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LEVELS OF REPRESENTATION AND LEVELS OF REALITY :

TOWARDS AN ONTOLOGY OF SCIENCE

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ABSTRACT

Science and theology each derive their particular languages and modes of representing reality from their respective fields. However, it is interesting to compare the methods and modes of interpretation in science and theology with reality itself, without confusion or concordism.

The aim of this paper is to consider the notion of levels of Reality in science, to compare it with notions of levels of representation and organization, and to study how it can be relevant for theology's attempt to propose and to present the mystery of God and of Human Being in the Christian tradition.

For example, when physicists described the quark, they first introduced it as a pure mathematical notion (i.e., first level of representation) ; next, as a free particle (second level of representation) ; and most recently, as a permanently-confined particle within hadrons (third level of representation). All three levels of representation refer to the same level of Reality, the quantum level.

In contrast, quantons (first level of representation) also correspond to waves and to corpuscles (second level of representation), but in this case, these two representations refer to two different levels of Reality. In fact, this second example leads us to consider a different type of logic - *the logic of the included middle* - which proves to be extremely fruitful as well for the theological framework, without any concordism.

As an exemplary case, we will apply the notion of levels or Reality, associated with the logic of the included middle, to an approach to the mystery of the Trinity, taking into account the specificities of theology. We will focus on the fact that such an approach is both modest and relevant and preserves a balance between faith and reason.

The purpose of this paper is to suggest a logical basis for the contemporary dialogue between science and theology. The danger of confusion or concordism between these is avoided here by using a new methodology, called "transdisciplinary"; i.e. a methodology which operates within the information - filled space between disciplines[1]. This information crosses all disciplines and goes beyond them. A critical feature of this new methodology is a new definition of Nature[2] which is in agreement with modern scientific knowledge, and which leads to a Gödel-like structure of Nature and knowledge (see also Ref. 3). It is precisely this Gödel-like structure which allows to build bridges between the rational discourses of science and theology, without ever violating these rational bounds.

For pedagogical reasons our starting place here will be science (namely, quantum physics), and we shall proceed by examining certain isomorphic aspects of theology.

The two pillars of the new definition of Nature are : *the logic of the included middle* and the notion of *levels of Reality,* taken as *axioms* which have a certain experimental scientific basis.

Quantum mechanics and, later, quantum physics caused the sudden appearence of mutually exclusive contradictories (A and non-A), for example : wave *and* particle ; continuity *and* discontinuity ; separability *and* non-separability ; local causality *and* global causality ; symmetry *and* symmetry breaking ; reversibility of time *and* irreversibility of time ; etc. One possible solution for this paradoxical situation is to replace the axiom of the excluded middle of classical logic (the famous *tertium non datur*) by *the axiom of the included middle,* which states that "there is a third term T which is at the same time A and non-A[4]. This formalism becomes completely clear if one takes into account the notion of *levels of Reality*[5].

Some definitions are in order. By the word *reality* we mean everything which *resists* our representations, descriptions, images, experiences or experiments. The concept of "Reality" used here will be understood in its ontological and also in its empirical scientific sense. By the term *level* we mean group of systems which is invariant under the action of certain laws.

Finally we maintain that two *levels of Reality* are different if the passage from one to the other involves a breakdown of laws and a breakdown of fundamental concepts (such as causality, for example). An obvious example is that of the pair "microphysical level" - "macrophysical level".

In the context of the present discussion the question of whether the number of levels of Reality is finite or infinite is irrelevant. What is important is their *discontinuous* structure : the passage from one level to another is, by definition, discontinuous. In our representation, the

levels of Reality are considered as energy levels, the energy being a unifying concept : it appears in a coded form as information or in a concrete form as substance.

The content of the axiom of the included middle becomes clear if we represent the three terms of the new logic : A, non-A and T, and the dynamic associated with them, by a triangle, with one of its vertices located on one given level of Reality and the other two vertices located at another level of Reality. If one considers just one level of Reality, everything apears as a pair of two contradictory elements (e.g., wave and particle). The third dynamic, that of the T-state, occurs at a different level of Reality, where that which appears to be separate (e.g., wave and particle) is in fact unified (e.g., quanton), and that which appears to be contradictory is perceived as non-contradictory.

We are thus lead to introduce the ternary of *living Nature* : Nature, anti-Nature, trans-Nature[2]. This ternary does not depend on a particular level of Reality ; i.e. it is *invariant* with respect to all levels of Reality.

Nature in the entirety of phenomena which appear to us as the results of cosmic processes or of our mind. It is characterized by increasing entropy, by a tendency to fragmentation, by a depletion of energy.

It is therefore clear what *anti-Nature* means : the decreasing of entropy, the tendency towards unity in diversity, the increasing density of energy.

Moving from Nature to anti-Nature involves a discontinuity. This discontinuity necessitates the introduction of a third term, "trans-Nature". *Trans-Nature* is both that which crosses and that which is beyond Nature and anti-Nature. Trans-Nature is the actualization of all T-states and of affectivity.

Of course, the three terms of the ternary of living Nature have to be considered *simultaneously*. However, it is important to note that modern scientific methodology is exclusively concerned with the first term of this ternary. It is only at the boundaries of modern science that we are offered glimpses of the other two terms of the ternary of living Nature.

This new definition of Nature has important consequences for the general problem of *representation*. We need to distinguish two classes of representations : those which refer to a single level of Reality and those which refer to several levels of Reality. In other words, the levels of representations *are not* in a one-to-one correspondence with the levels of Reality.

The representation of the quark is an interesting example of the first class of representations . When physicists first introduced the notion of quark, they described it as a pure mathematical notion (first level of representation). Next, the quark was represented as a

free particle (second level of representation). Now physicists consider the quark as a permanently - confined particle within hadrons (third level of representation). Each of these different levels of representation refer to a unique level of Reality - the quantum level. One can therefore understand why the notion of level of Reality is radically distinct from the notion of *level of organization*, as defined in the General Systems Theory. All levels of organization belong to a single level of Reality - they have a *horizontal* structure.

In contrast, quantons (first level of representation) also correspond to waves and to corpuscules (second level of representation), but in this case, these two representations require that we speak of two different levels of Reality, via the logic of the included middle, which reveals a *vertical* structure. It is precisely this logic of the included middle which can provide the rational foundation of a possible dialogue between modern science and theology.

The logic which governs the interaction of the levels of Reality is graphically described in Fig. 1.

The connection between two contiguous levels is insured by the logic of the included middled and is graphically represented in Fig. 1 by a basic triangle : the contradiction (A, non-A) present at a given level of Reality, e.g., NR_0 is resolved in a non-contradiction via the T-state at a immediate contiguous level, e.g., NR_1 (or NR_{-1}). However the "final", complete theory is not (and cannot ever be) found because in turn the respective T-state opens a new contradiction (A, non-A) at its own level, e.g., NR_1 (or NR_{-1}). This process continues indefinitely. The Gödel-like structure of Nature and knowledge is precisely represented by this process : the contradiction cannot be definitively solved and there is no conceivable complete theory. The logic of the included middle resolves the contradiction at a given level of Reality while simultaneously opening the contradiction at a different level of Reality.

The iterative action of the logic of the included middle, represented by the triangulation shown in Fig. 1, implies the imbrication of levels and the coherence of Nature as a whole.

A particular role is played by the three topological envelopes of all A, non-A and T-states, respectively, represented by the three closed loops in Fig. 1. The loops must be *closed* in order to insure the *coherence* of the transmission of information from one level to the other, in the entirety of all existing levels. Moreover, this coherence is not completely insured if the three closed loops run parallel to each other : they *must join together at least at one point* X. The situation represented in Fig. 1 is only the simplest one and is therefore in no way unique : the three topological envelopes could join together at several points, say X, Y, Z, etc.

The general structure shown in Fig. 1 represents the action of a true "Principium" which, for reasons which will become clear in the following, we call the *Ternary Principium of Immanent Transcendence*. The expresion "immanent transcendence" is borrowed from Husserl[6] because its content is perfectly adapted to our approach and also because it

represents a semantic construction typical for what could be a *language of the included middle.*

Now we can take the next step, which is to read a theological text and verify its inherent logical consistency in the light of the discussion above.

We will consider as an examplary case the *Quicumque Symbol*, attributed to Athanasius[7] and which played an important role in the development of the dogma of Trinity.

Such a text cannot be read using binary classical logic. Some philosophers even consider that tranditional thinking leads to the abolition of the non-contradiction and of identity axioms (see, for example, Ref. 8). As we will see, such a remark is based on a logical error, consisting in neglecting the fact that the axiom of the excluded middle is an axiom *independent* from the other two axioms of classical logic. Abolishing this axiom allows us to preserve the principles of identity and non-contradiction. As Bertrand de Margerie notes correctly, the history of the Christian dogma of the Trinity clearly shows a continuous dialectical process of searching for non-contradiction[9]. The *Quicumque symbol* is a magnificent illustration of that search.

As can be verified, this text demonstrates a perfect logical coherence if one performs the following correspondence at the level of language : Father $\rightarrow$ the closed loop going through all non-A (potentialization) states ; Son $\rightarrow$ the closed loop going through all A (actualization) states ; Holy Spirit $\rightarrow$ the closed loop going through all T-states ; God $\rightarrow$ point X (see Fig. 2). For reasons of space we have limited ourselves here to only a few examples which will serve to illustrate this perfect logical coherence.

In the *Quicumque symbol* it is said : *"Qualis Pater, talis Filius, talis Spiritus Sanctus ; increatus Pater, increatus Filius, increatus Spiritus Sanctus ; immensus Pater, immensus Filius, immensus Spiritus Sanctus ; aeternus Pater, aeternus Filius, aeternus Spiritus Sanctus : et tamen non tres aeterni, sed unus aeternus; sicut non tres increati, nec tres immensi, sed unus increatus et unus immensus..."*

The word "increatus" corresponds to the right of Fig. 2, where no levels of Reality are present. The word "immensus" corresponds to the fact that the three topological envelopes in Fig. 2 cross both the regions of "created" and "uncreated", encompassing everything which was, is and will be conceived by human reason. The word "aeternus" referes to the fact that strictly speaking, "time" is defined only in the left region of Fig. 2, where the totality of levels of Reality is present. However, there are not three but only one "increatus", "immensus" and "aeternus", because the three closed loops in Fig. 2 join at only one point (X $\Leftrightarrow$ God) : *"et tamen non tres dei, sed unus est Deus..."* The Trinity in Fig. 2 *is certainly not* a hidden quaternity, in spite of the presence of point X $\Leftrightarrow$ God. This joining (identification) point belongs to the topological definition of the three closed loops and therefore cannot be

conceived as an independent entity (on the mathematical, logical or symbolic level). Finally, let us quote an extremely significant part of the *Quicumque symbol* : *"Pater a nullo est factus nec creatus nec genitus. Filius a Patre solo est, non factus nec creatus, sed genitus. Spiritus Sanctus a Patre et Filio non factus nec creatus nec genitus, sed procedens. Unus ergo Pater, non tres Patres, unus Filius, non tres Filii ; unus Spiritus Sanctus, non tres Spiritus Sancti ; et in hac Trinitate nihil prius aut posterius, nihil maius aut minus, sed totae tres personae coaeternae sibi sunt et coaequales..."*

The word "creatus", as we've already said, refers to the left part of Fig. 2 (where the levels of Reality are present), while the word "genitus" refers to the right part of Fig. 2. However, in a dialectical process, the term "non-genitus" aquires all its meaning through the crossing of all potentialization non-A states, while "genitus" aquires all its meaning through the crossing of all actualization A-states. Finally, the word "procedens" rigorously describes the role of T-states which is that of a link of communion and love between Father and Son, in agreement with the interpretation of Saint Augustine[10]. The role of the T-states is also in perfect agreement with what it is said about the Third in Jo 14, 16 ; 14, 26, where it is designated under the double aspect of "Holy Spirit" (Holy Breath) and "the other Parakletos". The present considerations (which in fact could be much more developed) completely clarify the reason we used the expresion "immanent transcendence".

Let us close this study by underlying a crucial feature of the topological and symbolical representation of our Ternary Principium of Immanent Transcedence. As it can be seen from Figs. 1 and 2, the fundamental topological structure is represented by a shape (see the structure around point X in Fig. 1) which is topologically equivalent with an Y-structure. One can therefore understand why, among the various *trinitariograms* existing in literature, our Principium selects the one of Saint Augustine[11]. Somewhat surprisingly, the Y-structure appears as a basic structure in both religious or traditional thinking and in modern science. For example the Y-shape explicitely appears in alchemical iconography[12, 13] as the *mediator* of the union of masculine and feminine principles. In modern science, the Y-shape appears, first of all, in Peirce's theory of graphs and leads to his celebrated theorem concerning polyads[14]. It also appears in elementary particle physics, namely in the "Dual Topological Unitarization" approach[5] : the huge variety of existing hadrons cannot be described by strings if the Y-shape is not considered. Mesons are described as linear I-shapes, while baryons have to be described as Y-shapes , quarks and antiquarks being attached at the end of the respective strings.

Our Ternary Principium of Immanent Transcendence could be applied to a large variety of other problems : the logical foundation of theological discourse on the Incarnation, the regnition patterns and classification of heresies, and the iconographic representations of the mystery of the Trinity, both in Catholic and Orthodox approaches. However, such problems lie beyond the scope of the present study and cannot be discussed here.

Let us conclude by quoting the nice formulation of Bertrand de Margerie concerning the Trinity : "Unfathomable mystery does not contradict the rules of human logic at all"[15]. Trinitarian language must remain, by definition, for ever unachieved ; nevertheless, its progressive clarification is possible. In fact, the entire history of the Christian dogma of the Trinity testifies to an enormous and fruitful conflict between excluded middle thinking and included middle thinking[16].

It is our hope that the present study represents a constructive contribution to the clarification of Trinitarian language, as well as to the dialogue between science and theology, a dialogue which is more necessary today than ever before.

REFERENCES

1. Basarab Nicolescu, "Une nouvelle approche scientifique, culturelle et spirituelle - La transdisciplinarité", *Passerelles,* n° 7, Thionville, France, 1993.

2. Basarab Nicolescu, "Levels of Complexity and Levels of Reality", in Proceedings of the Pontifical Academy of Sciences on *The Emergence of Complexity in Mathematics, Physics, Chemistry and Biology*, The Vatican, October 26-31, 1992 (in press).

3. Walter Thirring, "Do the Laws of Nature Evolve?", in Proceedings of the Study Week of the Pontificia Academia Scientiarum on *Understanding Reality : the Role of Culture and Science*, The Vatican (forthcoming).

4. Stéphane Lupasco, *Le principe d'antagonisme et la logique de l'énergie*, Paris, Hermann, 1951.

5. Basarab Nicolescu, *Nous, la particule et le monde*, Paris, Le Mail, Diffusion DILISCO, 1985.

6. Edmond Husserl, *Méditations cartésiennes*, Paris, Vrin, 1966, p. 87-91.

7. Denziger-Schönmetzer, *Enchiridion Symbolorum, definitionum et declarationum de rebus fidei et morum*, 1951.

8. Umberto Eco, *Les limites de l'interprétation*, Paris, Grasset, 1992, p. 55-61, 370.

9. Bertrand de Margerie, *La Trinité Chrétienne dans l'histoire*, Paris, Beauchesne, 1975, p. 143.

10. Ibid., p. 49.

11. Ibid., p. 227.

12. E.-C. Flamand, *Erotique de l'alchimie*, Paris, Belfond, 1970.

13. José Lima de Freitas, *515 - Le lieu du miroir*, Paris, Albin Michel, 1993; also, private communication, February 1994.

14. D.D. Roberts, *The Existential Graphs of Charles S. Peirce*, Chicago, Mouton, 1973, p. 115.

15. Bertrand de Margerie, *La Trinité Chrétienne dans l'histoire*, op. cit., p. 204.

16. Bernard Sesboüé and Bernard Meunier, *Dieu peut-il avoir un fils? - Le débat trinitaire du IVe siècle*, Paris, CERF, 1993.
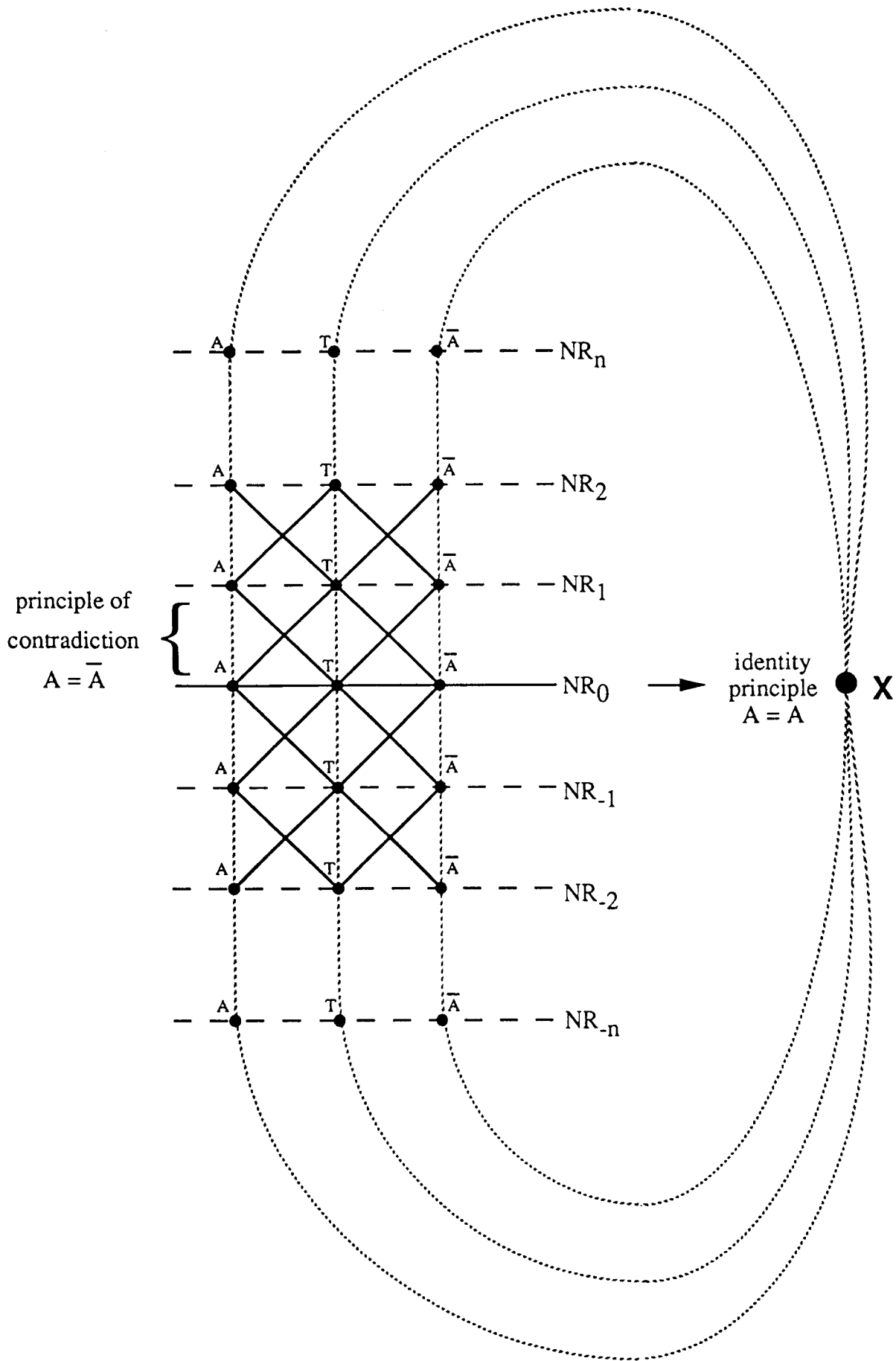
Fig. 1. Schematic representation of the Ternary
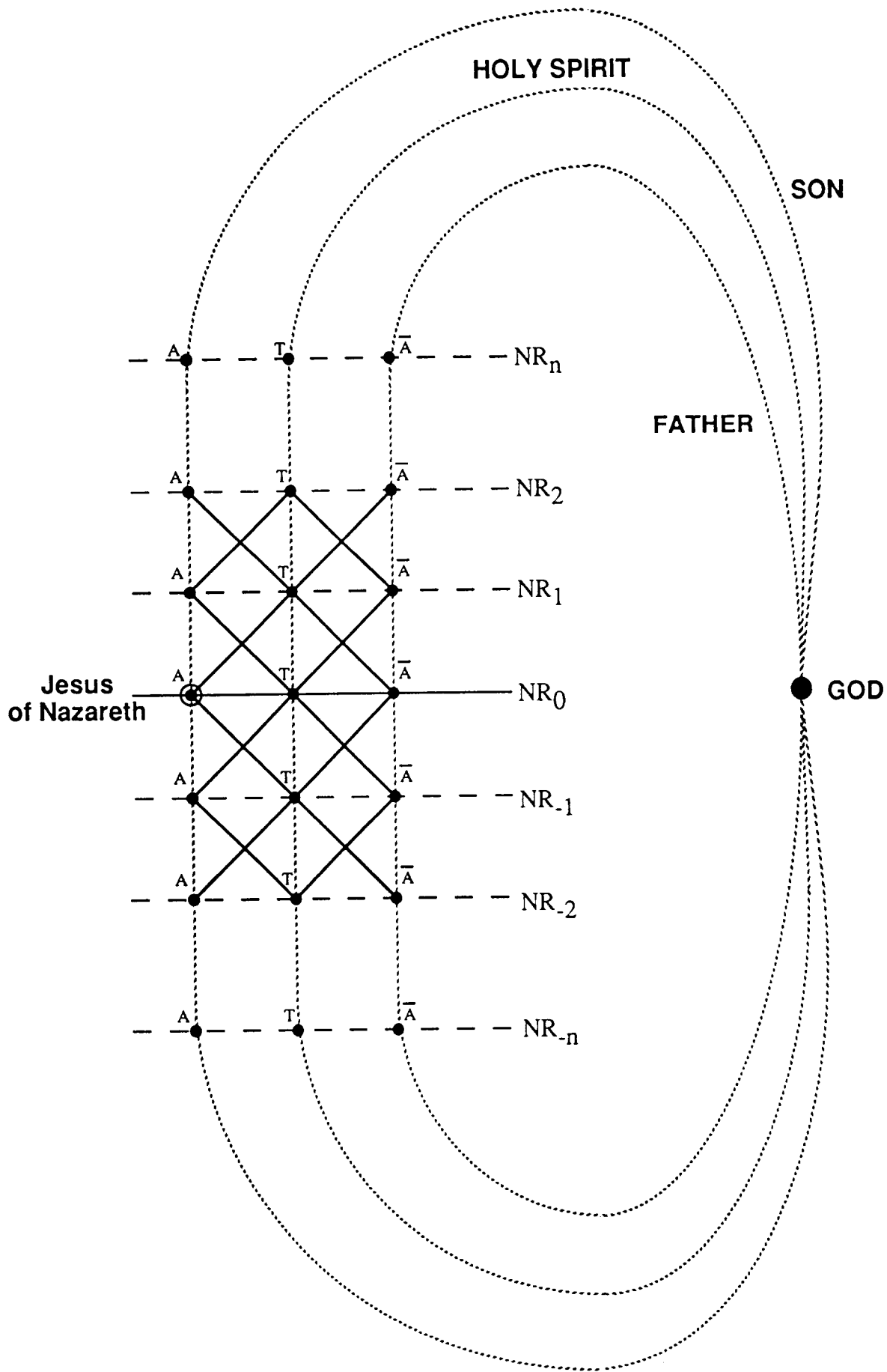Principium of Immanent Transcendence

Fig. 2. Graphic representation of the dogma of the Trinity in terms of the Ternary Principium of Immanent Transcendence