

NON-SEPARABILITY, COMPLEXITY AND CREATION BY RELATIONSHIPS

THIERRY MAGNIN

Université catholique de Lille, France

Introduction

This paper is devoted to the dialogue between physics and Christian theology, through some new ways to think about reality that have been introduced by quantum physicists during the first part of the twentieth century. In fact, quantum physicists experience a kind of incompleteness with respect to reality, which is close to that of the well-known philosopher Kant who claimed that science cannot reach the ultimate reality.¹

In a completely different field, the theologians facing God's mystery also face a kind of incompleteness which requires the adoption of the well-known apophatic approach.²

Thus, the aim of this paper is to show how the mystery of knowing, and the corresponding attitudes of research, emerge as very relevant epistemological mediations for the dialogue between physicists and theologians. The objective is then to show how we can articulate the theology of creation by Trinity (creation by relationships) with the new scientific view of the relations between the physical substances that reveals quantum physics (particularly through the concept of non-separability) and more generally with the sciences of complexity.

The following items will be presented:

¹ For a detailed analysis, see Max Jammer, *The Philosophy of Quantum Mechanics* (New York, J. Wiley and Sons, 1974); Lena Soler, ed., *Philosophie de la Physique* (Paris: L'Harmattan, 2006).

² For a detailed analysis of the corresponding attitudes between the physicists and the theologians, see Thierry Magnin, *Le scientifique et le théologien en quête d'origine* (Paris: Desclée de Brouwer, 2015).

- An abstract of the epistemology of quantum physics and some consequences to define 'complexity' at the quantum level.
- How physicists and theologians are facing the 'mystery of knowledge' in their respective fields.
- An example in the Catholic tradition of the apophatic approach in theology with Nicholas de Cusa.
- A conclusive perspective on what de Cusa called 'Unitrinity' and the creation by relationships.

The quantum physicist facing reality

Bohr and Heisenberg were among the most famous quantum physicists to show how the measuring procedure has a fundamental influence on the conditions on which the very definition of physical quantities in question is based.³ This was a very different situation compared to classical physics. The theory of measurement even shows that, for a physicist, to know and to measure is to act on reality. Reality is then a 'reality of interactions', which is in fact the object of the scientific analysis.

As Heisenberg said about the famous wave-corpuscle duality, depending on the operative system and conceptual apparatus (a detector or an interferometer) 'when playing with these two images (wave/corpuscle for example), going from one to the other and then back again, we finally obtain the right impression of the strange sort of reality which hides behind our atomic experiments'.⁴

This leads to the concept of complementarity by Niels Bohr speaking about quantons. According to this principle, the qualities of continuity (wave mode) and discontinuity (corpuscle mode) are mixed when referring to quantons (and describing them mathematically), even if quantons appear experimentally either in the wave mode or in the corpuscle mode.

Mutually exclusive contradictories (A and no-A) then appear in the description of reality as 'reality of interactions'. This is expressed by Heisenberg's uncertainty principle which can be summarised as follows:

³ See Niels Bohr, *Atomic Physics and Human Knowledge* (New York: Wiley and Sons, 1958); Werner Heisenberg, *Der Teil und Das Ganze* (Munich: Piper et Verlag, 1969).

⁴ Heisenberg, 132.

knowing the position of a particle is complementary to knowing its movement quantity (product of mass by velocity). If we know the value of the first one with a high degree of accuracy, then we cannot know the value of the other with the same degree of accuracy. Yet we need to know both in order to determine the behaviour of the particle. Thus quantum physics speaks in terms of uncertainty and unpredictability, even with deterministic equations.

*Non-separability, global causality and logic
of the included middle*

The two images of wave and corpuscle are mutually exclusive. A given entity cannot be, at the same time, continuous and discontinuous. With complementarity, however, continuity (the wave aspect) and discontinuity (the corpuscular aspect) are considered at the same time in the description of elementary particles. In this way, we find that there are numerous examples of contradictory couples (or antagonisms) in quantum mechanics: continuity vs discontinuity, separability vs non-separability, symmetry vs broken symmetry, local causality vs global causality.

Thus, a system composed of two entangled elementary particles, both emitted by the same source, is shown to be non-separable. If we measure the spin as $+1/2$ on one particle, the spin value of the other is immediately $-1/2$. The two particles are non-separable, they form a system together with the observer. Then one can speak about a global causality and not only local causality. A new logic of the included middle is involved in quantum physics, with a kind of ‘union of antagonisms’.⁵ Such antagonisms correspond to eight characteristics of quantum complexity:⁶

- i. Unity: the complementary modes of representation are related to the same object. What appears to be continuous (as a wave) under some experimental circumstances and discontinuous (as a corpuscle) under others is in fact related to the same object.

⁵ For a detailed analysis, see Thierry Magnin, *Le scientifique et le théologien en quête d'Origine: L'expérience de l'incomplétude* (Paris: Desclée De Brouwer, 2015).

⁶ Christopher Barina Kaiser, *The logic of complementarity* (Edinburgh: University of Edinburgh Press, 1974).

- ii. Common properties: going along with the unity of the modes, in the domain of atomic phenomena, these are rest mass, electric charge and spin angular momentum.
- iii. Completeness of each mode in one experimental situation; the object may be completely described, in a given situation, in terms of the appropriate mode without any explicit reference to the alternate mode. Only if the situation changes, does the alternate mode have to be taken into account.
- iv. Co-exhaustivity: together, the two modes are sufficient to simultaneously describe the object: there is no third mode.
- v. Equal necessity: the two modes are equally necessary, of equal importance.
- vi. Alternativity: the temporal evolution of the physical entity proceeds by a continual alternation between one mode and the other as the entity passes from one situation to another.
- vii. Co-inherence: each mode exists potentially inside the other; in this sense, an atomic object behaves both as a wave and as a corpuscle. There is an inter-participation or co-operation between the modes.
- viii. Mutual exclusivity: the two modes are mutually exclusive in the sense that they are conceptually incompatible and cannot be combined into a single picture.

Applied to the particle, the logic of the included middle can be illustrated by the figure of the triangle, as proposed by B. Nicolescu and his notion of level of reality⁷ (Figure 1). The two levels of reality that must be considered are the macroscopic level NR1 (related to classical physics with its appropriate and specific language and logic) and the microscopic level NR2 (related to quantum physics with its own appropriate and different logic). Research at point T corresponds to research focused on a level of reality where what is mutually exclusive at level NR1 can be unified at this level NR2. It corresponds to the included middle for which point T is not at the same level that the contradictory logical antagonisms. Nevertheless, the antagonism is never completely solved at NR2. New antagonisms can appear from point T at level NR2. The figure is only a simple heuristic to represent

⁷ Basarab Nicolescu, *Meaning and Evolution* (New York: Parabola Books, 1991).

the level structure of the included middle in quantum physics. In this representation, no basic contradictions with Aristotle's logic of non-contradiction occur because point T is not at the same level of the two components of the basic contradiction.

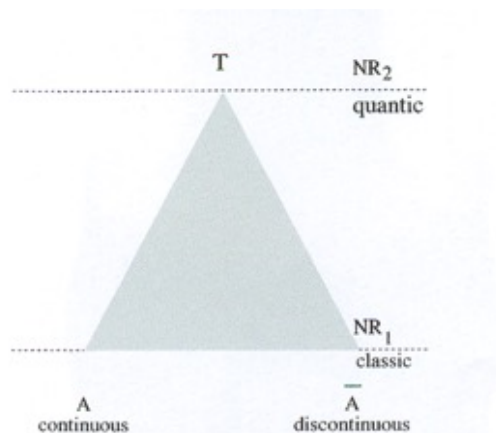


FIGURE 1. LEVELS OF REALITY IN THE LOGIC OF THE INCLUDED MIDDLE.
 NR* 1 = macroscopic (level 1, local causality and separability, classical physics)
 NR* 2 = microscopic (level 2, global causality and nonseparability, quantum mechanics)
 NR = niveau de réalité (level of reality)

Something is beyond our knowledge, something of the order of Origin

Through the relation of the observer with reality in quantum physics, one can say that something resists our experiments and is beyond our understanding⁸. Contrary to classical physicists, the quantum physicists say: 'if you do such experiments you will observe such effects'. Physics is then only able to predict the observations but not to directly describe reality. A form of complexity including the observer leads to speaking of a 'veiled reality'⁹. It looks impossible to the quantum physicist to reach the foundations of things, the origin of things, as previously said by the philosopher Kant. This underlines an essential evolution of the ideas of reality and truth in hard sciences, and opens to the question of the withdrawal of foundations!¹⁰

⁸ Ian G. Barbour, *Religion and Science* (San Francisco: Harper, 1997).

⁹ Bernadrd d'Espagnat, *Une incertaine réalité* (Paris: Gauthier-Villars, 1995).

¹⁰ Jean Ladrière, 'L'Abîme' in *Savoir, faire, espérer; les limites de la raison*, vol.1, ed., Jean Beaufret, (Bruxelles Pub, Facultés Univ. St Louis, 1976).

Moreover, whether it be in the study of language (Wittgenstein), logic (Gödel), the structure of matter (Heisenberg), or irreversible evolution (Prigogine), it is apparent that similar conclusions are reached regarding to incompleteness, the horizon of undecidability/unpredictability and the impossibility of limiting truth to the totality of what can be said, whether this be formally demonstrated or directly measured.

To accept that something can be formalised, is to accept that some aspect of that 'thing' is necessarily missing. Thus, constructing a theory of knowledge requires acceptance that something is *beyond our knowledge*. This does not represent a defeat of scientific reason, but a condition of progress in intelligibility.

Physicists experiment with something that escapes! They face what we can call the mystery of knowledge, in the sense of the French philosopher Gabriel Marcel who makes the distinction between a problem and a mystery:

The problem is a question that we ask ourselves about elements that have been laid out before us, as it were, and that are, generally speaking, external to us. There is mystery, on the contrary, when the one asking the question belongs to the very thing about which he is asking the question, that is, the mystery of being, about which I can only inquire into insofar as I am.¹¹

The mystery of knowing can be a 'bridge', a mediation, between scientists and theologians and favours their dialogue, in respect to their two distinct domains. Thus, in the apophatic theology, the mystery of God the 'Unspeakable', is illustrated in the famous prayer attributed to Gregory of Nazianzus, 'O transcendent, Almighty God, what words can sing your praises?...'.

Far from being a 'knowledge gap', mystery is a call for exploration. The rehabilitation of mystery at a philosophical level (G. Marcel uses the term 'meta-problematical' to describe mystery) allows for an interesting bridge between science and theology, and a real opening to alterity, the origin of things and the research of God! The mystery of knowledge is related to very different fields for the scientist and the theologian,

¹¹ Gabriel Marcel, *Positions et approches concrètes du Mystère ontologique* (Nauwelaerts et Vrin, 1949), 35.

but both are facing a reality which is beyond their knowledge. Their acceptance of the mystery of knowledge is an opportunity for an openness to alterity, with the joyful incomplete condition which is not a defeat of human reason but a real opportunity to research the truth (which is always beyond our understanding).

The logic of the included middle in theology

In Christian theology, one can represent the mystery of Incarnation and the Biblical Covenant with the same methodological approach of the logic of the included middle (Figures 2 and 3), with respect to the specificity of the Christian mysteries. Figure 2 illustrates a representation of the dogma of Incarnation, using the levels of reality. In classical language, man is finite and God is infinite. In classical logic, an entity cannot be both finite and infinite! This statement defines reality level NR1 (bottom of triangle). In the Christian tradition, the unity of antagonisms between finite and infinite is realised by Jesus Christ, reality level NR2 (faith, top of triangle). Here, the incarnate Son of God, Christ, realises the unity of antagonisms, especially on the Cross. For the believer, the Cross is the sign of a 'passing-through,' a sign of conversion that is never finished! Thus the believer goes by faith from level NR1 to level NR2, but never totally reaches point T. The novelty of Christ is given by Revelation and is completely beyond what we can imagine, even if we can approach the mystery by human reason. This is typical of the apophatic approach.

Even if there is no relation between the status of quantum reality and the status of Jesus Christ (obviously!), the antagonism 'finite-infinite' in theology in comparison with the continuous-discontinuous antagonism in science, along with their corresponding modes of representation, is quite analogous in terms of the logic of the included middle. The analogy here is related to the mode of representation in terms of logic, not to the attributes! The logic of quantum physics appears quite interesting for presenting the terms of Christian dogmas.

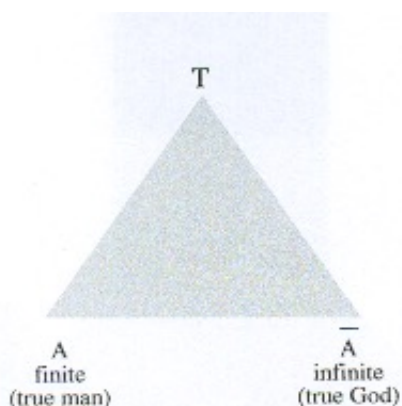


FIGURE 2. Representation of the dogma of Incarnation in terms of levels of reality in the logic of the included middle.

Another important point of the Christian tradition, the Covenant between God and man in the Bible, can also be expressed in terms of complementarity, using the logic of the included middle. Creation is separated from God (one of the translations of 'creation' in Hebrew means 'separation') and is, at the same time, in relation with God through the Covenant. Thus, the Covenant includes both the separation (alterity) and the relation (unity/communion), as shown in Figure 3.

There is a strong unity of antagonisms in the Covenant that allows both freedom of choice for man and the given gift of love from God to humanity. The love of God given to humanity is completely free, which opens a free man's response. The experience of faith is open to an understanding of the covenant as a unity of antagonisms that is never completely solved by man. Using the terms from the hylemorphism of Aristotle, one can say that the actualisation of the separation induces the potentialisation of the relation. Similarly, the actualisation of the relation induces the potentialisation of the separation, in a dynamic equilibrium.

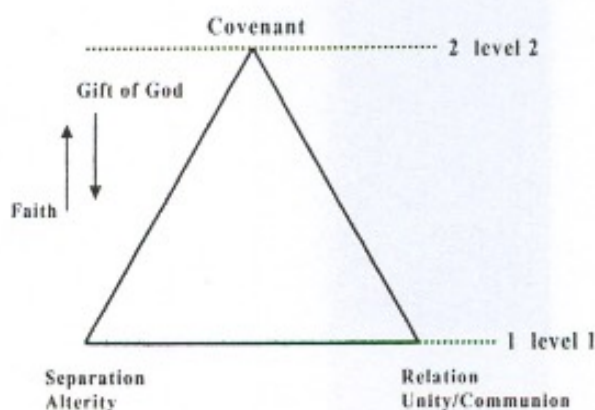


FIGURE 3. Representation of the biblical Covenant between man and God.

In this dynamical equilibrium through the presentation with the included middle logic, the fundamental alterity between God and Creation is clear, which avoids classical forms of pantheism. Thus, a true partnership is proposed by God to man in the Covenant. The free love of God allows and generates the freedom of man. Then, the sin of man will in fact correspond to the rupture of man from the couple alterity-unity, for instance when man takes the place of God or when he builds some idols. In contrast, man can become himself inside the alterity-unity offered by the free love of God. The more man becomes man, the more God appears both intimately linked with man and completely 'Other'! Moreover, looking to the Covenant through complementarity emphasises the fact that God creates at each moment and not only at the beginning of time and space. The love of God gives being and life to creatures at once. This way to present Creation in Christian theology is of prior importance in the debate between science and theology.

Finally, Jesus Christ opens the New Creation through the cross and Easter. On the cross, he realises the perfect antagonism 'separation-unity' with his Father, which opens to the New Covenant between God and Humanity, God and Cosmos. In daily life, this unity of antagonisms of 'full power of God-non power of Christ on the Cross' corresponds to the fundamental way for the Church towards God's Kingdom! Then for the Christ disciple, to become himself is closely related to giving himself to God.

Apophatic theology and Creation by relationships

The French Christian philosopher Blaise Pascal said ‘The last function of reason is to recognise that there is an infinity of things which surpasses it’¹². The apophatic tradition, since Denys the Areopagite, is well known in Orthodoxy. In the Catholic tradition, Nicholas de Cusa (1401-1464) is one of the most famous examples. He wrote *incognoscibilis Deus se mundo in speculo et aenigmate cognoscibiliter ostendit*—the unknowable God shows himself in a knowable way by the world, in the mirror or in enigma¹³. His most famous book is named *De docta Ignorantia*, which can be translated as the learning ignorance. ‘All that we conceive that God is, it is no more true to affirm that it is, rather to deny it. All we conceive that God is not, it is no more true to deny that it is rather sweet to affirm.’¹⁴

To approach the mystery of God, reason works but recognises at the same time its ignorance in speaking of the Unspeakable. Nevertheless this ignorance can become *learning* when the human being, aware of the abyss of the ‘unknowledge’ where his reason leads him to face God’s mystery, can let himself go to the mystery and ‘welcome’ the unspoken that gives itself to man. This approach doesn’t reject reason. On the contrary, it gives to reason a significant role that goes to the recognition of its own limits (unknowledge)!

As an example, Nicholas de Cusa puts human reason in front of contradiction through the logical assertion of God as both ‘maximum and minimum’. The corresponding *coïncidentia oppositorum* at infinite takes into account the fact that human reason can only reach ‘possibles’, but also that something in the human soul is capable of ‘impossibles’! The human intellect is crossed by something which escapes the human being but which is constitutive of himself. The finite man is crossed by Infinity. In this situation, the ‘intellect’ in the *coïncidentia oppositorum* is able to enter the mystery of the infinite God.

Nicholas de Cusa speaks about God as the ‘non-Other’.¹⁵ (For him, we can only say about the non-other that he is non-other than the

¹² Blaise Pascal, *Pensées*, 267, ed. Leon Brunschvicg (Paris: Édition 1897).

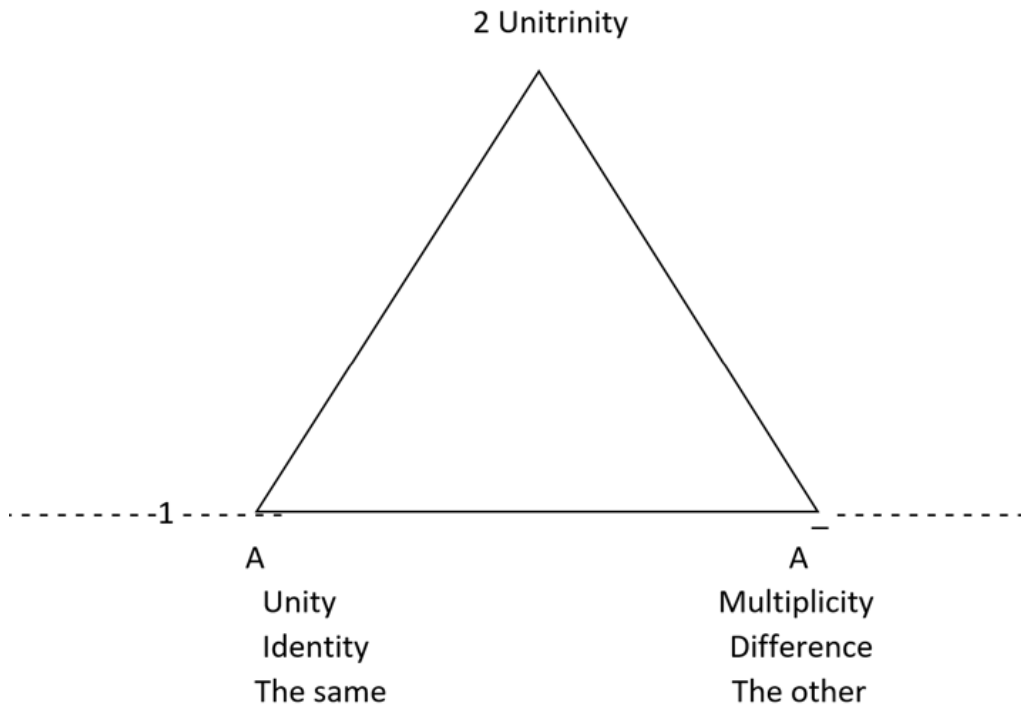
¹³ Nicolas de Cues, *Dialogue à trois sur le pouvoir-est: Trialogus de possest*, trans. P. Cayer et al. (Paris, Librairie philosophique J. Vrin, coll. « Philologie et Mercure », 2006), 107.

¹⁴ Nicolas de Cues, ‘La docte ignorance’, trans. M. de Gandillac, in *Oeuvres choisies de N. de Cues*, (Paris: Aubier, 1942) 71.

¹⁵ Hervé Pasqua, Introduction, *Nicolas de Cues. Du non-autre, Le guide du penseur*, trans. Hervé Pasqua (Paris: Éditions du Cerf, Paris, 2002).

non-other. This definition is the threefold repetition of the name ('the non-other is non-other than the non-other'), and it doesn't only show that this 'essence' is determined by itself without the need of anyone else, but it reveals its trinity in an indivisible unity. The non-Other gives life to the Other in the exact movement he is leaving. Indeed, the God 'One and Three' is the foundation of the real Unity: 'Given that the absolute unity is necessarily three-one... the universe could not be one without the Trinity it is coming from'¹⁶. The reasoning of the 'non-other' is mainly set on the intellectual level, but one should not forget the mystic theologian who is sensible to the communion between those three persons, with a direct link between creation and salvation.

In this view, one can propose with Nicholas de Cusa the vision of the 'Unitrinity', vision of the creation by Christian trinity, creation by relationships, as represented on figure 4.



*Figure 4. Representation of the trinity in terms of levels of reality.
Level 1: the one who is; Level 2: the one who is non-other than the one.*

¹⁶ Nicolas of Cusa, *On learned ignorance (De docta Ignorantia)*, II, 7, (Minneapolis, Minnesota: Arthur J. Banning Press, 1981).

The creative fertility of God is due to the communion of the Three. Their union, which is absolute unity, is creating, creative and personalising through love-movement relationships to the creation, particularly to humanity. Animated and non-animated elements do enter in the circle of influence of the Unitrinity in his creative dynamics. They unite themselves by becoming what they are.

Such creation by relationships is explained by Nicholas de Cusa in the 'learning ignorance':¹⁷ 'created things begin to be by virtue of the fact that God is Father; they are perfected by virtue of the fact that He is Son; they harmonize with the universal order of things by virtue of the fact that He is Holy Spirit.'

One will notice the three 'by virtue of', emphasise the fact that the origin of things is a gift from the One that is One and Three. In the dynamics of relationships between the three, love overflow gives the creation. God is present until the depths of the matter and he is creating by 'shaping resemblances', all of this by being transcendent. There is no pantheism in this presentation: even if there is a strong relation between God and the universe, the Creator stays distinct from the world and creates from 'innerself'. The universe becomes a kind of gateway to the knowledge of the creative Trinity: *All the created powers carry the image of the productive power from the creating Trinity*.¹⁸ (Here we can recall the following sentence: 'For in Him we receive life, movement and being' (Acts 17, 28).¹⁹

In conclusion, what we can say is that the philosophical category of the mystery (mystery of knowing) is quite a relevant mediation between physics and theology, particularly in the context of quantum physics. The logic of the included middle is then relevant to exploration of a reality which is always beyond our understanding, while reaching the human soul. The creation by relationships, the gift of the Trinity in its inner dynamics, looks quite interesting for the dialogue between science and apophatic theology.

¹⁷ Ibid., I, 24.

¹⁸ Nicolas of Cusa, *De pace fidei*, 8.

¹⁹ All the created powers carry the image of the productive power from the creating Trinity.