Chicago Press, 1969), <http://catalog.hathitrust.org/api/volumes/oclc/45693.html>. The concept of “saving the phenomena” (“σώζειν τὰ φαινόμενα”) is what makes Duhem’s interpretation of the “Galileo affair” unique; see Finocchiaro, *Defending Copernicus and Galileo Critical Reasoning in the Two Affairs*, 277–90.

40 What Benedict Ashley, O.P., prefers we call “metascience” in Ashley, *The Way Toward Wisdom an Interdisciplinary and Intercultural Introduction to Metaphysics*. Since sciences are specified by their formal objects, and since metaphysics studies being in general, then metaphysics is the true philosophy of science.

41 Martin, *Pierre Duhem Philosophy and History in the Work of a Believing Physicist*. argues that Blaise Pascal’s skepticism highly influenced Duhem. Also, Vicaire’s criticism here is similar to that of Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis*, 207–9, <http://books.google.com/books?id=ohxdaJqcRf8C&pg=PA207>. For Catholics’ criticism of Duhem, see Martin, *Pierre Duhem Philosophy and History in the Work of a Believing Physicist*, 203–6, <http://books.google.com/books?id=0jQBcEnsDv0C&pg=PA203>., in which Martin defends Duhem against Maritain’s misconceptions of Duhem.

42 Pierre Maurice Marie Duhem, *Essays in the history and philosophy of science*, trans. Roger Ariew and Peter Barker (Indianapolis: Hackett Pub. Co., 1996), 30, <http://books.google.com/books?id=UofBybolmREC&pg=PA30>. Originally published as Eugène Vicaire, “De La Valeur Objective Des Hypothèses Physiques,” *Revue de Questions Scientifiques* 33 (1893): 451–510.

43 Pierre Maurice Marie Duhem, “Physique et métaphysique,” *Revue de questions scientifiques* 34 (1893): 55–83. Translated in Duhem, *Essays in the History and Philosophy of Science*, 29–49.

physical laws by classifying them does not oblige us to admit a similar subordination among the metaphysical laws of which the physical laws are a manifestation.”<sup>44</sup> After mentioning how if we understood perfectly the nature of physical objects we would be able to devise the best classification of the physical laws governing those objects, he says “we would still be free logically to adopt another, to connect physical laws in a different order, to accept another mode of representation of physical phenomena. ... A classification, in fact, is not a judgment. It can be convenient or inconvenient, good or bad; it cannot be true or false.”<sup>45</sup>

For Duhem physical theories do not presuppose metaphysics or “metaphysical” models. Since physicists are free to classify physical laws in many ways, metaphysics and other explanatory frameworks—e.g., Aristotle’s crystalline spheres, Descartes’s vortices, the electromagnetic ether, phlogiston, atoms, etc.<sup>46</sup>—do not determine a physical theory, although they can be instrumental causes in the genesis of a physical theory. He supports this view with many historical examples of how physical theory overcame the limitations of a particular “metaphysical” model, e.g., how Fresnel’s theory of light overcame the limitations Descartes’s “metaphysical” vortex theory of light. Duhem would thus appear to agree that modern mathematical physics is not strictly a science—in the classical sense of certain knowledge through causes or by reasoning from indisputable principles<sup>47</sup>—but that it is really dialectics<sup>48</sup> or art,<sup>49</sup> a tool for further understanding.<sup>50</sup>

Classification is a type of analogical knowledge. Just as theology makes “use of analogy and the Aristotelian concept of a ‘mixed science’ [*scientia media*<sup>51</sup>], combining propositions established by

44 Duhem, *Essays in the History and Philosophy of Science*, 37.

45 Ibid.

46 This list of explanatory frameworks courtesy: Martin Hilbert, “Re: Duhem,” January 14, 2013., author of “Pierre Duhem and Neo-Thomist Interpretations of Physical Science” (Ph.D. thesis, University of Toronto, 2000).

47 cf. *Expositio Posteriorum*, lib. 1 l. 4 (spec., n. 6)

48 Ashley, *The Way Toward Wisdom an Interdisciplinary and Intercultural Introduction to Metaphysics*, 288–90. 437: Dialectic “is the logic of debate, of dialogue, and of research in which problems are raised and both or all sides of a question are expounded and tentative solutions examined. Thus, dialectic is a necessary instrument of philosophy or science in the search for understanding.”

49 Vincent Edward Smith, *Philosophical Physics*. (New York: Harper, 1950), 49–58.

50 Hence why some consider Duhem an instrumentalist, e.g.: Roger Ariew, “Pierre Duhem,” in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Spring 2011, 2011, <http://plato.stanford.edu/archives/spr2011/entries/duhem/>.

51 Roy J. Deferrari, M. Inviolata. Barry, and Ignatius. McGuiness, *A Lexicon of Saint Thomas Aquinas: Based on the Summa Theologica and Selected Passages of His Other Works* (Baltimore: Catholic University of America Press, 1948), 999.:

- *Expositio Posteriorum* lib. 1 l. 41 n. 3 {*Thomas Aquinas, A Commentary on the Posterior Analytics of Aristotle*, ed. Joseph Kenny, O.P., trans. Fabian R. Larcher, O.P. (Albany, NY: Magi Books, 1970), 141, <http://dhsprory.org/thomas/PostAnalytica.htm#41.>}: “quaedam scientiae sunt pure mathematicae, quae omnino abstrahunt secundum rationem a materia sensibili, ut geometria et arithmetica: quaedam autem scientiae sunt mediae, quae scilicet principia mathematica applicant ad materiam sensibilem, sicut perspectiva applicat principia geometriae ad lineam visuaem, et harmonica, idest musica, applicat principia arithmeticae ad sonos sensibiles.” (“some sciences are purely mathematical, those, namely, which abstract according to reason from sensible matter, as geometry and arithmetic; but other sciences are intermediate, namely, those which apply mathematical principles to sensible matter, as optics applies the principles of geometry to the visual line, and harmony, i.e., music [acoustics], applies the principles of arithmetic to sensible sounds.”)
- *Super Boethium De Trinitate* q. 5 a. 3 ad 6 {*Aquinas, The Division and Methods of the Sciences: Questions V and VI of His Commentary on the De Trinitate of Boethius*, 44.}: “Ad sextum dicendum quod in compositis simplicia salvantur et proprietates eorum, licet per alium modum, sicut propriae qualitates elementorum et motus ipsorum proprii inveniuntur in mixto; quod autem est compositorum proprium, non invenitur in simplicibus. Et inde est quod quanto aliqua scientia est abstractior et simpliciora considerans, tanto eius principia sunt magis applicabilia aliis scientiis. Unde principia mathematicae sunt applicabilia naturalibus rebus, non autem e converso, propter quod physica est ex suppositione mathematicae, sed non e converso, ut patet in III caeli et mundi. Et inde est quod de rebus naturalibus et mathematicis tres ordines scientiarum inveniuntur. Quaedam enim sunt pure naturales, quae considerant proprietates rerum naturalium, in quantum

reason with propositions assented to by faith” “to organize, as it were, a science of supernature (that of revealed theology);”<sup>52</sup> so, too, do modern scientists

take knowledge we possess from ordinary experience of nature to organize the special type of knowing we call modern science, making use of analogy or modeling techniques and the “mixed science” of mathematical physics, which combines propositions established through the observation of nature with those of mathematics. ... [This] is distinctive of Thomism, in contrast to other Scholastic systems of thought, namely, that analogical middle terms are sufficient for a valid demonstration, no less in mathematical physics than in the science of sacred theology.<sup>53</sup>

In Duhem’s words:

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huiusmodi, sicut physica et agricultura et huiusmodi. Quaedam vero sunt pure mathematicae, quae determinant de quantitibus absolute, sicut geometria de magnitudine et arithmetica de numero. Quaedam vero sunt mediae, quae principia mathematica ad res naturales applicant, ut musica, astrologia et huiusmodi. Quae tamen magis sunt affines mathematicis, quia in earum consideratione id quod est physicum est quasi materiale, quod autem est mathematicum est quasi formale; sicut musica considerat sonos, non in quantum sunt soni, sed in quantum sunt secundum numeros proportionabiles, et similiter est in aliis. Et propter hoc demonstrant conclusiones suas circa res naturales, sed per media mathematica; et ideo nihil prohibet, si in quantum cum naturali communicant, materiam sensibilem respiciunt. In quantum enim cum mathematica communicant, abstractae sunt.” (“Simple bodies and their properties remain in composite bodies, although in a different way, as the proper qualities of the elements and their proper movements are found in a mixed body. What is proper to composite bodies, however, is not found in simple bodies. And so it is that the more abstract and simple the objects of a science are, the more applicable its principles are to the other sciences. Thus the principles of mathematics are applicable to natural things, but not visa versa, because physics presupposes mathematics; but the converse is not true, as is clear in the *De Caelo et Mundo*. So there are three levels of sciences concerning natural and mathematical entities. Some are purely natural and treat of the properties of natural things as such, like physics, agriculture, and the like. Others are purely mathematical and treat of quantities absolutely, as geometry considers magnitude and arithmetic numbers. Still others are intermediate, and these apply mathematical principles to natural things; for instance, music, astronomy, and the like. These sciences, however, have a closer affinity to mathematics, because in their thinking that which is physical is, as it were, material, whereas that which is mathematical is, as it were, formal. For example, music [acoustics] considers sounds, not inasmuch as they are sounds, but inasmuch as they are proportionable according to numbers; and the same holds in other sciences. Thus they demonstrate their conclusions concerning natural things, but by means of mathematics. Therefore nothing prevents their being concerned with sensible matter insofar as they have something in common with natural science, but insofar as they have something in common with mathematics they are abstract.”)

- *In II Physica* lect. 3 n. 7 [164.] {Thomas Aquinas, *Commentary on Aristotle’s Physics*, trans. Richard J. Blackwell, Richard J. Spath, and W. Edmund Thirlkel, vol. 1, *Rare Masterpieces of Philosophy and Science* (New Haven: Yale University Press, 1963), 80, <http://dhspriority.org/thomas/Physics2.htm#3>.}: “Dicuntur autem scientiae mediae, quae accipiunt principia abstracta a scientiis pure mathematicis, et applicant ad materiam sensibilem; sicut perspectiva applicat ad lineam visuaem ea quae demonstrantur a geometria circa lineam abstractam; et harmonica, idest musica, applicat ad sonos ea quae arithmeticus considerat circa proportiones numerorum; et astrologia considerationem geometriae et arithmeticae applicat ad caelum et ad partes eius.” (“Those sciences are called intermediate sciences which take principles abstracted by the purely mathematical sciences and apply them to sensible matter. For example, perspective applies to the visual line those things which are demonstrated by geometry about the abstracted line; and harmony, that is music, applies to sound those things which arithmetic considers about the proportions of numbers; and astronomy applies the consideration of geometry and arithmetic to the heavens and its parts.”)
- *Summa theologica* II-II q. 9 a. 2 ad 3 {Thomas Aquinas, *Summa Theologica*, trans. Dominicans of the English Province, 1947, <http://www.ccel.org/ccel/aquinas/summa.pdf>.}: “Ad tertium dicendum quod, sicut supra dictum est, quilibet cognoscitivus habitus formaliter quidem respicit medium per quod aliquid cognoscitur, materialiter autem id quod per medium cognoscitur. Et quia id quod est formale potius est, ideo illae scientiae quae ex principiis mathematicis concludunt circa materiam naturalem, magis cum mathematicis connumerantur, utpote eis similiores, licet quantum ad materiam magis convenient cum naturali, et propter hoc dicitur in II Physic. quod sunt magis naturales.” (“As stated above [q. 1 a. 1], every cognitive habit regards formally the mean through which things are known, and materially, the things that are known through the mean. And since that which is formal, is of most account, it follows that those sciences which draw



There would be a very exact correspondence [analogy] between this natural classification or physical theory, after it had reached its highest degree of perfection, and the order in which a finished cosmology [natural philosophy] would arrange the realities of the world of matter; consequently, the more physical theory, on the one hand, and cosmology, on the other, approach each other in their perfect form, the more clear and detailed should be an analogy of these two doctrines.<sup>54</sup>

Duhem thus sees in the history of the development of physical theories—from as far back as Aristotle to the present day—a long, steady, continuous<sup>55</sup> process asymptotically approaching the best, “natural classification,” the bridge between modern physics and reality being analogy.<sup>56</sup> As Édouard Hugon, O.P., notes in the volume of his scholastic manual on natural philosophy,<sup>57</sup> Duhem observes that

Little by little...by the very effect of this development, mechanical hypotheses came up against obstacles on all sides which were more and more numerous and difficult to surmount. The atomic, Cartesian, and Newtonian systems gradually lost favour with physicists and made way for methods analogous to those advocated by Aristotle. Present-day physics is tending to return to a peripatetic form.<sup>58</sup>

Had Duhem lived to see the full development of quantum physics,<sup>59</sup> he would have recognized with Werner Heisenberg (1901-76) that the probability wave concept in quantum mechanics “was a quantitative version [analogue] of the concept of ‘potentia’ in Aristotelian philosophy”<sup>60</sup> and that the

conclusions about physical matter from mathematical principles, are reckoned rather among the mathematical sciences, though, as to their matter they have more in common with physical sciences: and for this reason it is stated in *Phys. II*, 2 that they are more akin to physics.”)

Mathematical physics is a “mixed science” (*scientia media*) because it is midway between the first two degrees of abstraction (physical and mathematical abstraction); this *scientia media* is “materially physical and formally mathematical.”

52 William A. Wallace, “Thomism and the Quantum Enigma,” *The Thomist* 61 (1997): 455–468, <http://www.thomist.org/jourl/1997/973AWall.htm>.

53 Ibid. This argument is implicit in Wallace, *The Modeling of Nature: Philosophy of Science and Philosophy of Nature in Synthesis*.

54 Pierre Maurice Marie Duhem, “Physics of a Believer (Physique de Croyant),” *Annales de Philosophie Chrétienne* 155 (1905): 44–67, 133–159, <http://ftp.colloquium.co.uk/~barrett/croyant.html>. This quotation courtesy: Hilbert, “Re: Duhem.”

55 For an overview of the “continuity thesis” in the history of science, see: James Hannam, *God’s Philosophers: How the Medieval World Laid the Foundations of Modern Science* (London: Icon Books, 2009).

56 This insight courtesy: Hilbert, “Re: Duhem.”

57 Édouard Hugon, *Cursus philosophiae thomisticae*. (Parisii: Lethielleux, 1903), vol. 2, [http://liberius.net/auteur.php?id\\_auth=25](http://liberius.net/auteur.php?id_auth=25). Translated in: Édouard Hugon, O.P., *Cosmology*, trans. Francisco J. Romero Carrasquillo (Germany: Editiones Scholasticæ, 2013). For other quotes in Hugon—in which he shows modern science does not contradict, but rather corroborates, hylemorphism—see: Alan Aversa, “Hugon & Duhem on Hylemorphism & Modern Science,” *Quaestiones Disputatae: The Ite Ad Thomam Forum*, January 4, 2013, <http://bit.ly/X7LKme>. Because Hugon taught at the Angelicum from 1909 to 1929, Garrigou-Lagrange gave his approbation of this manual, which contains copious references to Duhem. Popes St. Pius X, Benedict XVI, and Pius XI all heartily recommended Hugon’s manual.

58 Pierre Maurice Marie Duhem, *Mixture and Chemical Combination: And Related Essays*, trans. Paul Needham (Dordrecht; Boston: Kluwer Academic Publishers, 2002), 119, <http://link.springer.com/book/10.1007/978-94-017-2292-6>. Originally published as: Pierre Maurice Marie Duhem, *Le mixte et la combinaison chimique: essai sur l’évolution d’une idée* (Paris: C. Naud, 1902), 200, <http://books.google.com/books?id=JT6AAAAMAAMAJ&pg=PA200>.: “Peu à peu...par l’effet même de ce développement, les hypothèses mécanistes se heurtent de toutes parts à des obstacles de plus en plus nombreux, de plus en plus difficiles à surmonter. Alors la faveur des physiciens se détache des systèmes atomistiques, cartésiens ou newtoniens pour revenir à des méthodes analogues à celles que prônait Aristote. La Physique actuelle tend à reprendre une forme péripatéticienne.”

59 René Dugas, “La Méthode Physique Au Sens de Duhem Devant La Mécanique Des Quanta,” *Revue Générale Des Sciences Pures et Appliquées* no. 49 (1937): 68–71.

60 Werner Heisenberg, *Physics and Philosophy* (Harper Perennial Modern Classics, 1963), 41, <http://www.archive.org/details/physicsandphilos010613mbp>.

“concept of the soul for instance in the philosophy of Thomas Aquinas was more natural and less forced than the Cartesian concept of ‘res cogitans,’ even if we are convinced that the laws of physics and chemistry are strictly valid in living organisms.”<sup>61</sup> Thus, modern physics is increasingly corroborating, albeit analogically, St. Thomas’s natural philosophy.<sup>62</sup> As Aristotle says in *Physica* 191a7-8, “The underlying nature is known by analogy.”<sup>63</sup>

Duhem’s philosophy of physics—that physical theories are classifications, not explanations, of experimental laws, a corollary of which is that physical theory is distinct from metaphysics—has its roots in the *Summa theologica* article on the rational knowability of the Trinity, the quote of which in his *La théorie physique* he prefaces with: “Saint Thomas showed...the incapacity of physical method to grasp an explanation that is certain.”<sup>64</sup> But St. Thomas was neither a skeptic nor a positivist for distinguishing two uses of reason:<sup>65</sup>

Reason is employed in two ways to establish a point:

1. for the purpose of furnishing sufficient proof of some principle, as in natural science,<sup>66</sup> where sufficient proof can be brought to show that the movement of the heavens is always of uniform velocity.<sup>67</sup>
2. Reason is employed in another way, not as furnishing a sufficient proof of a principle,

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61 Ibid., 80.

62 For an excellent overview of St. Thomas’s natural philosophy, see: Giovanni Maria Cornoldi, *The Physical System of St. Thomas*, trans. Edward Heneage. Dering, 1893, <http://maritain.nd.edu/jmc/etext/physic.htm>.

63 Matthew John. Kelly, “The Interpretation of St. Thomas Aquinas of Aristotle, *Physica* 191a7-8: ‘The Underlying Nature Is Known by Analogy.’” (Ph.D. thesis, Notre Dame, 1963). Cf. St. Thomas *In Physic.*, lib. 1 l. 13 n. 9.

64 Duhem, *La théorie physique: son objet, sa structure*, 57.: “Saint Thomas marque...l’incapacité de la méthode physique à saisir une explication certaine.” Translated in Duhem, *The Aim and Structure of Physical Theory*, 41. Immediately prior to quoting the *Summa* in *La théorie physique*, Duhem also quotes, although he thinks the formulation in the *Summa* is the clearest, St. Thomas’s *In Physic.* lib. 2 l. 3 n. 7 [164.] (“How Physics and Mathematics Differ in Their Consideration of the Same Thing,” quoted in fn. 51 *supra*) and *In II De cælo*, lect. 17, n. 451 {St. Thomas Aquinas, *Aquinas’ Exposition of Aristotle’s Treatise on the Heavens*, trans. Fabian R. Larcher, O.P. and Pierre H. Conway (Columbus, OH: College of St. Mary of the Springs, 1964), 74, <http://dhspriority.org/thomas/DeCoelo.htm>.}: “...huiusmodi irregularitates conatus est ad rectum ordinem reducere, assignando diversos motus planetis...Illorum tamen suppositiones quas adinvenierunt, non est necessarium esse veras: licet enim, talibus suppositionibus factis, apparentia salvarentur, non tamen oportet dicere has suppositiones esse veras; quia forte secundum aliquem alium modum, nondum ab hominibus comprehensum, apparentia circa stellas salvantur. Aristoteles tamen utitur huiusmodi suppositionibus quantum ad qualitatem motuum, tanquam veris.” (Astronomers have “tried to reduce these irregularities to a right order by assigning diverse motions to the planets... Yet it is not necessary that the various suppositions which they hit upon be true — for although these suppositions save the appearances, we are nevertheless not obliged to say that these suppositions are true, because perhaps there is some other way men have not yet grasped by which the things which appear as to the stars are saved. Aristotle nevertheless uses suppositions of this kind, in what regards the quality of the motions, as true.”)

65 Thomas Aquinas, *Summa Theologica*, I q. 32 a. 1 ad 2., slightly modified. Latin original: “ad aliquam rem dupliciter inducitur ratio. Uno modo, ad probandum sufficienter aliquam radicem, sicut in scientia naturali inducitur ratio sufficiens ad probandum quod motus caeli semper sit uniformis velocitatis. Alio modo inducitur ratio, non quae sufficienter probet radicem, sed quae radici iam positae ostendat congruere consequentes effectus, sicut in astrologia ponitur ratio excentricorum et epicyclorum ex hoc quod, hac positione facta, possunt salvari apparentia sensibilia circa motus caelestes, non tamen ratio haec est sufficienter probans, quia etiam forte alia positione facta salvari possent.”

66 This is what we moderns would call “natural philosophy,” corresponding to the first degree of abstraction that deals with what is material and in motion (*ens mobile*). See *Super Boethium De Trinitate* q. 5 a. 2 (Aquinas, *The Division and Methods of the Sciences: Questions V and VI of His Commentary on the De Trinitate of Boethius*, 25–31.). That the subject of natural philosophy is *ens mobile*, see: Tommaso de Vio Cajetan and Charles de Koninck, *Tractatus de subjecto naturalis philosophiae: unica quaestione contentus*, vol. 1 (Québec: Éditions Laval, 1939).

67 Assuming the principles from which this “sufficient proof” derive are self-evident, as they were for the most part among scholars in St. Thomas’s and Aristotle’s eras. A better example might be that sufficient proof the earth is round is that it casts a curved shadow on the moon.

but as confirming already established principles, by showing the congruity of their results, as in astronomy<sup>68</sup> the theory of eccentrics and epicycles is considered as established because thereby the sensible appearances of the heavenly [e.g., planetary] movements can be explained;<sup>69</sup> not, however, as if this proof were sufficient, forasmuch as some other theory<sup>70</sup> might explain them.

The first use of reason allows one to draw conclusions from self-evident principles. It is demonstrative, explicative, and *propter quid*, forming a demonstration from cause to effect. The second use of reason—viz., that of “saving the appearances” without offering any explanation of the causes of the appearances—is descriptive, not explanatory; it is also the way the Trinity is known to natural reason.

## Duhem in Garrigou-Lagrange

### In the New Theology Debates

That physical theories are classifications and not explanations influenced Garrigou-Lagrange, especially later in his life when he challenged the redefinition of truth—by Henri Bouillard, S.J., and other “New Theologians”<sup>71</sup>—from the traditional “*adæquatio rei et intellectus*”<sup>72</sup> to the Modernist “*conformitas mentis et vitæ*.”<sup>73</sup> Bouillard insisted that theological notions, such as those used to express Catholic dogma, must change with the times while still analogously expressing the same unchangeable truths: “A theology which is not current will be a false theology,” he says.<sup>74</sup> Garrigou-Lagrange gives the example of how the Council of Trent used the “stable notion” of formal causality in its teaching on justification.<sup>75</sup> Bouillard argues that since the Aristotelian notion of formal causality is no longer “current,” it must be replaced with a modern notion while still maintaining the Council of Trent’s teaching on justification unchanged. Garrigou-Lagrange asks: “how can ‘an unchanging truth’ [e.g., the Council of Trent’s doctrine on justification] maintain itself if the two notions [e.g., ‘formal causality’

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68 Astronomy was the science of the ancient Greeks and Medievals most similar to what after Galileo and Newton has been termed “modern science.”

69 In fact, “the theory of eccentrics and epicycles” can establish “the sensible appearances” of *any* continuous movement of an object in the sky, given a sufficient number of eccentrics and epicycles. This is because the theory can be re-expressed in modern mathematical idiom as a complex Fourier series; and Fourier series, given a sufficient number of terms, can approximate to arbitrary accuracy any algebraic function, such as the function corresponding to the position of a planet in the sky over time. See: Norwood Russell Hanson, “The Mathematical Power of Epicyclical Astronomy,” *Isis* 51, no. 2 (June 1960): 150–8, <http://www.jstor.org/stable/226846>. For a humorous yet insightful understanding of this, watch: *Ptolemy and Homer (Simpson)*, 2008, <http://youtu.be/QVuU2YCwHjw>. Technical background of the video: Christián C. Carman, “La refutabilidad del sistema de epiciclos y deferentes de Ptolomeo,” *Principia: an international journal of epistemology* 14, no. 2 (June 22, 2011): sec. 3, doi:10.5007/1808-1711.2010v14n2p211.

70 e.g., that of Copernicus or Galileo

71 David L. Greenstock, T.O.P., “Thomism and the New Theology,” *The Thomist* 13 (1950): 567–96, <http://bit.ly/GW7BZr>. For an historical account of Garrigou-Lagrange versus the several Dominican and Jesuit “New Theologians,” see Jürgen Mettepenningen, *Nouvelle Théologie - New Theology Inheritor of Modernism, Precursor of Vatican II*, 101–11.

72 “conformity of reality with the intellect”

73 “conformity of the mind with life”

74 Quoted in: Garrigou-Lagrange, “Where Is the New Theology Leading Us?,” para. 1. Originally published as Réginald Garrigou-Lagrange, O.P., “La Nouvelle Théologie: où va-t-elle?,” *Angelicum* 23 (1946): 126, <http://bit.ly/Z0e8JB>., quoting Bouillard’s *Conversion et grâce chez S. Thomas d’Aquin*, 1944, p. 219: “Une théologie qui ne serait pas actuelle serait une théologie fausse.” On Bouillard and his *Conversion et grâce chez S. Thomas d’Aquin*, see Jürgen Mettepenningen, *Nouvelle Théologie - New Theology Inheritor of Modernism, Precursor of Vatican II*, 83–7.

75 Schaff, *Creeds of Christendom, with a History and Critical Notes. Volume II. The History of Creeds.*, 2:112 sess. 6, cap. 7, can. 10.: “Si quis dixerit, homines sine Christi iustitia, per quam nobis meruit, justificari, aut per eam ipsam formaliter justos esse: anathema sit.” (“If any one saith, that men are just without the justice of Christ, whereby he merited for us to be justified; or that it is by that justice itself that they are formally just: let him be anathema.”)

and ‘justification’] united by the verb ‘to be’ are essentially variable or changeable?”<sup>76</sup> Bouillard responds by saying that the old and new notions are analogous, not “united by the verb ‘to be’” (i.e., not univocal). Garrigou-Lagrange retorts, a few paragraphs after discussing Ptolemy’s provisional astronomical hypothesis and citing *Summa Theologica*, I q. 32 a. 1 ad 2:

There is an abuse of analogy here. Two analogous notions do not express in different ways the same reality, but express realities that are different and similar according to a proportion, for example: the being of God and that of a creature, the being of a created substance and that of an accident, or again this sign of health which is the complexion and this other which is the pulse.

When, on the contrary, two theological notions express differently one same reality, they can be *univocal* if there is no other difference between them than that between what is confused and what is distinct. ... [T]here are not two notions that are different and analogous; it is the same notion that has become more explicit and distinct.<sup>77</sup>

This can be said even for the “stable notions” in the history of physics, which also “become more explicit and distinct” over time. For example, the physics concept of mass discussed by St. Thomas<sup>78</sup> before the “Galilean revolution” is not completely unrelated nor just analogically related to the modern physics concept of mass; it has always been the one and same concept, only now less confused.

Garrigou-Lagrange explicitly discusses the Duhemian understanding of modern physical theory as classification in another response to Bouillard:<sup>79</sup>

If the notion of formal cause is obsolete, then the affirmation that is based on this notion is also obsolete. If one must “give up” this notion, it is necessary, whether one wants to or not, to give up as well this assertion, just as we gave up the astronomical hypothesis of Ptolemy that wasn’t a true conception, conformed to reality, but merely a practical representation that gave a provisional classification to the phenomena that had been observed up to that time.

Thus, Garrigou-Lagrange says that dogmatic theology must not reason hypothetically, where “saving the phenomena” in this case would be “preserving religious experience,” which Modernists think is the main purpose of dogma;<sup>80</sup> dogmatic theologians must reason in the first way of *Summa theologica* I q.

76 Garrigou-Lagrange, “Where Is the New Theology Leading Us?”. Originally published as: Réginald Garrigou-Lagrange, O.P., “La Nouvelle Théologie: où va-t-elle?”, 127.: “«une vérité immuable» peut-elle se maintenir, si les deux notions qu’elle réunit par le verbe être, sont essentiellement changeantes?”

77 Réginald, O.P. Garrigou-Lagrange, “Les Notions Consacrées Par Les Conciles,” *Angelicum* 24 (1947): sec. 2, <http://bit.ly/YPIBff>.: “on abuse ici de l’analogie. Deux notions analogues n’expriment pas de façons différentes la même réalité, mais expriment des réalités différentes et semblables selon une *proportion*, par exemple: l’être de Dieu et celui de la créature, l’être de la substance créée et celui de l’accident, ou encore ce signe de la santé qu’est le teint et cet autre qu’est le pouls. Lorsque, au contraire, deux notions théologiques expriment différemment une même réalité, elles peuvent être *univoques*, s’il n’y a d’autre différence entre elles que celle du confus et du distinct. ... ce ne sont pas deux notions différentes, et analogues, c’est la même notion devenue plus explicite et distincte.” Translated in Albert Kallio, “The Last Battle of Garrigou-Lagrange” (Our Lady of Victories Church, November 28, 2011), 14–5, <http://bit.ly/10LSQN7>.

78 For the first time, St. Thomas distinguished, mass, weight, and the resisting medium of a projectile in *In IV Physica* lect. 12, n. 535. Duhem’s account: Pierre Maurice Marie Duhem, “The 12th Century Birth of the Notion of Mass Which Advised Modern Mechanics (... and Void and Movement in the Void),” in *Le Système Du Monde*, 369–77, accessed June 18, 2013, <http://ftp.colloquium.co.uk/~barrett/void.html>.

79 Réginald Garrigou-Lagrange, “L’immutabilité des vérités définies et le surnaturel,” *Angelicum* 25 (1948): 288, <http://bit.ly/Z0e8JB>.: “Si la notion de cause formelle est périmée, l’affirmation qui se fonde sur cette notion est périmée elle aussi. Si l’on doit «renoncer» à cette notion, il faut, qu’on le veuille ou non, renoncer aussi à cette assertion, comme on a renoncé à l’hypothèse astronomique de Ptolémée, qui n’était pas une conception vraie par conformité au réel, mais seulement une représentation *commode* qui classait *provisoirement* les phénomènes observés jusque là.” Translated by Kallio, “The Last Battle of Garrigou-Lagrange,” 15.

80 Pope St. Pius X, “Pascendi,” para. 11.: Writing on the Modernists’ understanding of the origin of dogmas, Pope St. Pius X says: “Eius porro ut assequamur naturam, ante omnia inquirendum est, quaenam intercedat relatio inter *formulas*

32 a. 1 ad 2, “for the purpose of furnishing sufficient proof of some principle.”

### In Garrigou-Lagrange’s Other Works

Physical theory as classification also appears in *Dieu: son existence et sa nature*, where Garrigou-Lagrange argues that a proof of God’s existence, “In the rigor of its proof and its power to convince, ... must surpass the so-called scientific demonstrations of the present day.”<sup>81</sup> After stating that the positive sciences do not reason *propter quid* (from causes to effects) but *quia* (from effects to causes), since they only report facts or empirical laws without recourse to metaphysical concepts such as causality, he continues: “When positive science proceeds from general facts or *laws*, to explain the reasons for these laws, it can only provide us with temporary working hypotheses, which are not so much explanations as convenient representations apt to classify the facts. (Cf. the work of H. Poincaré and Duhem.)<sup>82</sup> ... The scientist’s only concern is to give a more or less convenient classification of the phenomena.”<sup>83</sup>

In the section of *Le sens commun* on the nominalist theory of common sense, Garrigou-Lagrange notes that “The recent critique of the sciences is ... fully in accord with Plato and Aristotle,<sup>84</sup> it recognizes that positive science can only establish facts, their relatively constant relations or their approximate laws, and classify these laws or general facts with provisional hypotheses that we can only hope to relate to being.”<sup>85</sup> In an extended footnote<sup>86</sup> in this quote, Garrigou-Lagrange quotes Duhem, who

has shown in his *Essay on the concept of physical theory from Plato to Galileo (Annales de Phil.*

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*religiosas et religiosum animi sensum. Id autem facile intelliget, qui teneat formularum eiusmodi non alium esse finem, quammodum suppeditare credenti, quo sibi suae fidei rationem reddat.”* (“To ascertain the nature of dogma, we must first find the relation which exists between the *religious formulas* and the *religious sentiment*. This will be readily perceived by him who realises that these formulas have no other purpose than to furnish the believer with a means of giving an account of his faith to himself.”)

81 Garrigou Lagrange, *God, His Existence and His Nature a Thomistic Solution of Certain Agnostic Antinomies*, 61–2. French original: “Sa rigueur doit être supérieure en soi à celle des démonstrations dites aujourd’hui scientifiques.” (Garrigou-Lagrange, *Dieu, son existence et sa nature solution thomiste des antinomies agnostiques*, 62.)

82 I have added this parenthetical remark to the English translation, as it is present in the French original.

83 Garrigou Lagrange, *God, His Existence and His Nature a Thomistic Solution of Certain Agnostic Antinomies*, 63. French original: “Dès que la science positive veut dépasser les faits généraux ou les lois, pour atteindre les raisons des lois, elle ne peut fournir que des hypothèses provisoires, qui sont bien moins des explications que des représentations commodes pour classer les faits. (Cf. travaux de MM. H. Poincaré et Duhem.) ... [I]l importe seulement de classer plus ou moins commodément les phénomènes.” (Garrigou-Lagrange, *Dieu, son existence et sa nature solution thomiste des antinomies agnostiques*, 63.)

84 Garrigou-Lagrange places his extended footnote on Duhem here.

85 Réginald Garrigou-Lagrange, *Le Sens Commun: La Philosophie de L’être et Les Formules Dogmatiques*, 4th ed. (Paris: Desclée de Brouwer, 1936), 40., my translation of “La critique récente des sciences est ... pleinement d’accord avec Platon et Aristote, elle reconnaît que la science positive ne peut que constater des faits, leurs rapports relativement constants ou leurs lois approchées et classer ces lois ou faits généraux par des hypothèses provisoires qu’on ne peut avoir l’espoir de rattacher à l’être.”

86 My translation of *Ibid.*, fn. 1: “vient de montrer dans son *Essai sur la notion de la théorie physique de Platon à Galilée (Annales de Phil. Chrét., 1908)* que saint Thomas, et après lui l’université de Paris «du début du XIV<sup>e</sup> siècle au début du XVI<sup>e</sup> siècle, a donné touchant la méthode physique des enseignements dont la justesse et la profondeur passent de beaucoup tout ce que le monde entendra dire à ce sujet jusqu’au milieu du XIX<sup>e</sup> siècle»; cf. *Annales de Phil. Chrét.*, juillet 1908, pp. 352-376. — On connaît le passage classique de saint Thomas «...» de *Cælo*, l. II, leçon XVII, et aussi l. I, leçon 3 — et *Summa Theol.*, I<sup>a</sup>, q. 32, a. 1, ad 2. — M. Duhem montre également que «Bellarmin et celui qui allait être Urbain VIII firent à Galilée les remarques si logiques qui avaient été si nettement formulées auparavant par saint Thomas d’Aquin, Osiander et plusieurs autres; mais ils ne parvinrent pas, semble-t-il, à le convaincre et à le détourner de sa confiance exagérée en la portée de la méthode expérimentale»... «Contre le réalisme impénitent de Galilée, le Pape donna libre cours au réalisme (devenu) intransigeant des péripatéticiens du S. Office.» (*Annales de Phil. Chrét.*, sept. 1908.)”

*chrét.*, 1908) that St. Thomas, and after him the university of Paris “from the fourteenth century to the early sixteenth century, gave their teachings regarding the physical method an accuracy and depth surpassing most everything that the world would hear about it until the mid-nineteenth century”; cf. *Annales de Phil. chrét.*, July 1908, p. 352-376. — We know the classic passage from St. Thomas: ... *De Cælo*, lib. II, lec. XVII,<sup>87</sup> and also lib. I,- lec. 3 — and *Summa Theol.*, I<sup>a</sup>, q. 32, a. 1, ad 2.<sup>88</sup> — Duhem also shows that “Bellarmine and he who would become Urban VIII made for Galilee such logical remarks that were so clearly formulated earlier by St. Thomas Aquinas, Osiander,<sup>89</sup> and several others; but they failed, it seems, to convince him and distract his exaggerated confidence in the scope of the experimental method” ... “Against the unrepentant realism of Galilee, the Pope gave free rein to the (now) intraneasigent realism of the Peripatetics of the Holy Office.” (*Annales de Phil. chrét.*, September 1908.)

Arguing against the pragmatic definition of truth, Garrigou-Lagrange shows that Duhem’s philosophy of science does not lead to skepticism, as Vicaire thought, but rather it implies an objective notion of truth:

The scientist, says P. Duhem, has no right to say that the principle [of inertia] is true, but neither has he the right to say it is false, since no phenomenon has so far constrained us to construct a physical theory which would exclude this principle. It is retained, so far, as guide in classifying phenomena. This line of argument renders homage to the objective notion of truth. We could not reason thus under truth’s pragmatic definition.<sup>90</sup>

Duhem’s understanding of physical theory as classification appears in other Garrigou-Lagrange passages, even if he does not mention Duhem explicitly.<sup>91</sup>

## Garrigou-Lagrange’s Letters to Duhem

### 7 January 1909 Letter

Roma, 7 Janvier, 1909

Rome, 7 January 1909

Monsieur,

Je vous suis bien reconnaissant de m’avoir fait adresser l’«Essai sur la notion de la Théorie physique de Platon à Galilée».<sup>92</sup> J’avais lu ces

Sir,

I am very grateful you made me address the *Essay on the Concept of Physical Theory from Plato to Galileo*.<sup>93</sup> I had read these articles in the

87 Quoted in fn. 64 *supra*

88 Quoted in fn. 65 *supra*

89 Andreas Osiander (1498-1552), a Lutheran theologian and mathematical publisher, wrote the unsigned preface of his publishing company’s edition of Copernicus’s *De revolutionibus* which says that Copernicus’s theory does not explain astronomical phenomena, but only “saves their appearances:” “Neque enim necesse est eas hypotheses [i.e., principi, assumptiones] esse veras, imo, ne verisimiles quidem, sed sufficit hoc unum si calculum observationibus congruentem exhibeant.” (“It is neither necessary that these hypotheses [i.e., principles, assumptions] be true, nor even that they be likely, but one thing is sufficient; namely, that the calculation to which they lead agrees with observation.”) {Duhem, *Essays in the History and Philosophy of Science*, 183.} For a translation of Osiander’s entire preface and Kepler’s opposition to Osiander’s seemingly “fictionalist” or instrumentalist philosophy of science, see Edward Rosen, *Three Copernican Treatises the Commentariolus of Copernicus, the Letter Against Werner, the Narratio Prima of Rheticus* (New York: Octagon Books, 1971), 24–33, <http://hdl.handle.net/2027/heb.05987.0001.001>, where p. 33 mentions Duhem’s contribution to the debate.

90 Réginald Garrigou-Lagrange, *Reality: A Synthesis of Thomistic Thought*, trans. Patrick Cummins (St. Louis, Mo.: Herder, 1950), chap. 57 Realism and Pragmatism, sec. III. Pragmatic Consequences, <http://www.ewtn.com/library/THEOLOGY/REALITY.HTM#57>.

91 e.g., in Garrigou-Lagrange’s commentary on *Summa Theologica* I<sup>a</sup> q. 1-26, Garrigou-Lagrange, Réginald, O.P., *De Deo Uno* (Torino: Casa Editrice Marietta, 1950), 90, 93., where he discusses the classification of phenomena in the context of Kant, and in *Essenza e attualità del tomismo* (Brescia: La Scuola editrice, 1946), 9–10.

92 Pierre Maurice Marie Duhem, *Σώζειν τὰ Φαινόμενα: Essai sur la notion de théorie physique de Platon à Galilée* (Paris:

articles dans les «Annals de Th. Ch.» et été très content d’y voir si bien mis en relief l’opinion de S. Thomas et ses origines, aussi que les textes remarquables de Jean de Jandun. La Sorbonne actuelle doit être assez désagréablement surprise de vous entendre dire que «l’Université de Paris du début du XIV s. au début du XVI s. a donné touchant le méthode physique des enseignements dont la justice et la profondeur passent de beaucoup ce qu’on a entendu dire jusqu’au milieu du XIX s.» – Il est fort intéressant aussi de lire les remarques faites par Bellarmine et le futur Urbain VIII à Galilée. On se demande pourquoi les péripatéticiens du S. Office devinrent si intransigeants réalistes.

Je me permettrai de vous adresser dans quelques semaines une mise en forme de la preuve de l’existence de Dieu par le mouvement. Vous me rendriez bien-service si vous vouliez me dire à qui dans cette preuve ne vous paraîtra pas convaincant.

Je regrette de n’avoir plus l’occasion de passer par Bordeaux mes parents habitent maintenant Limoges.

Je vous prie d’agréer, cher monsieur, avec mes bien sincères remerciements, l’expression de mes sentiments respectueux et dévoués.

*Annales de Philosophie Chrétienne* and was very happy to see so highlighted the opinion of St. Thomas<sup>94</sup> and his origins, and also the remarkable texts of John of Jandun.<sup>95</sup> The current Sorbonne should be fairly unpleasantly surprised to hear you say that “the University of Paris from the early fourteenth century to the beginning of sixteenth century gave their teachings regarding the physical method an accuracy and depth surpassing much everything that the world would hear about it until the mid-nineteenth century.” It is also very interesting to read the remarks of Bellarmine and the future Urban VIII to Galileo. One wonders why the Peripatetics of the Holy Office became such intransigent realists.

Let me send you, in a few weeks, an outline of the proof of the existence of God from movement. You would do me great service if you would tell me whether this evidence will seem unconvincing.

I regret not having the occasion to pass by Bordeaux; my parents now live in Limoges.

Please accept, dear sir, with my very sincere thanks, the expression of my respectful and dedicated sentiment.

Fr. Reg. Garrigou-Lagrange

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A. Hermann, 1908), <http://books.google.com/books?id=Wl43AQAAMAAJ>.

93 Pierre Maurice Marie Duhem, *To Save the Phenomena, an Essay on the Idea of Physical Theory from Plato to Galileo*, trans. Edmund Doland and Chanihah Maschler (Chicago: University of Chicago Press, 1969), <http://catalog.hathitrust.org/api/volumes/oclc/45693.html>. excerpt: Pierre Maurice Marie Duhem, *Essays in the History and Philosophy of Science*, trans. Roger Ariew and Peter Barker (Indianapolis: Hackett Pub. Co., 1996), 131–56, <http://books.google.com/books?id=UofBybolmREC&pg=PA131>.

94 *De caelo* and *Summa* quoted in fn. 64 and 65 *supra*

95 John of Jandun (1275-1328) was an “Averroist master of arts at Paris” (J. A. Wesihiepl, “John of Jandun,” *New Catholic Encyclopedia* (Detroit: Gale, 2003), Gale Virtual Reference Library.). This is what Garrigou-Lagrange read by Duhem: “Jean de Jandun, grand admirateur d’Aristote et d’Averroès, adopte cependant, avec tous les astronomes de son temps, la seule théorie astronomique qui fournisse aux observateurs et aux calculateurs des canons et des éphémérides. Il affirme [*Acutissimæ quæstiones in duodecim libros Metaphysicæ ad Aristotelis et magni Commentatoris intentionem ab eodem exactissime disputatæ* lib. XII quæst. XX.], «avec Ptolémée et tous les astronomes modernes», qu’il est nécessaire de supposer l’existence d’excentriques et d’épicycles. «En effet, il faut admettre au sujet des corps célestes les hypothèses qui permettent de sauver les phénomènes (*salvare apparentias*) observés depuis longtemps et constatés sans qu’aucune erreur soit à craindre, lorsqu’il est impossible, sans recourir à ces hypothèses, de sauver ces phénomènes et d’en rendre raison.» (Pierre Maurice Marie Duhem, *Σώζειν τὰ Φαινόμενα*: Essai sur la notion de théorie physique de Platon à Galilée (Paris: A. Hermann, 1908), 49, <http://books.google.com/books?id=Wl43AQAAMAAJ&PA49>.) My translation: “John of Jandun, a great admirer of Aristotle and Averroes, adopts, however, with all the astronomers of his time, the only astronomical theory that provides observers and calculators models and ephemerides. He says [*Acutissimæ quæstiones in duodecim libros Metaphysicæ ad Aristotelis et magni Commentatoris intentionem ab eodem exactissime disputatæ* lib. XII quæst. XX.], «With Ptolemy and all modern astronomers», it is necessary to assume the existence of eccentrics and epicycles. «Indeed, we must admit about celestial bodies assumptions that save the phenomena (*salvare apparentias*) observed for a long time and recorded without any error likely to occur, when it is impossible, without resorting to these assumptions, to save these phenomena and to give an account.»”

## 10 July 1909 Letter

Roma, 10 Juillet, 1909

Cher Monsieur,

Je suis bien en retard pour vous remercier de l'aimable attention que vous avez eue de m'envoyer votre livre sur «le mouvement absolu et le mouvement relatif».<sup>96</sup> Je voulais attendre d'avoir pris connaissance de certains chapitres qui m'intéressent particulièrement. Il ne m'a malheureusement pas été possible de lire autres choses que la conclusion, je suis obligé de remettre cette étude à un peu plus tard.

Je me permettrai de vous demander un renseignement au sujet du principe d'inertie que vous présentez le 27 sous la forme suivante à titre de postulat «selon cette théorie un corps théorique de dimensions infiniment petites, qui existerait seul en présence du trièdre de référence, se mourrait, par rapport à ce trièdre en ligne droite avec une vitesse constante.» C'est bien il me semble l'équivalent de la formule: «le corps qui n'est soumis à aucune force ne peut avoir qu'un mouvement rectiligne et uniforme».

Vous admettez, si je ne me trompe, que ce n'est là ni une vérité t'imposant à priori (susceptible d'être déduite du principe de raison suffisante), ni une vérité démontrée expérimentalement, comme le croyait Newton; il me semble que selon vous c'est un postulat suggéré par certains faits particuliers (comme par ex: le mouvement des projectiles qui continue lorsque l'impulsion a cessé) et étendu ensuite à des cas plus généraux sans que cette extension puisse être ni confirmée ni contredite par l'expérience.

Mais ce postulat qui est à la base de la mécanique moderne non seulement ne paraît pas susceptible d'être déduit des principes de raison

Rome, 10 July 1909

Dear Sir,

I am late in thanking you for the kind attention you had in sending me your book on "absolute motion and relative motion." I wanted to wait before reading some chapters that interest me particularly.<sup>99</sup> It was unfortunately not possible to read other things than the conclusion; I am obliged to give this study a bit more time.

Permit me to inquire about the principle of inertia that you presented on the 27<sup>th</sup>, in the following form as a postulate: "according to this theory, a theoretical body of infinitely small dimensions, which would exist only in the presence of a reference frame, would slow down, compared to the frame in a straight line with constant speed." That seems to me the equivalent of the formula: "the body which is subject to no force has a uniform rectilinear motion."

You admit, if I am not mistaken, that it is neither a truth you impose *a priori* (which can be deduced from the principle of sufficient reason), nor a truth demonstrated experimentally, as Newton believed; it seems to me that you think this is an assumption suggested by certain particular facts (as, e.g., projectile motion that continues when the impulse has ceased) and extended to more general cases without this extension being neither confirmed nor contradicted by experience.

But this postulate that underlies modern mechanics not only does not seem likely to be inferred from the principles of sufficient reason and causality, but it *seems to be their contrary*. For Aristotle and St. Thomas, a movement must *necessarily* stop as soon as the cause that gave it birth ceases. This is, for them, an absolute or

96 Pierre Maurice Marie Duhem, *Le Mouvement Relatif et Le Mouvement Absolu* (Orne: Montligeon, 1907), [http://www.ac-nancy-metz.fr/enseign/philo/textesp/Duhem\\_mouvement\\_relatif\\_et\\_absolu.pdf](http://www.ac-nancy-metz.fr/enseign/philo/textesp/Duhem_mouvement_relatif_et_absolu.pdf).

99 Some chapters that might have interested Garrigou-Lagrange: "I. Il appartient à la métaphysique de fixer le sens de ces mots: La terre est immobile, la terre tourne." ("1. It pertains to metaphysics to fix the sense of these words: The earth is stationary, the earth rotates."), "II. Le mouvement du ciel et le repos de la terre d'après Aristote" ("2. The movement of the heavens and the immobility of the earth according to Aristotle"), "V. Albert le Grand" ("5. Albert the Great"), "VI. Saint Thomas d'Aquin" ("6. St. Thomas Aquinas"), "XII. Jean de Jandun" ("12. John of Jandun"), "Note: Sur un *Somme de Logique* attribuée à Saint Thomas d'Aquin" ("Note: On the *Logicæ Summa* attributed to St. Thomas Aquinas"), and the conclusion.



suffisante et de causalité, mais il *paraît leur être contraire*. Pour Aristote et S. Thomas un mouvement doit *nécessairement* s'arrêter dès que cesse la cause qui lui a donné naissance. C'est là, pour eux, une nécessité métaphysique ou absolue. En effet le principe métaphysique de causalité appliqué au mouvement se formule: «quidquid movetur ab alio movetur» Le mobile n'a pas seulement besoin d'être mû par un moteur pour passer du repos au mouvement, mais il en a encore besoin pour continuer à se mouvoir. Le mouvement n'est pas en effet un *état*, ce n'est pas non plus comme le concevait imaginativement Descartes une réalité restante toujours la même et passante d'un corps dans un autre. Si l'on définit le mouvement non pas mécaniquement en fonction du repos comme le faisait Descartes, mais métaphysiquement en fonction de l'être, on le concevra comme un *devenir*, passage de la puissance à l'acte, et l'on verra que ce passage ne peut s'effectuer si le mobile n'est soumis à aucune force. La puissance qui de soi n'est pas l'acte ne peut de soi être actualisée sous même force intervenir la division de l'être en puissance et acte, il suffit de dire: la continuation du mouvement implique à chaque instant un changement de position, lequel ne peut être sans raison suffisante, affirmer que ce changement peut s'effectuer sans raison d'être réalisatrice ce serait en venir à nier le principe d'identité ou de non-contradiction. En effet ce changement de position est *union successive du divers* (de la position A et de la position B), or dire que l'*union inconditionnelle* du divers est possible, c'est dire que des éléments *de soi* (inconditionnellement) être quelque chose d'un, (au moins d'une unité d'union), ce qui est la négation du principe d'identité, et conséquemment du principe de non contradiction. – De telle sorte qu'en généralisant le principe d'inertie on doit en venir à dire avec Hegel, comme avec tous les panthéistes évolutionnistes comme M. Bergson: le devenir est à lui-même sa raison, les principes d'identité et de non contradiction ne sont que des lois de la pensée abstraite et non pas des lois du réel, le réel en son fond est une contradiction réalisée. – La

metaphysical necessity. Indeed, the metaphysical principle of causality applied to the movement is formulated as “*quidquid movetur ab alio movetur.*”<sup>100</sup> The mobile being has not only need to be driven by a motor to move from rest to motion, but it still needs it to continue to move. The movement is not in effect a *state*; it is not, as Descartes imaginatively conceived, reality remaining always the same and passing from one body to another. If we define the movement not mechanically depending on the rest, as did Descartes, but metaphysically, as a function of being, we will view it as a *becoming*, a transition from potentiality<sup>101</sup> to actuality,<sup>102</sup> and you will see that this passage cannot occur if the mobile being is not subject to any force. Potentiality itself nor actuality itself can actualize itself, as the same force involves the division of being into potentiality and actuality; it suffices to say: the continuation of the movement involves constantly changing position, which cannot be without sufficient reason; to claim that this change can be effected without fulfilling this purpose would amount to denying the principle of identity or non-contradiction. In fact, this change in position is the *union of various successives* (from position A and position B), or that the *unconditional* union of various things is possible is to say that elements *of itself* (unconditionally) are something other than one, (at least one unit of union), which is the negation of the principle of identity, and consequently of the principle of non-contradiction. So, in generalizing the principle of inertia, we must come to say with Hegel, as with all pantheistic evolutionists, such as Bergson: becoming is itself its own reason; the principles of identity and non-contradiction are laws of abstract thought and not the laws of reality; reality in its core is a realized contradiction. Classical metaphysics says the contrary: the principle of identity and non-contradiction are not only laws of abstract thought, but fundamental laws of reality; that is why becoming cannot be in its own right, but must ultimately have its reason in a reality that is in all and for all identical to itself, absolutely simple, and immutable, that is, as A is

100 “Whatever is moved is moved by another.”

101 Traditionally called “potency”

102 Traditionally called “act”

métaphysique classique dit au contraire: le principe d'identité et de non contradiction n'est pas seulement loi de la pensée abstraite, mais loi fondamentale du réel c'est pourquoi le devenir ne peut être à lui-même sa raison, mais doit avoir en fin de compte sa raison dans une réalité qui soit en tout et pour tout identique à elle-même; absolument simple et immuable, qui soit à l'être comme A est A, *Ipsum esse subsistens, Acte Pur*, et par conséquent essentiellement distincte du monde multiple et changeant.

Le principe d'inertie loin de paraître avoir une valeur absolue dans l'ordre scientifique, me paraît impliquer une absurdité métaphysique. Je ne lui vois d'autre base que ce mouvement des projectiles qu'Aristote essayait de concilier tout bien que mal avec le principe «quidquid movetur ab alio movetur» et pour l'explication duquel on inventa la théorie de l'*impetus* admise par des thomistes comme Jean de S. Thomas et Goudin.

Je me demande ce que la science prétend affirmer quand elle formule ce principe d'inertie. Et ce qu'elle fait porter seulement son affirmation sur les modalités du mouvement (*rectiligne et uniforme*), ou va-t-elle plus loin et fait-elle encore porter son affirmation sur *le fait que le mouvement continue* alors que le mobile n'est soumis à aucune force? – Il me semble que si l'affirmation est restreinte aux *modalités* du mouvement la science reste dans son domaine et ne se heurte à aucune impossibilité métaphysique. Si au contraire l'affirmation porte sur *la réalité, l'être même* du mouvement qui continuerait sans cause, la science non seulement sort de ses limites mais elle énonce un postulat qui est en opposition radicale avec les trois grands principes métaphysiques de causalité, de raison suffisante et d'identité.

S'il est ainsi contraire aux lois fondamentales de la raison, comment le principe d'inertie a-t-il pu devenir la base de la physique moderne? – J'ai demandé des éclaircissements sur ce sujet à Monsieur Boulanger de la faculté des sciences de Lille, qui nous a fait le plaisir de venir nous voir ici plusieurs fois. Il m'a fait lire un travail de Monsieur Painlevé sur les principes de la mécanique. Et il m'a semblé retrouver l'opposition que je viens de vous énoncer entre le principe métaphysique «quidquid movetur ab alio

*A, Ipsum esse subsistens, Pure Actuality*, and therefore essentially distinct from the manifold and changing world.

The principle of inertia seems far from having an absolute value in the scientific realm; it seems to imply a metaphysical absurdity. I do not see it other than this basic projectile motion that Aristotle was trying to reconcile, for better or worse, with the principle that “*ab alio quidquid movetur movetur*” and the explanation for which the theory of *impetus* was invented, which Thomists such as John of St. Thomas and Goudin admitted.

I wonder what science claims to say when it formulates the principle of inertia. And does it only bear its assertion on the modalities of movement (*straight and uniform*), or will it further assert *the fact that the movement continues* while the mobile body is not subjected to a force? It seems to me that if the statement is limited to the *modalities* of the movement, science remains in its field and does not encounter any metaphysical impossibility. If instead the statement relates to *the reality, the very being* of the movement that would continue without cause, science not only exceeds its limits but it provides a premise which is in stark contrast with the three great metaphysical principles of causality, sufficient reason, and identity.

If it is so contrary to the fundamental laws of reason, how could the principle of inertia become the basis of modern physics? I asked for clarification on this matter to Boulanger of the faculty of science of Lille, who gave us the pleasure to visit us here several times. He had me read a work of Painlevé<sup>103</sup> on the principles of mechanics. And it seemed that the opposition I just stated, between the metaphysical principle “*quidquid movetur ab alio movetur*” and the principle of inertia which Mr. Painlevé notes in the Scholastic and Copernican mechanics, returns.

“The Scholastics’ principle of inertia,” he says, “is stated as: ‘Every physical element far away from the others remains absolutely fixed.’ For the Scholastics, there is therefore no *momentum*: a material thing moving away briskly and a long distance from all other bodies stops abruptly. According to the Copernicans, on the contrary, it keeps its speed in magnitude,

movetur» et le principe d'inertie dans celle que M. Painlevé signale entre la mécanique scolastique et la mécanique copernicienne.

«Le principe de l'inertie scolastique, dit-il, s'énonçait: 'Tout élément matériel infiniment éloigné des autres reste absolument fixe.' Pour les scolastiques, il n'y a donc pas de *vitesse acquise*: qu d'un élément matériel en mouvement on écarte brusquement et à grande distance tous les autres corps, l'élément s'arrête brusquement. D'après les coperniciens, au contraire, il garde sa vitesse en grandeur, direction et sens. - Cette divergence sur le principe d'inertie suffit à creuser un abîme entre les deux doctrines.» (p. 398)

Je ne puis concevoir comment le principe d'inertie entendu au sens coperniciens n'est pas la violation des premiers principes rationnels. Admis que tout corps est indifférent au repos ou au mouvement, on sait qu'il faut une cause non seulement pour expliquer le changement qui consiste à passer du repos au mouvement, mais encore pour expliquer tous les changements impliqués dans le mouvement même; tandis que le repos s'explique par la simple cessation de l'action qui produisait le mouvement. – En d'autres termes le repos est un état; mais on ne peut parler d'*état de mouvement*, puisqu'il est essentiellement un changement; le mouvement ne peut être un *état*. – Une simple impulsion finie ne peut produire un effet *infini*. C'est pourtant ce que disent les coperniciens.

Ce problème<sup>97</sup> n'est pas sans rapport avec la preuve de l'existence de Dieu par le mouvement. Je n'ai pu encore rédiger cette preuve que je désirais vous soumettre, elle entrera dans un article «Dieu» que je prépare pour la «Dict. Apologétique de la Foi catholique». J'ai dû développer bien des difficultés, passage des phénomènes physico-chimiques aux phénomènes vitaux, de ceux-ci aux phénomènes sensibles, de ceux-ci aux phénomènes volontaires. N'y aurait-il pas sans sortir de l'ordre physique un exemple de série ascendante permettant d'imager la preuve. On dit souvent le matelot est porté par le navire,

direction, and sense. This divergence in the principle of inertia is enough to drive a wedge between the two doctrines.” (p. 398).

I cannot imagine how the principle of inertia understood in the Copernican sense is not the violation of first rational principles. Admitting that any body is indifferent to rest or motion, we know we have a cause that not only explains the change of moving from rest to movement, but also for explaining all the changes involved in the movement itself, while rest is explained by the mere cessation of the action that produced the movement. In other words rest is a state, but one cannot speak of a *state of motion*, since it is essentially a change; movement cannot be a *state*. A simple finite impulse cannot produce an *infinite* effect. Yet this is what the Copernicans are saying.

This problem<sup>104</sup> is not unrelated to the proof of the existence of God by movement. I have not yet written the proof that I wanted to submit to you; it will come in the article “God” I am preparing for the *Dict. Apologétique de la Foi Catholique*. I had many difficulties develop, ranging from physico-chemical phenomena to vital phenomena, from sensitive phenomena to phenomena of the will. There it would not, without leaving the physical example of a [hierarchically] ascending series, permit us to imagine the proof. It is often said the sailor is supported by the vessel, the vessel by the wave, the wave through the earth, the earth by the sun, the sun by another center; but you cannot go on to infinity. Then we must account for a mover that does not need to be pre-moved, but must be its own activity, and to give a reason of the *being* that alone can *act by itself*, which is *itself*. But what is *per se* is that in which there is not a distinction between essence (susceptible to exist) and existence, i.e., that which is to the being as A is A, pure being or pure actuality, without limit, without any mixture of non-being. This example of ascending series is only half-satisfactory because we stay in the same species of causality,

97 “a été traité récemment par E. Meyerson «Identité et Réalité» Alcan 1 vol de 430p. Mais M. Boulanger m'a dit que cet ouvrage laisse beaucoup à désirer au pdv. scientifique.”

103 Paul Painlevé (1863–1933), French mathematician

104 “It was treated recently by E. Meyerson *Identity and Reality* (Alcan, 1 vol. of 430p.), but Boulanger said that this book leaves much to be desired from a scientific point of view.”

le navire par le flot, le flot par la terre, la terre par le soleil, le soleil par un autre centre mais on ne peut remonter à l'infini, enfin de compte il faut un moteur qui n'ait pas besoin d'être prémû,<sup>98</sup> mais pour cela il doit être son activité même; et pour rendre raison de l'être seul peut *agir par soi* qui *est par soi*. Or ce qui est par soi est ce en quoi il n'y a distinction entre essence (susceptible d'exister) et existence, cad. Ce qui est à l'être comme A est A, pur être ou pur acte, sans limite, sans mélange de non-être. Cet exemple de série ascendante n'est qu'à moitié satisfaisant parce qu'on reste dans la même espèce de causalité, savoir l'*attraction*. On ne trouve pas d'exemple de passage d'un effet donné à une cause vraiment équivoque c'est à dire d'ordre supérieur; ce serait l'image de la dernière démarche qui conduit au 1<sup>er</sup> moteur.

Je vous demande pardon, cher monsieur, de cette trop longue lettre, l'amabilité avec laquelle vous m'avez reçu à Bordeaux m'a invité à vous parler ainsi en toute liberté. Si vous pouvez écrire un article sur cette question du pr. d'inertie vous rendriez bien service aux philosophes scolastiques. – Avec mes bien sincères remerciements, je vous prie d'agréer, cher monsieur, l'expression de mon très respectueux dévouement.

fr. Reg. Garrigou-Lagrange. O.P.

namely that of *attraction*. We find no example of passing from a given effect to a cause really clear, i.e., of a higher order; this picture would be the last step that leads to the first mover.

I beg your pardon, dear sir, for this too long a letter, for the kindness with which you received me in Bordeaux and invited me to speak freely as well. If you can write an article on the issue of the problem of inertia you would render a great service to Scholastic philosophers. With my very sincere thanks, please accept, dear sir, the very expression of my respectful devotion.

Fr. Reg. Garrigou-Lagrange. OP

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98 Réginald Garrigou-Lagrange, "Prémotion Physique," ed. A. Vacant, E. Mangenot, and É. Amann, *Dictionnaire de Théologie Catholique* (Paris: Librairie Letousey et Ane, 1936).

## **7 March 1914 Letter**

Roma, 7 Mars, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Cher Monsieur,

Permettez-moi de vous offrir mes humbles félicitations pour votre récente nomination à l'Académie des Sciences.<sup>105</sup> Comme le dit la *Revue Neo Scolastique de Louvain*: Il est peu de nominations aussi bien mérités.<sup>106</sup> *Tous les thomistes* en particulier s'en réjouissent.

J'ai été très heureux aussi de voir que l'Institut de France et la ministère de l'Instruction publique patronnent votre grand ouvrage,<sup>107</sup> dont je viens de faire acheter le premier volume pour notre bibliothèque. Je vois que vous y traitez fort longuement un problème sur lequel je m'étais permis de vous interroger il y a cinq ans: la conciliation du principe «quidquid movetur ab alio movetur» avec le mouvement des projectiles. Souvent j'ai été interrogé depuis sur la manière de concilier ce principe, base de la preuve du premier moteur, avec l'axiome de la mécanique moderne: une force constante produit un mouvement uniformément accéléré.

Lorsque je vous écrivais il y a cinq ans je défendais timidement la théorie de l'impetus qui s'écarte de celle d'Aristote, mais se trouve chez de bons thomistes comme Jean de S Thomas. *Cursus phil. phil. natur.* q. 23. a. 2. et Goudin. Elle s'appuie surtout sur le texte du S. Thomas *de Potentia* q. 3. a. 11. a 5<sup>m</sup>. «Instrumentum intelligitur movevi a principali agente *quamdiu retinet virtutem* a principali agente impressam, unde sagitta *tamdiu* movetur a projciente, *quamdiu* manet vis impulsus projcientis.» C'est une application de la théorie thomiste de la

causalité instrumentale théorie qui n'est guère

<sup>105</sup> Pierre Maurice Marie Duhem, *Notice Sur Les Titres et Travaux Scientifiques de Pierre Duhem Rédigée Par Lui-même Lors de Sa Candidature à l'Académie Des Sciences*, vol. 1, 7 (Paris: Gauthier-Villars, 1917).

<sup>106</sup> M. De Wulf, "Le Mouvement Néo-scolastique," *Revue Néo-scolastique de Philosophie* 21, no. 81 (1914): 91, doi:10.3406/phlou.1914.2203.

<sup>107</sup> Pierre Maurice Marie Duhem, *Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols. (Paris: A. Hermann, 1913).

<sup>108</sup> The first volume covers Greek cosmology: Pythagorean astronomy, Platonic cosmology, Aristotelian physics, and Ptolemaic astronomy.

<sup>109</sup> John of St. Thomas, *Cursus philosophicus thomisticus: secundum exactam, veram, genuinam Aristotelis et Doctoris Angelici mentem* (Parisiis [Paris]: Ludovicus Vivès, 1883), 397–402.

<sup>110</sup> "An instrument is understood to be moved by the principal agent so long as it retains the power communicated to it by the principal agent; thus the arrow is moved by the archer as long as it retains the force wherewith it was shot by him." {Thomas Aquinas, *On the Power of God*, trans. Laurence Shapcote, 3 vols. (London: Burns, Oates & Washbourne, 1932), <http://dhspriority.org/thomas/QDdePotentia.htm#3:11.> }

Rome, 7 March 1914

ANGELICUM  
Via S. Vitale, 15

Dear Sir,

Let me offer you my humble congratulations on your recent appointment to the Academy of Sciences. As stated in the *Revue Neo Scolastique de Louvain*: There are few appointments so well deserved. *All Thomists* especially rejoice.

I was also delighted to see that the Institute of France and the Ministry of Education publicly patronize your great work, the first volume<sup>108</sup> of which I just bought for our library. I see that you are dealing at great length with the problem I asked you to consider five years ago: reconciling the principle "*quidquid movetur ab alio movetur*" with projectile motion. I was often asked to reconcile this principle, the basis of proof of the prime mover, with the axiom of modern mechanics: a constant force produces a uniformly accelerated motion.

When I wrote to you five years ago, I timidly defended the theory of impetus that deviates from that of Aristotle, but is found among good Thomists like John of St. Thomas's *Cursus phil. phil. natur.* q. 23. a. 2.<sup>109</sup> and Goudin. It relies primarily on the text of St. Thomas's *De potentia* q. 3. a. 11. a. 5. "Instrumentum intelligitur moveri a principali agente *quamdiu retinet virtutem* a principali agente impressam, unde sagitta *tamdiu* movetur a projciente, *quamdiu* manet vis impulsus projcientis."<sup>110</sup> This is an application of the Thomist theory of *instrumental causality*, a theory which is not that implicit in Aristotle, but that consistently returns in both St. Thomas's philosophy and theology.

## 6 April 1914 Letter

Roma, 6 Avril, 1914

Rome, April 6, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

ANGELICUM  
Via S. Vitale, 15

Cher Monsieur,

Avant de vous remercier des renseignements que vous avez eu la bonté de me donner dans votre dernière lettre, je voulais lire, dans vos *Études sur Léonard du Vinci*<sup>113</sup> ce qui concerne l'histoire de la théorie de l'*impetus* chez les scolastiques. Il ne m'a pas été encore possible de faire cette lecture, et la correction de plusieurs

Dear Sir,

Before thanking you for the information you kindly gave me in your last letter, I wanted to read in your *Études sur Léonard du Vinci* the history regarding the theory of *impetus* among the scholastics. I was not able to do this reading, and the correction of several theses forces me to procrastinate.

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111 John of St. Thomas, *Cursus philosophicus thomisticus: secundum exactam, veram, genuinam Aristotelis et Doctoris Angelici mentem* (Paris: Ludovicus Vivès, 1883), 436–52.

112 These pages {*Le système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, vol. 1, ch. VI, sec. VII (“La chute accélérée des graves”), pp. 397-8.} are the conclusion of the chapter on dynamics after Aristotle and the section entitled “La chute accélérée des graves” (“The accelerated fall of bodies”), which comes after two sections discussing the projectile theory of John Philoponus (c. 490 – 570), also known as the Grammarian, a Christian commentator and opponent of Aristotle. “Philoponus’ main significance for the history of science lies in his being, at the close of antiquity, the first thinker to undertake a comprehensive and massive attack on the principal tenets of Aristotle’s physics and cosmology, an attack unequalled in thoroughness until Galileo.” (S. Sambursky, “John Philoponus,” *Complete Dictionary of Scientific Biography*, 1973, [http://www.encyclopedia.com/topic/John\\_Philoponus.aspx#1](http://www.encyclopedia.com/topic/John_Philoponus.aspx#1).) Here is what likely troubled Garrigou-Lagrange:

«Au sujet de la chute accélérée des graves, la vérité n’était aucunement apparue aux philosophes grecs. Leur raison était trop fermement et trop unanimement convaincue qu’une force a pour mesure la vitesse du mouvement qu’elle produit pour qu’ils puissent, le moins du monde, soupçonner cet axiome de la Mécanique moderne: Une force constante produit un mouvement uniformément accéléré.

«Au sujet des deux autres problèmes qui les ont préoccupés, du mouvement des corps dans le vide et du mouvement des projectiles, ils ne sont pas demeurés dans une ignorance aussi complète.

«Sans doute, la Physique péripatéticienne qui, en d’autres circonstances, a eu de si pénétrantes et si prophétiques intuitions, s’est égarée, ici, dans des erreurs grossières. Nulle part les méprises qui viciaient certains de ses principes n’ont produit de conséquences plus contraires aux enseignements de l’expérience. Nulle part, non plus, elle n’exercera une plus durable et plus pernicieuse influence; le joug de la Dynamique aristotélicienne est un de ceux que la Science moderne aura le plus de peine à secouer.

«Cependant, hors des écoles péripatéticiennes, il s’est trouvé des mécaniciens hellènes pour formuler, au sujet du mouvement des corps, dans le vide ou en milieu plein, des principes sensés. Ces principes, c’est dans les écrits de Jean Philopon, et là seulement, que nous en trouvons l’énoncé formel.»

(My translation: “On the accelerated fall of bodies, the truth was in no wise apparent to the Hellenistic philosophers. Their reasoning was too strong and too unanimously convinced that a force is measured by the speed of movement it produces, so they can at least suspect this axiom of modern Mechanics: A constant force produces uniformly accelerated motion.

“On the other two issues that have concerned the motion of bodies in a vacuum and the motion of projectiles, they did not remain in complete ignorance.

“Without a doubt, Aristotelian physics—which, in other circumstances, was so penetrating and so prophetically intuitive—strayed here into gross errors. Nowhere have misunderstandings which vitiated some of its principles produced consequences more contrary to the teachings of experience. Nowhere, either, will it have more lasting and pernicious influence; the yoke of Aristotelian dynamics is one of those modern science will have more trouble shaking.

“However, Hellenistic mechanics was founded out of the Peripatetic school to formulate sound principles on the motion of bodies in a vacuum or filled space. It is in the writings of John Philoponus, and only there, that we find the formal statement of these principles.”)

Duhem continues in the remaining few paragraphs to praise John Philoponus highly.

113 Pierre Maurice Marie Duhem, *Études sur Léonard de Vinci, ceux qu’il a lus et ceux qui l’ont lu*, 2 vols. (Paris: A. Hermann, 1906), <http://catalog.hathitrust.org/api/volumes/oclc/2286058.html>.

thèses m'oblige à la remettre à plus tard.

Les affirmations très nettes que vous formulez sur la valeur du principe d'inertie m'obligent à une grande prudence. Elles me montrent aussi combien serait nécessaire une étude de la valeur de ce principe au triple point de vue mathématique, expérimental et métaphysique.

Pour l'instant je ne trouve moyen d'éviter la contradiction qu'en distinguant ces trois points de vue.

Pour le *mathématicien* qui abstrait des qualités sensibles et aussi de la cause efficiente et finale, pour ne considérer que la quantité mesurable, je conçois que le principe d'inertie n'offre pas de difficulté. Du point de vue mathématique il ne semble ni évidemment vrai ni évidemment faux qu'un mouvement une fois donné dure indéfiniment.

Du point de vue de la *physique expérimentale* qui s'en tient à l'étude des phénomènes sensibles et de leurs lois approchées, on n'examine que les *causes sensibles* qui produisent le mouvement ou le transforment, on fait abstraction de l'influx invisible de la Cause première. De ce point de vue le principe d'inertie est suggéré par l'expérience, mais, si je comprends ce qu'a écrit H. Poincaré dans «La science et l'hypothèse» p. 112 – 119<sup>114</sup> ce principe ne serait pas expérimentalement démontré, selon lui: «Axiome ou soi-disant axiome». Écrivez vous vous même comment l'expérience permettrait elle de prouver rigoureusement que le mouvement cesse *uniquement* à cause des résistances extérieures, et non pas en partie par lui même. Par ailleurs comme il se transforme en chaleur lorsqu'il est arrêté, on est porté à penser qu'il durerait toujours s'il n'était pas arrêté, et rien dans l'expérience n'infirme cette façon de voir.

Du point de vue *métaphysique* le mouvement même local n'est plus seulement une quantité mesurable, ou un phénomène sensible, susceptible de transformation, mais un *devenir*, de l'être qui devient et passe progressivement de la puissance à l'acte. De ce point de vue une cause sensible, comme une chiquenaude, est incapable

The very clear statements that you make on the value of the principle of inertia force me to be greatly prudent. They also show how much I would need a study of the value of this principle in three points of view: mathematical, experimental, and metaphysical.

For now I cannot find a way to avoid the contradiction in distinguishing these three perspectives.

For the *mathematician* who abstracts from sensible qualities and also from the efficient and final cause, and who considers only the measurable quantity, I conceive that the principle of inertia does not offer difficulty. From the mathematical point of view it seems neither obviously true nor obviously false whether a movement lasts indefinitely.

From the perspective of *experimental physics*, which sticks to the study of sensory phenomena and their approximate laws, examining only the *sensible causes* that produce the movement or transform, we disregard the hidden impulses of the First Cause. From this point of view the principle of inertia is suggested by experience, but, if I understand H. Poincaré has written in *Science and Hypothesis* pp. 93 to 97,<sup>115</sup> this principle would not be experimentally demonstrated, according to him: "Axiom or so-called axiom." You write yourself how experience would allow him to prove rigorously that the movement continues *only* because of external resistances, and not in part by itself. Also, as it turns into heat when it is stopped, we tend to think it would last forever if it were not stopped, and nothing in experience invalidates this view.

From the *metaphysical* point of view, the same local movement is not only a measurable amount, or a sensory phenomenon, susceptible to transformation, but a *becoming*, of *being becoming* and gradually moving from potentiality to actuality. From this perspective a sensible cause, like a snap of the finger, cannot produce by itself this new *reality*, which is movement. It takes an invisible intervention of the First being. Metaphysics cannot admit that the same

114 Henri Poincaré, *La science et l'hypothèse*, Bibliothèque de philosophie scientifique (Paris: Flammarion, 1920), sec. Le Principe d'inertie, <http://catalog.hathitrust.org/api/volumes/oclc/54353332.html>.

115 Henri Poincaré, *The Foundations of Science*, trans. George Bruce Halsted, Science and Education (Lancaster, PA: Science Press, 1946), 93–7, <http://catalog.hathitrust.org/api/volumes/oclc/225279.html>.



de produire par elle seule cette *réalité* nouvelle qui est le mouvement. Il faut une intervention invisible du Premier être. La métaphysique ne peut admettre qu'un même mouvement passe d'un corps dans un autre, car il est *ce* mouvement par ce qu'il est le mouvement de *ce* corps. Chaque fois donc que le mouvement local par suite d'arrêt est dit se transformer, il y a production par lui d'un mouvement nouveau, et cela n'est possible (métaphysiquement) que par une nouvelle intervention invisible de l'Être premier ou du premier moteur. Un mouvement sensible ne donne naissance à un autre mouvement sensible qu'avec le concours invisible de Dieu. Il y a toujours subordination de la cause physique sensible à l'Agent premier invisible

|                            |                        |                            |                        |
|----------------------------|------------------------|----------------------------|------------------------|
| 1 <sup>er</sup> moteur     | 1 <sup>er</sup> moteur | 1 <sup>er</sup> moteur     | 1 <sup>er</sup> moteur |
| mouv <sup>t</sup><br>local | chaleur                | mouv <sup>t</sup><br>local | électricité            |
| cause<br>sensible          | cause<br>sensible      | cause<br>sensible          | cause<br>sensible      |

Si donc une intervention invisible de Dieu est nécessaire du point de vue métaphysique pour qu'un mouvement par suite d'arrêt en produise un autre, cette intervention invisible semble nécessaire pour que le mouvement local non arrêté dure indéfiniment. Par lui-même il est une réalité non permanente, mais transitoire, une réalité qui devient, dans laquelle il y a toujours du nouveau passage de la puissance à l'acte. Descartes ne considérerait le mouv<sup>t</sup> que des points de vue mathématique et mécanique, mais à la considérer du point de vue métaphysique ou de l'*être*, il semble nécessaire de maintenir la conclusion thomiste de la non perpétuité d'un mouvement local produit par simple impulsion, même dans le vide.

S'il en était ainsi la formule du principe d'inertie serait celle d'une loi approchée suggérée par l'expérience et toute *relative* aux causes qui tombent sous l'expérience, mais elle serait susceptible d'être complétée d'un point de vue supérieur qui seul permet de parler dans l'*absolu*. De même la somme de l'énergie resterait

movement from one body passes to another, as it is *this* movement that is the motion of *this* body. So every time that the locomotion as a result of said judgment shall be transformed, it is produced by a new movement, and this is possible (metaphysically) only by a new intervention of the invisible first Being or first mover. Substantial movement does not create another substantial movement except with the invisible help of God. There is always a subordination of the sensible physical cause to the invisible first Agent.

|                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|
| 1 <sup>st</sup> mover | 1 <sup>st</sup> mover | 1 <sup>st</sup> mover | 1 <sup>st</sup> mover |
| locomotion            | heat                  | locomotion            | electricity           |
| sensible<br>cause     | sensible<br>cause     | sensible<br>cause     | sensible<br>cause     |

So if an invisible intervention of God is necessary in terms of metaphysics for a motion from rest to occur in another, this invisible intervention seems necessary, as unstopped locomotion lasts indefinitely. By itself it is a not permanent but transient reality, a reality that becomes, in which there is always something new transitioning from potentiality to actuality. Descartes believed movement to be mathematical and mechanical, but to consider the metaphysical point of view or that of being, it seems necessary to maintain the Thomist conclusion of the non-perpetuity of a local movement produced by simple impulse, even in a vacuum.

If so, the formula of the principle of inertia is that of an approximate law suggested by experience and *relative* to the causes that fall within experience but would be expected to be completed from a higher standpoint which alone can speak in *absolute* terms. Similarly, the amount of energy remains constant, yet the energy would be renewed, as the sum of human activity is relatively constant and yet humanity is renewed; God creates souls at every moment.

Forgive me, dear sir, this too long a second letter. I apologize for the questions I am asked by some philosophers who recently converted to Catholicism and even Thomism and were arrested by this difficulty. In case you'd

constante, et pourtant l'énergie se renouvellerait, comme la somme de l'activité humaine est relativement constante et pourtant l'humanité se renouvelle, Dieu crée des âmes à chaque instant.

Pardonnez-moi, cher monsieur, cette seconde lettre trop longue. J'ai pour excuse les questions qui me sont posées par quelques philosophes récemment convertis au catholicisme et même au thomisme et arrêté par cette difficulté. Au cas où vous seriez amené à écrire sur cette question de deux aspects physique et métaphysique du principe d'inertie, je ne manquerais pas d'y renvoyer mes correspondants votre article sur «Physique et métaphysique» paru il y a déjà longtemps était des plus intéressants et l'on serait heureux d'en voir l'application à ce problème.

Avec mes meilleurs remerciements, je vous prie d'agréer, Monsieur, mes bien respectueux hommages.

fr. Reg. Garrigou-Lagrange  
Roma, 18 Avril, 1914

## 18 April 1914 Letter

Roma, 18 Avril, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Cher Monsieur,

Je vous suis vivement reconnaissant de la longue lettre que vous avez eu la bonté de m'écrire. Elle me montre beaucoup mieux que je ne l'avais compris jusqu'ici la valeur que vous accordez aux principes fondamentales des théories mécaniques et physiques: ni axiomes évidents de soi, ni lois expérimentales, mais postulats. Et cela est de nature à diminuer de beaucoup l'apparente opposition qui existe entre la mécanique moderne et les principes les plus généraux de la métaphysique traditionnelle.

Je trouve même, cher monsieur, votre lettre si claire que je serais bien heureux de la transcrire exactement, sans aucun commentaire, à titre d'appendice, dans un ouvrage sur Dieu que je

want to write about this issue from two aspects, physical and metaphysical, of the principle of inertia, I would not fail to return to my correspondents your article on "Physics and Metaphysics"<sup>116</sup> that appeared long ago and was most interesting, and we would be happy to see the application to this problem.

With my best thanks, please accept, Sir, my most respectful homage.

Fr. Reg. Garrigou-Lagrange

Rome, April 18, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Dear Sir,

I am deeply grateful for the long letter you were kind enough to write me. It shows me a lot better than I had previously understood the value you place on the fundamental principles of mechanical and physical theories: neither self-evident axioms nor experimental laws, but postulates. And this is likely to reduce significantly the apparent contrast between the modern mechanics and the most general principles of traditional metaphysics.

I even find, dear sir, your letter so clear that I would be happy to transcribe it exactly, without comment, as an appendix in a book about God that I must publish in July. It would be useful to more than one philosopher I know and would dispel certain obscurities that prevent one from

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116 Pierre Maurice Marie Duhem. 1996. "Physics & Metaphysics." In *Essays in the History and Philosophy of Science*, trans. Roger Ariew and Peter Barker (Indianapolis: Hackett Pub. Co., 1996), <http://books.google.com/books?id=UofBybolmREC&pg=PA131> <http://books.google.com/books?id=UofBybolmREC&pg=PA29>. Originally published in Pierre Maurice Marie Duhem, "Physique et métaphysique," *Revue de questions scientifiques* 34 (1893): 55–83.

dois publier en Juillet.<sup>117</sup> Ce serait utile à plus d'un philosophe que je connais, et dissiperait certaines obscurités qui empêchent de bien saisir la preuve classique de l'existence de Dieu par le mouvement.

Vous verrez peut-être quelque inconvénient à ce que je publie intégralement cette note sous votre nom. En ce cas je pourrais la donner comme un résumé de vos ouvrages, faits dans les termes mêmes dont vous avez l'habitude de vous servir.

Pardonnez-moi, cher monsieur, cette nouvelle indiscretion, et agréez, je vous prie, avec mes meilleurs remerciements, l'expression de mes sentiments très respectueux et dévoués.

fr. Reg. Garrigou-Lagrange

#### 4 May 1914 Letter

Roma, 4 Mai, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Cher Monsieur,

Je vous suis bien reconnaissant de me permettre de publier votre lettre comme appendice du livre sur Dieu dont je vous avais parlé. Je la ferai imprimer dans un mois et vous en adresserai les épreuves.

Avec mes meilleurs remerciements je vous prie et agréer, cher monsieur, l'expression de mes sentiments respectueux.

fr. Reg. Garrigou-Lagrange

#### 21 May 1914 Letter

Roma, 21 Mai, 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Cher Monsieur,

Au moment d'envoyer à l'imprimeur votre lettre sur la valeur du principe de l'inertie que vous voulez bien me permettre de publier sous votre nom, comme appendice de l'ouvrage dont je vous ai parlé, je pense qu'il vous sera plus commode de faire directement sur le manuscrit les modifications que vous jugeriez utiles.

understanding the classical proof of the existence of God through movement.

You may see some reason why I publish this note in full under your name. In this case I could give it as a summary of your works, made in the words you are accustomed to use.

Forgive me, dear sir, this new indiscretion, and accept, I pray you, with my best thanks, the expression of my very friendly and dedicated sentiments.

Fr. Reg. Garrigou-Lagrange

Rome, 4 May 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Dear Sir,

I am very grateful for allowing me to publish your letter as an appendix to the book on God which I told you about. I will print it in a month, and you shall address the proofs.

With my best thanks, please accept, dear sir, the assurances of my respective sentiments.

Fr. Reg. Garrigou-Lagrange

Rome, 21 May 1914

COLLEGIO ANGELICO  
Via S. Vitale, 15

Dear Sir,

When submitting your letter to the printer on the value of the principle of inertia that you permit me to publish under your name, as an appendix of the book which I mentioned, I think it will be more convenient to make the changes that you judge useful directly on the manuscript.

Of the proofs, these corrections would be

<sup>117</sup> Réginald Garrigou-Lagrange, *Dieu, son existence et sa nature solution thomiste des antinomies agnostiques* (Paris: G. Beauchesne, 1914), <http://catalog.hathitrust.org/api/volumes/oclc/10358267.html>.

Sur les épreuves, ces corrections seraient moins faciles. Il convient aussi d'indiquer tout de suite les passages qui doivent être mis en italiques, peut-être suffirait-il de souligner ceux qui sont marquées de deux traits.

Le titre de la note qui répondrait à l'ouvrage serait: note sur la valeur du principe de l'inertie, ou plus généralement: note sur la valeur des principes de la mécanique.

Je vous prie, cher monsieur, d'excuser la liberté avec laquelle j'ai recours à vous, et d'agréer l'expression de ma respectueuse gratitude.

fr. Reg. Garrigou-Lagrange

### **Pentecost 1914 Letter**

Roma, Fête de la Pentecôte, 1914  
COLLEGIO ANGELICO  
Via S. Vitale, 15

Cher Monsieur,

Je vous suis bien reconnaissant d'avoir mis au point pour l'imprimeur la lettre sur la valeur du principe de l'inertie ou tiendra compte pour la mise en italique ou en petites capitales des seuls soulignements à l'encre rouge.

Selon votre désir, je laisserai à cette note la forme de lettre, en renvoyant le lecteur à votre ouvrage sur la théorie physique.

Je ne manquerai pas de vous adresser un exemplaire du volume quand il paraîtra en Octobre probablement.

Je reste toujours désireux de vous voir traiter le problème des rapports des premiers principes de la mécanique avec le principe de causalité: Monsieur Boulanger, lorsqu'il était encore professeur à Lille, me donna un opuscule de P. Painlevé intitulé «mécanique qui traite de cette question, en opposant la mécanique scolastique et la mécanique copernicienne» l'opposition consisterait en ceci que pour les scolastiques il n'y a pas de vitesse acquise.

Ce travail demanderait sans doute à être repris, et vous l'avez certainement fait vous-même dans vos nombreux ouvrages qui touchent presque tous à cette question. Le temps et la

less easy. It should also be suitable to indicate immediately which passages should be italicized; perhaps it would suffice to mark those with two lines.

The title of the note that would appear in the book should be: "Notes on Value of the Principle of Inertia," or more generally: "Note on the Value of the Principles of Mechanics."

I beg you, dear sir, to excuse the freedom with which I have recourse to you, and accept the expression of my respectful gratitude.

Fr. Reg. Garrigou-Lagrange

Rome, Pentecost,<sup>118</sup> 1914  
COLLEGIO ANGELICO  
S. Via Vitale, 15

Dear Sir,

I am very grateful to have developed for the printing the letter on the value of the principle of inertia and will consider putting in italics or small capitals only what is underlined in red ink.

According to your desire, I will leave this note in the form of a letter, referring the reader to your book on physical theory.

I'll be sure to send you a copy of the volume when it will be published, probably in October.

I am still anxious to see you address the problem of the rapport of the first principles of mechanics with the principle of causality: Mr. Baker, when he was a professor at Lille, gave me a booklet of P. Painlevé entitled "Mechanics which treats this question, by opposing Scholastic mechanics and Copernican mechanics"; the opposition would consist in that for the scholastics there is no momentum.

This work undoubtedly requires being performed, and you have probably done it yourself in your many books that touch almost all this question. Unfortunately we lack time and scientific training to follow you.<sup>119</sup>

A general study of philosophy of science

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118 Pentecost fell on 31 May 1914.

119 Is this Garrigou-Lagrange's tragic fault?

formation scientifique nous manquent malheureusement pour vous suivre.

Une étude générale de philosophie des sciences qui condenserait les résultats de vos recherches sur ce point rendrait certainement de grands services.

Avec mes meilleurs remerciements, je vous prie d'agrèer, cher monsieur, mes respectueux hommages.

fr. Reg. Garrigou-Lagrange

which condenses the results of your research on this point would certainly render a great service.

With my best thanks, please accept, dear sir, my respective homage.

Fr. Reg. Garrigou-Lagrange

## Duhem's letter with Garrigou-Lagrange's introduction printed in his *Dieu, son existence et sa nature*

### NOTE SUR LA VALEUR DES PRINCIPES DE L'INERTIE ET DE LA CONSERVATION DE L'ÉNERGIE<sup>120</sup>

Nous avons parlé à plusieurs reprises (p. 239, 249-256, 260) de ces deux principes et du problème de leur conciliation avec le principe de causalité.

Selon le principe de causalité, il n'y a pas de changements sans cause; dès lors une cause est requise aussi bien pour le changement qui a lieu au cours du mouvement que pour le passage du repos au mouvement lui-même. S'il en était autrement une *impulsion finie et minima* pourrait produire dans le vide un mouvement perpétuel, dans lequel il y aurait toujours *du nouveau*, un perpétuel passage de la puissance à l'acte; une chiquenaude donnée il y a dix mille ans produirait encore aujourd'hui son effet et le produirait toujours, éternellement. Ce mouvement qui n'aurait pas besoin d'être entretenu, n'aurait pas de terme, ni de fin au sens métaphysique du mot; comment ne serait-il pas contraire aux principes de causalité et de finalité?

Le principe de l'inertie s'énonce pourtant: la matière ne peut d'elle-même ni se mettre en mouvement, ni modifier son état de mouvement; un corps en mouvement, si aucune cause

### NOTE ON THE VALIDITY OF THE PRINCIPLES OF INERTIA AND CONSERVATION OF ENERGY<sup>121</sup>

We have spoken on several occasions (Vol. I, pp. 259-260; 270-278; 282) of these two principles and of the problem of their reconciliation with the principle of causality.

According to the principle of causality, there is no change without a cause; hence a cause is required as much for the change which takes place in the course of motion as for the transition from rest to motion itself. If it were otherwise, a *finite and minimum impulsion* could produce in the void a perpetual motion in which there would always be something new, a perpetual transition from potentiality to act; a finite power could forever be in motion, a snap of the finger ten thousand years ago would still produce its effect today, and would produce it always, eternally. This motion, which would have no need of being kept up, would have neither end nor beginning in the metaphysical sense of the terms. Would it not be contrary to the principles of causality and finality?

The principle of inertia is expressed as follows: of itself matter cannot set itself in motion or modify the motion that it has; a body in motion, if no external cause acts upon in, retains a rectilinear

<sup>120</sup> Garrigou-Lagrange, *Dieu, son existence et sa nature solution thomiste des antinomies agnostiques*, 759–63.

<sup>121</sup> Reginald. Garrigou Lagrange, *God, His Existence and His Nature a Thomistic Solution of Certain Agnostic Antinomies*, trans. Bede Rose (St. Louis, Mo.: B. Herder Book Co., 1934), 447–52, <http://catalog.hathitrust.org/api/volumes/oclc/1543761.html>.

extérieure n'agit sur lui, conserve indéfiniment un mouvement rectiligne et uniforme.

Si l'on objecte que les faits semblent être en contradiction avec le principe de l'inertie, qu'une bille lancée sur un plan horizontal bien poli, s'arrête au bout d'un certain temps, qu'un train ayant acquis sa vitesse normale s'arrête si l'on ne fait pas agir la vapeur sur le pistons; le physicien répond: cet arrêt est dû au frottement de la bille sur le plan, ou à celui des roues sur les rails et aussi à la résistance de l'air.

Est-il démontré que ce frottement et cette résistance sont l'*unique* cause de l'arrêt? est-il scientifiquement prouvé que le mouvement donné ne se ralentit pas aussi de lui-même? «A-t-on jamais expérimenté sur des corps soustraits à l'action de toute force, demande H. Poincaré [*Le Science et l'Hypothèse*, p. 112 à 119], et si on l'a fait, comment a-t-on su que ces corps n'étaient soumis à aucune force?» Comment, sans sortir des limites de sa science, le physicien pourrait-il soutenir que la *motion divine n'est pas nécessaire* pour qu'un corps lancé dans le vide se meuve éternellement?

Le principe de la conservation de l'énergie s'énonce: «L'énergie totale (actuelle et potentielle) d'un système de corps soustrait à toute action extérieure demeure constante.» Ce principe est nécessairement lié au précédent, il revient à dire: il est impossible que le mouvement cesse jamais, s'il disparaît sous une forme il reparaît sous une autre, ainsi le mouvement d'un projectile ne cesse qu'en engendrant de la chaleur, et la chaleur elle-même produit du mouvement local. L'équivalence est constatée, avec le correctif apporté par la loi de la dégradation de l'énergie.

Est-ce à dire qu'une chiquenaude donnée il y a dix mille ans a encore son effet aujourd'hui par suite des transformations de l'énergie, et qu'elle l'aura toujours, sans que l'énergie ait besoin d'être *renouvelée*? Suffit-il d'admettre que cette énergie est *conservée* par Dieu, comme le veut Descartes, et que la *motion divine* s'est seulement exercée dans le passé à l'origine du monde? Comment, sans sortir des limites de sa science, le physicien pourrait-il affirmer que la *motion divine*

uniform motion indefinitely.

If anyone objects that the facts seem to contradict the principle of inertia—v.g., that a billiard ball, shot on a very smooth plane, stops at the end of a certain time; that a train, after acquiring its normal speed, stops if the steam is not made to act on the pistons—the physicist replies that this stopping is due to the friction of the billiard ball on the plane, or to that of the wheels on the rails, and also to the resistance of the air.

Is it a demonstrated fact that this friction and this resistance are the only causes of the stopping? Is it scientifically proved that the given motion does not slow down also of itself? “Has it ever been proved from experiments with bodies removed from the influence of all external force,” asks H. Poincaré [*Le Science et l'Hypothèse*, pp. 112-119] “that these bodies are not influenced by any force?” How, without exceeding the limits of his science, can the physicist maintain that the *divine motion is not necessary* for a body hurled into a void to move eternally?

The principle of the conservation of energy is expressed as follows: “In a system of bodies removed from all external influence, the total energy (actual and potential) of this system remains constant.” This principle is necessarily connected with the preceding, and it is tantamount to saying that it is impossible for motion ever to cease; if it disappears under one form it reappears under another; thus the motion of a projectile ceases only in generating heat, and heat itself produces local motion. The equivalence is established by reason of the corrective administered to it by the law of the diminution of energy.

Does it follow that a given snap of the finger made a thousand years ago has still its effect today because of the transformations of energy, and that it will always be so, without any need for the energy to be *renewed*? Is it enough to admit that this energy is *conserved* by God, as Descartes says, and that the *divine motion* was only exerted in the past, in the beginning of the world? How, without exceeding the limits of his science, can the physicist declare that the *divine motion is not necessary* for the perpetual transformation of

*n'est pas nécessaire* pour que l'énergie ne reste pas *individuellement* la même, ce n'est pas *le même* mouvement, parce qu'il est le mouvement de *ce* corps. De même l'activité humaine est relativement constante à la surface de la terre, et pourtant elle ne reste pas individuellement la même, elle est renouvelée, puisque les hommes naissent et meurent. Aristote disait déjà: *corruptio unius est generatio alterius*, la matière ne perd une forme qu'en en recevant une autre; ce qui peut se traduire en termes modernes relativement à l'énergie: une forme de l'énergie ne disparaît pas sans qu'une autre apparaisse. Est-ce à dire que la forme qui disparaît est cause première et toute suffisante de celle que la suit? Nullement: la science expérimentale qui étudie seulement les rapports constants des phénomènes entre eux ne peut se prononcer ni pour ni contre la nécessité de l'intervention d'une Cause première invisible pour la transformation de l'énergie. Mais du point de vue métaphysique, un mouvement ne donne naissance à un autre mouvement qu'avec le concours invisible de l'Être premier, cause de tout être en tant qu'être, du Premier moteur, cause suprême de l'activité des causes secondes. De même, du point de vue métaphysique, un mouvement local ne peut se perpétuer dans le vide, ne peut être un *perpétuel passage de la puissance à l'acte*, sans l'intervention invisible de l'Acte pur, cause suprême de toute actualisation. Pour soutenir avec Descartes qu'il suffit que Dieu *conserve* le mouvement, il faut entendre par cette expression que Dieu continue à mouvoir.

Ainsi seulement se peuvent concilier les principes mécaniques de l'inertie et de la conservation de l'énergie avec le principe métaphysique de causalité. Toute autre conciliation que rejette la nécessité de l'intervention de la cause première reste illusoire [Il y aurait à étudier du même point de vue la conciliation du principe de l'inertie avec la loi de l'attraction universelle.].

Le physicien n'a pas à résoudre ce problème, il ne peut se prononcer positivement sur la valeur de la solution qu'en donne la métaphysique traditionnelle, il doit seulement reconnaître que cette solution ne s'oppose en rien à ce que la physique est en droit d'affirmer sur la valeur de ses propres principes, dans l'ordre phénoménal.

energy? It is clear that energy is not *individually* the same; it is not the *same* motion that passes from one body into another, for it is *this* motion, because it is the motion of *this* body. Likewise, human activity is relatively constant on the surface of the earth, and yet it is not individually the same; it is renewed, since human beings are born and die. Long ago Aristotle said: *The corruption of one is the generation of another*; matter loses one form only to receive another; and this can be expressed in modern terms with regard to energy by saying that a form of energy does not disappear without another appearing. Does it follow that the form which disappears is the first and all-sufficient cause of the one succeeding it? By no means; experimental science, which studies only the constant relations between phenomena, cannot declare itself either for or against the necessity for the intervention of a first invisible Cause for the transformation of energy. But, from the metaphysical point of view, one motion does not give rise to another except with the invisible concurrence of the First Being, which is the cause of all being as such, of the Prime Mover who is the supreme cause of the activity of secondary causes. Likewise, from the metaphysical point of view, a local motion cannot be perpetuated in a void, cannot be a *perpetual transition from potency to act*, without the invisible intervention of the pure Act, the supreme cause of all actualization. To maintain with Descartes that for this, it is sufficient that God *conserve* the motion, we must understand by this expression that God continues to move.

Thus only can the mechanical principles of inertia and conservation of energy be reconciled with the metaphysical principle of causality. Every other reconciliation, which rejects the necessity of the intervention of the first cause, is illusive. [The reconciliation of the principle of inertia with the law of universal attraction would have to be studied from the same point of view.]

It is not for the physicist to solve this problem; he cannot pronounce finally on the validity of the solution given by the metaphysics of the Schools; he must merely recognize that this solution is in no way opposed to what physics has the right to affirm about the validity of its principles in the

Sur ce dernier point, nous sommes heureux de reproduire une lettre de M. Pierre Duhem, de l'Académie des Sciences, où il a bien voulu résumer pour nous les idées maîtresses de son bel ouvrage *la Théorie physique*. Nous le prions d'agréer avec nos remerciements, l'expression de notre respectueuse reconnaissance.

Mon Père,

Je vous dois quelques explications pour certains termes ambigus de ma précédente lettre et en particulier pour le nom d'*axiome* ou *soi-disant axiome* que j'ai donné au principe de l'inertie.

Je commence par préciser que je prendrai les mots Mathématique, Physique, Métaphysique dans le sens où les entendent, en général, nos contemporains, non dans le sens d'Aristote et des Scolastiques.

Dans ces conditions, la loi d'inertie n'existe pas pour le mathématicien; les principes de la Science des nombres et de la Géométrie sont les seuls qu'il ait à admettre; il ne s'occupe pas des principes de la Mécanique et de la Physique; s'il lui arrive d'étudier les problèmes que lui posent le mécanicien et le physicien, c'est sans se soucier de la voie par laquelle ils ont été conduit à formuler ces problèmes.

Je ne considère donc le principe de l'inertie que tel qu'il est pour le physicien.

On en peut dire alors ce qu'on peut dire de tous les principes des théories mécaniques et physiques.

Ces principes fondamentaux ou *hypotheses* (au sens étymologique du mot) ne sont pas des *axiomes*, c'est-à-dire des vérités évidentes de soi.

Ce ne sont pas davantage des *lois*, c'est-à-dire des propositions générales que l'induction ait tirées directement des enseignements de l'expérience.

Il se peut que certaines vraisemblances rationnelles ou certains faits d'expérience nous les *suggèrent*; elle ne leur confère, par elle-même, aucune certitude. *Au point de vue de la pure Logique*, les principes fondamentaux des théories mécaniques et physiques ne peuvent être regardés

phenomenal order.

On this point it gives us pleasure to publish a letter from Pierre Duhem, of the Academy of Sciences, in which he gives us a summary of the main ideas of his fine work, *La Théorie physique* [*La Théorie physique, son object et sa structure*].

The letter reads as follows:

"Dear Father: I owe you some explanations for certain ambiguous terms in my previous letter and especially for the name '*axiom*' or '*so-called axiom*' which I gave to the principle of inertia.

"I begin by stating precisely that I shall take the words mathematics, physics, and metaphysics according to the meaning generally given them by our contemporaries, not according to the meaning given them by Aristotle and the Scholastics

"In these circumstances, the law of inertia does not exist for the mathematician; the principles of the science of numbers and of geometry are the only ones that he has to admit; he is not concerned with the principles of mechanics and physics; if he happens to study the problems presented to him by the mechanist and physicist, he does so regardless of the way by which they have been led to formulate these problems.

"I consider, therefore, the principle of inertia only as it is for the physicist.

"One may say of it, then what may be said of all principles of mechanical and physical theories. These fundamental principles of *hypotheses* (in the etymological sense of the word) are not *axioms*, self-evident truths. Nor are they *laws*, that is, general propositions reached directly by induction from the teachings of experience.

"It may be that certain rational probabilities or certain facts of experience *suggest* them to us; but this suggestion is in no way a *demonstration*; it does not confer on them, of itself, any certitude. *From the point of view of pure logic*, the fundamental principles of the theories of mechanics and physics can be looked upon only as *postulates freely posited by the mind*.

"From the ensemble of these postulates, deductive



que comme des *postulats librement posés par l'esprit*.

De l'ensemble de ces postulats, le raisonnement déductif tire un ensemble de conséquences plus ou moins éloignées qui s'accordent avec les phénomènes observés; *cet accord est tout ce que le physicien attend des principes qu'il a postulés*.

Cet accord confère aux principes fondamentaux de la théorie une certaine vraisemblance. Mais il ne peut jamais leur conférer la certitude, car on ne peut jamais démontrer que, d'autres postulats pris comme principes, on ne déduirait pas des conséquences qui s'accorderaient aussi bien avec les faits.

En outre, on ne peut jamais affirmer qu'on ne découvrira pas un jour des faits nouveaux qui ne s'accorderont plus avec les conséquences des postulats qu'on avait posés au fondement de la théorie; faits nouveaux qui obligeront à déduire, de nouveaux postulats, une théorie nouvelle.

Ce changement de postulats s'est produit maintes fois au cours du développement de la Science.

De ces observations, deux conséquences:

1° *D'aucun des principes de la théorie mécanique et physique, on n'a et on n'aura jamais le droit d'affirmer catégoriquement qu'il est VRAI.*

2° *D'aucun des principes sur lesquels repose la théorie mécanique et physique, il n'est permis d'affirmer qu'il est FAUX, tant qu'on n'a pas découvert des phénomènes en désaccord avec les conséquences de la déduction dont ce principe est une des prémisses.*

Ce que je viens de dire s'applique, en particulier, au principe de l'inertie. Le *physicien* n'a pas le droit de dire qu'il est certainement vrai; mais encore moins a-t-il le droit de dire qu'il est faux, puisqu'aucun phénomène ne nous a jusqu'ici, (si l'on fait abstraction des circonstances où intervient le *libre arbitre* de l'homme) contraint de construire une théorie physique d'où ce principe serait exclu.

Tout ceci est dit en demeurant dans le domaine du *physicien*, pour qui les principes ne sont pas les affirmations de propriétés réelles des corps, mais

reasoning deduces an ensemble of more or less remote consequences which agree with the perceived phenomena; *this agreement is all that the physicist expects from his postulated principles*.

"This agreement confers a certain probability upon the fundamental principles of the theory. But it can never confer certitude on them, for it can never be demonstrated that, if other postulates were taken as principles, consequences would not be deduced which would agree just as well with the facts.

"Besides, it can never be affirmed that some day new facts will not be discovered which no longer agree with the consequences of the postulates that had been posited as being at the basis of the theory: new facts compelling us to deduce a new theory from new postulates. This change of postulates has been effected many a time in the course of the development of science.

"From these considerations two consequences follow: (1) *We shall never have the right to affirm categorically of any one of the principles of the mechanical and physical theory, that it is true.* (2) *We are not allowed to affirm of any one of the principles on which the mechanical and physical theory rests, that it is false, so long as there has been no discover of phenomena that disagree with the consequences of the deduction of which this principle constitutes one of the premises.*

"What I have just said applies particularly to the principle of inertia. *The physicist has not the right to say it is certainly true; but still less has he the right to say it is false, since we have so far met with no phenomenon (if we leave out of consideration the circumstances in which the free will of man intervenes) that compels us to construe a physical theory from which this principle would be excluded.*

"All this is said without going beyond the domain of the *physicist*, for whom the principles are not affirmations of real properties of the bodies, but premises of deductions the consequences of which must be in agreement with the phenomena every time that a free will does not intervene to disarrange the determinism of the latter.

le prémisses de déductions dont les conséquences doivent s'accorder avec les phénomènes toutes les fois qu'une volonté libre n'intervient pas pour déranger le déterminisme de ceux-ci.

A ces principes de Physique, peut-on et doit-on faire correspondre certaines propositions qui affirmeraient certaines propriétés réelles des corps? — A la loi de l'inertie, par exemple, doit-on faire correspondre l'affirmation qu'il existe, dans tout corps en mouvement, une certaine réalité, l'*impetus*, douée de tels ou tels caractères? — Ces propositions s'étendent-elles ou ne s'étendent-elles pas aux êtres doués de volonté libre? Ce sont problèmes que la méthode due physicien est inhabile à traiter et qu'il laisse à la libre discussion des métaphysiciens.

A cette liberté du métaphysicien, le physicien ne serait amené à s'opposer que dans un seul cas: Celui où le métaphysicien formulerait une proposition que contredirait directement aux phénomènes ou qui, introduite à titre de principe dans la théorie physique, conduirait à des conséquences en contradiction avec les phénomènes. Dans ce cas, il serait légitimement fondé à dénier au métaphysicien le droit de formuler une telle proposition.

Voilà, mon Père, le résumé de ce que je dirais si j'écrivais jamais, sur le principe de l'inertie, l'article que vous avez la bonté de souhaiter...

P. DUHEM

*N. B.* — Des conclusions assez semblables à celle de M. Duhem sont exprimées par M. E. MEYERSON, *Identité et Réalité*, (Paris, Alcan, 1908) qui examine au point de vue de l'expérience et au point de vue de la raison philosophique la valeur des principes d'inertie et de la conservation de l'énergie. L'auteur va jusqu'à dire, ce qui nous semble fort juste: «le principe d'inertie exige que nous concevions le mouvement comme un état, si le mouvement est un état il doit se maintenir comme tout état... Le principe d'inertie exige que nous concevions la vitesse comme une substance. Or, c'est une conception entièrement paradoxale pour l'entendement immédiat...» p. 132 et 134.

“To these principles of physics, can we and must we make certain propositions correspond which would affirm certain real properties of bodies/ To the law of inertia, for instance, must we make the affirmation correspond that there is, in every body in motion, a certain reality, an *impetus*, endowed with such or such characteristics? Do these propositions apply or not to other beings endowed with free will? These are problems that the method of the physicist is incapable of grappling with and it leaves them to the free discussion of the metaphysicians.

“There is only one case which would induce the physicist to be opposed to this liberty of the metaphysician. It is that in which the metaphysician would formulate a proposition directly contradicting the phenomena or a proposition which, introduced in virtue of a principle in the physical theory, would lead to consequences in contradiction to the phenomena. In this case, there would be just grounds for denying the metaphysician the right to formulate such a proposition.

“Now you have, Reverend Father, the summary of what I would say if I were ever to write, concerning the principle of inertia, the article that you so kindly wish me to write

P. DUHEM

*N.B.* Conclusions more or less like those of Duhem are expressed by E. MEYERSON. In his *Identité et Réalité* (1908), he examines, from the point of view of experience and of philosophic reason, the validity of the principles of inertia and of conservation of energy. The author goes so far as to say, what seems to us quite right, that “the principle of inertia demands that we view *motion as a state*; if motion is a state, it must maintain itself like every state. ... The principle of inertia demands that we view *speed as a substance*. Now this is an entirely paradoxical concept for the immediate understanding” (pp. 132, 134).

Professor GUSTAVO PÉCSI, in his *Crisi degli assiomi della Fisica Moderna*, translated from the German [*Krisis der Axiome der modernen Physik*] (1910), goes further still and believes he can

Le Prof. Dott. GUSTAVO PÉCSI, dans son livre *Crisi della Fisica Moderna*, traduit de l'allemand [*Krisis der Axiome der modernen Physik*], Rome, Desclée 1910, va plus loin encore et croit pouvoir établir rigoureusement la fausseté du principe de l'inertie, qui aboutirait à cette contradiction: le mouvement est essentiellement immobile, il n'y a en lui rien de nouveau (p. 201).

prove absolutely the falsity of the principle of inertia which would end in this contradiction: that motion is essentially motionless, that there is nothing new in it (p. 201).

## Conclusion

We have seen Duhem's philosophy of physics, which is based upon St. Thomas's distinction between the two uses of reason, applied to a theological problem, affirming what Pope Pius XII wrote in *Humani Generis*, "that sufficient reason, causality and finality—and lastly the attainment of certain and immutable truth,"<sup>122</sup> must still be maintained today, as by understanding the true nature, limits, and strengths of modern physics. Whenever it seems the faith contradicts reason, as it seemed to Garrigou-Lagrange when he was formulating his proof for God's existence, we must follow his example and strive to push the limits of our knowledge further rather than subject faith to so-called reason, which is really opinion or wishful-thinking,<sup>123</sup> for "The false appearance of such a contradiction [between the faith and modern science] is mainly due, either to the dogmas of faith not having been understood and expounded according to the mind of the Church, or to the inventions of opinion having been taken for the verdicts of reason."<sup>124</sup> Modernists hold that "it is evident that science is to be entirely independent of faith, while on the other hand, and notwithstanding that they are supposed to be strangers to each other, faith is made subject to science."<sup>125</sup> This also cannot be so because "faith is above reason,"<sup>126</sup> [and] there can never be any real discrepancy between faith and reason, since the same God who reveals mysteries and infuses faith has bestowed the light of reason on the human mind; and God can not deny himself, nor can truth ever contradict truth."<sup>127</sup>

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122 Pope Pius XII, "Humani Generis," August 12, 1950, para. 29,

[http://www.vatican.va/holy\\_father/pius\\_xii/encyclicals/documents/hf\\_p-xii\\_enc\\_12081950\\_humani-generis\\_en.html](http://www.vatican.va/holy_father/pius_xii/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis_en.html).

Latin original: "rationis nempe sufficientis, causalitatis et finalitatis — ac demum certae et immutabilis veritatis"

([http://www.vatican.va/holy\\_father/pius\\_xii/encyclicals/documents/hf\\_p-xii\\_enc\\_12081950\\_humani-generis\\_lt.html](http://www.vatican.va/holy_father/pius_xii/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis_lt.html)).

123 since, as St. Augustine said, "Reasoning does not make things so; it finds them so." (*De vera religione*, ch. 39, n. 73.)

124 Schaff, *Creeds of Christendom, with a History and Critical Notes. Volume II. The History of Creeds.*, 2:249.: "Inanis autem hujus contradictionis species inde potissimum oritur, quod vel fidei dogmata, ad mentem Ecclesiae intellecta et exposita non fuerint, vel opinionum commenta pro rationis effatis habeantur."

125 Pope St. Pius X, "Pascendi," para. 17.: "Sic ergo conficitur, scientiam a fide omnino solutam esse, fidem contra, ut scientiae extranea praedicetur, eidem subesse."

126 cf. St. Thomas Aquinas's *Summa Contra Gentiles*, lib. 1 cap. 6, "That it is not a mark of levity to assent to the things that are of faith, although they are above reason."

127 Schaff, *Creeds of Christendom, with a History and Critical Notes. Volume II. The History of Creeds.*, 2:248.: "fides sit supra rationem, [et] nulla tamen unquam inter fidem et rationem vera dissensio esse potest: cum idem Deus, qui mysteria revelat et fidem infundit, animo humano rationis lumen indiderit; Deus autem negare seipsum non possit, nec verum vero unquam contradicere."