

*Cantower XXX***The Conservation of Energy**September 1st 2004**30.1 Contexts**

Gradually there is emerging more acutely the question that becomes explicit in *Cantower XXXVI*: what is the function of these *Cantowers*? While It is to be tackled explicitly later - and indeed this Cantower concludes to a fuller version of it - we need to putter with it at this stage, and the word *putter* is itself a clue to a broad answer. The word *putter* (the British might say *potter*) refers to a casualness about, a dawdling with, something. We are, then, not being formal or organized. In a word, another word, we are not being **hodic**. Within the third word of metaphysics, W3, we are rambling transculturally around C₉, outside the matrix of functional specialization. This you can locate in that diagram, nodding your head: you see what I mean. In so far as you are with me, coming along with me, in our struggle, you also see that you don't see what I mean. We are map-reading: think of a mountain-climber describing a particularly difficult hanger or face to a novice climber. Now, you may well be way beyond the novice state. But we get a first simple light about our puttering: I seem to be directing my chat mainly at novices, novice readers of *Insight*, but also novice teachers.

Still, the chat is serious. I do not think that I am writing about the standard teaching of the book in the present generation. So, there is a sense - which we will tackle head on in *Cantower XXXVI* - in which I am writing to later generations. The writing is a steady advertence to a general theme of mine: that there was no context of texts for *Insight* as there was for Joos' *Theoretical Physics*.¹ That context of texts will emerge out of emergent probability and it is my scheming hope that these essays will lift, Space-Time wise, the statistics of emergence, and, vortex- wise, the range of survival-probabilities.

As the last paragraph perhaps shows you, this is not quite *haute vulgarization*.

¹Georg Joos (with the collaboration of Ira M. Freeman), *Theoretical Physics*, Blackie and Son, London, 1951.

My deliberate abundance of footnotes leads you round the text of *Insight* and into the text of *Method in Theology*. So: another step in What these essays are about: giving at least a modest lift to the reading of *Insight* by anyone, now or later, perhaps much later. Footprints and footnotes in the sands. And the *anyone* gives a clue to the transient nature of the *Cantowers*: they are to be replaced by a variety of efforts both within specialties and within local cultures.

The present topic certainly brings out the problem of context acutely: I am dealing with the two chapter fours, both introductory in different ways to the problem of *energy, energy, energia*. Feynman's effort is in the main on a most elementary level; Lonergan's effort is profound yet in ways deceptively simple in its reading-demands. Furthermore, as we shall see, there is the problem of his moving viewpoint, a viewpoint that is meshed tightly with the meaning of energy in a world view of emergent probability that reaches from *The First Three Minutes*² to *The Last Three Minutes*.³ And then there is my effort here, to lift the reading of both texts by an anonymous **you**. To lift How high, and How?

Recall our struggle with Archimedes, with his first supposition. Archimedes undoubtedly struggled a great deal with the varieties of waters in Sicily before he came up with that terrible supposition with which he began his treatise of Floating Bodies. Now - be shocked! - I have been struggling with the notion of energy for just over fifty years this year, and in particular with Lonergan's treatment of energy for forty five years. I was immediately impressed with his few pages back in my first reading of them, 1957-8. I puttered - that word again: it really is the only way to prepare for insight - about the topic at various stages in my career, but moved more into focus in these past two years and a little over a month ago: Sunday August 5th 2003 to be precise (should I

²Steven Weinberg, *The First Three Minutes. A Modern View of the Origin of the Universe*, New York, Basic Books, 1988.

³Paul Davies, *The Last Three Minutes*, London, Phoenix Paperbacks, 2000.

admit that it was during my wife's sermon? Which I listen to twice every Sunday, so am I not allowed distractions?). At all events, I too came up with my supposition: should I type it in here and claim that *somehow* I had told you? Under the word *somehow* which I would have you associate with Hegel's insight about which Lonergan writes.⁴

The entire human group reaches for that gift to being, the being of this and that understanding this and that of being. Joyce has his mindgrip on the "hole story" of *Finnegans Wake*, but this woman or that man has a mindgrip on this love or that, or even a favorite cat or hat. And the cat, or the 'hole story', reaches for that cherishing of inner word. But the whole cherishing is beyond each little me: so we live by belief, by analogies, and above all by techniques. Shared words, bundled together in complexities of reference, allows us to carry on leaning on the understanding of strangers. And the third stage of meaning is to make that leaning luminous, so that nominal identification will be recognized just as such, and the analogies with one's own favorite hat can help towards cherishing the strangers's cherishing.

So, I would like to think that I have finally begun to cherish *energy*, energy, *energia*, on an analogy with Proust's cherishing remembering-tea-taste. When you work through Proust's six volumes have you shared that cherishing?

⁴I have quoted Lonergan reflection more than once, but since it is unavailable outside the Toronto archives it bears repetition here. "As the labor of introspection proceeds, one stumbles upon Hegel's insight that the full objectification of the human spirit is the history of the human race. It is the sum of the products of common sense and common nonsense, of the sciences and the philosophies, of moralities and religions, of social orders and cultural achievements, that there is mediated, set before us as the mirror in which we can behold, the originating principle of human aspiration and human attainment and failure. Still, if that vast panorama is to be explored methodically, there is the prior need for method". (I quote here from p. 14 of a Lonergan archival file labeled A697. It contains a typescript numbered pp. 8-23. Very plausibly it is a continuation of a first chapter of *Method* found in file V.7. (The file is reproduced in O'Leary, *Lonergan's Practical View of History*, Axial Press, Halifax, 2004). That file, as well as containing the first sketch of functional specialization, contains a full sketch of a chapter one of *Method* as well as a nine-page typescript that is the beginning of that chapter.

And the context lurking in that last paragraph is the single context that I wish you to muse over as you move through this paragraph. And you must asque yourself - we shall deal with that odd word in the fourth section - whether you have an analogue for my old troublesome mate of fifty years, yielding up to me, in this 72nd year, glimpses of her contrariness?

*“O winged lady,
 Like a bird
 You scavenge the land
 Your feet are continually restless”.*⁵

I quote from a poem which I first used in reference to the third person of the Christian trinity,⁶ quite foreign to the minding of that strange princess, quite foreign to the present association of it with energy in its various guises. Or is it? Let us putter, see, seize, be seized. My next section turns you back to Feynman’s view, to his elementary hints to a first-year university class in physics. Then section 3 will move the Lonergan’s invitation to a climb towards a worldview, classically expressed to an anonymous you. In the final section I carry forward, within those two added contexts, my effort to reach and to share what I might dare to call an **Annotaste of Throat**.⁷

My daring there, with its poetic license, invites you to ruminate over “the whole range of proportionate being”, and the transcendent coring of that being. We are concluding the seventh of the ten gestation *Cantowers*, the fourth of our reflections on introducing these early chapters of *Insight*. But this particular fourth chapter happens to

⁵Extract from *The Hymn to Inanna* by Enheduanna (daughter of the Sumerian King, Sargon, about 2300 B.C), quoted on p. 5 of Jane Hirshfield, ed., *Women in Praise of the Sacred: 43 Centuries of Spiritual Poetry by Women* (New York: Harper Collins, 1994).

⁶The first section of my “Our Journaling Lonelinesses: a Response”, in the Festschrift volume 3 (2003) of *Journal of Macrodynamical Analysis*, (<http://www.mun.ca/jmda/>) was titled **Spirant**, and began with this poem.

⁷I am recall the conclusion of ths short poem that begins and ends *Cantower II*.

invite the reaching for a worldview, an invitation coincident with the invitation of the entire present project. So, at the quartermark of my *Cantowers* - especially since I may not make it all the way! - a reach in fantasy for a heuristic glimpse of energy's call would not be out of place.

30.2 Feynman: 'What is energy?'

But let us begin with Feynman's elementary introduction. We are immediately in double difficulty: with Feynman's confusions, with the confusions of your students, or perhaps with your own confusions. Feynman's confusions we have already mused over, especially in the previous essay, but we will view them now from another helpful angle. Your confusions, student confusions? A later culture of education will perhaps do better in eliminating the confusion generated by *haute vulgarization* or by no education at all in the area. The confusion, in either case, pivots on the failure to incarnate the distinctions introduced by Lonergan in section 2.3 of the second chapter of *Insight*, when he reflects on 'nature'. It probably shocks you to find me claiming that Feynman fails here, in spite of his brilliance: such is the massive hold of a culture of truncation. He poses the question, What is energy? Is he in control of the question and his own meaning of it? To answer that is-question one must take the data as it comes, sentence by sentence: a task for the functional specialty interpretation, which is a proximate topic, a task for you and, perhaps your class.

Ponder, then, his second sentence: "To illustrate the ideas and the kind of reasoning that might be used in theoretical physics, we shall now examine one of the most basic laws of physics, on conservation of energy."⁸ Just what is he talking about here? Perhaps you are not sufficiently unconfused to diagnose precisely his confusions?

⁸The first paragraph of Feynman I, 4-1. The second paragraph offers further obscurities and methodological muddles, grist for your mill. I hope the sentence, ending with the word *energy*, brings to mind the same sentence challenge (at note XX) in the previous *Cantower*. What is said here of Feynman applies also to Greiner.

Might I leave the sentence with you, like a fresh problem of a principle of displacement, where Feynman is the displaced person?⁹

A main problem right through here is the problem of a missing theoretic horizon in the reader devoid of the experience of struggling for a serious scientific definition: and I would claim that this void is not filled by lengthy investigations in literary and historical studies, not a comfortable claim for the first two generations of *Insight's* readers. Again, we run into that problem, For Whom am I writing? But I would hope that Feynman's presentation - when you slip passed or correct the methodological comments - is at least a pedagogical lift towards the complex world of Lindsay and Margenau and Lonergan. So, at the end of his first light-weight section on conserved quantities, he makes mention of the different forms of energy, a lead into the rest of his lecture. And he concludes that section 4.1 with a paragraph worth pausing over in anticipation of what Lonergan has to say:

"It is important to realize that in physics today, we have no knowledge of what energy *is*. (His italics: what does he mean by this emphasis?) We do not have a picture that energy comes in little blobs of a definite amount. It is not that way. However, there are formulas for calculating some numerical quantity, and when we add it all together it gives always the same number. It is an abstract thing in that it does not tell us the mechanism or the *reasons* (again italics his; same question for you) for the various formulas."

Before we pause over this paragraph, I would like to skip forward to his conclusion to the lecture - the in-between stuff will occupy us shortly. On that

⁹Although functional interpretation is a topic that has to be tackled later I would suggest that small-scale interpretation-experiments are a way to begin. We shall see that the functional orientation demands a sentence-by-sentence control of meaning. No harm, then in beginning with a sentence or three about a sentence. And heavy questions occur immediately: for instance, is part of Feynman's meaning in this sentence the warped meaning of his subjectivity and is it a meaning that a GEMb mode of hodic interpretation would reach for and express?

concluding page he takes up the question of “available energy”¹⁰ and points forward : “the laws which govern how much energy is available are called the *laws of thermodynamics* and involve a concept called entropy for irreversible thermodynamic processes”. Then he comments on our sources of energy and on nature’s liberality. “She liberates a lot of energy from the sun, but only one part in two billion falls on the earth”.¹¹

This conclusion throws us back into the context of chapter four of *Insight*’s reach for a worldview, a context which of course, *as* metaphysicians, we never left. We are struggling always with coming to grips with the doctrinal pointing of chapter 4 of *Insight* to the large numbers and long intervals of time and slight probabilities, “given sufficient numbers and sufficient time, even slight probabilities become assured.”¹² That struggle, and that coming to grips, would push us towards reflections on entropy

¹⁰Feynman I, 4–8.

¹¹*Ibid.*, I do not wish to distract us here from the main drive, but his conclusion gives further food for thought about future energy (whatever that is!), when he writes of the energy of 150 gallons of running water a minute as a source of enough energy for a U.S.A. day. Let us recall, too, Feynman’s interest in nano-technologies and think of the surge in that filed in the past few decades. (Carver Mead notes, “Back in 1959, Feynman gave a lecture entitled ‘There’s plenty of Room and the Bottom’ and goes on to talk of that surge, *Collective Electrodynamics. Quantum Foundations of Electromagnetism*, MIT Press, 2000, xv). This is the stuff of foundational fantasy in the spirit of Lonergan’s reflections of 1942. “Nor is it impossible that further developments in science should make small units self-sufficient on an ultra-modern standard of living to eliminate commerce and industry, to transform agriculture into a superchemistry, to clear away finance and even money, to make economic solidarity a memory, and power over nature the only difference between high civilization and primitive gardening” (Lonergan, *For A New Political Economy*, 20. What are involved are new levels of infolding of quantified energy residues or reserves. For a semi-popular survey see the special issue of *Scientific American*, September 2001, on various aspects of “Nanotech”.

¹²*Insight*, 127[150]. There are changes from the first to the second edition of *Insight* that relate to problems of convergence. See Chapter 8 of P. McShane, *Randomness, Statistics and Emergence* (Gill, Macmillan and Notre Dame, 1972).

that are beyond Lonergan's introductory invitation in this chapter, and beyond Feynman's introductory effort. But the teacher of *Insight*, the foundational person, the user of a foundational perspective that is contemporarily adequate, must, will, be increasingly be embarrassed into that struggle.¹³ In these elementary rambles in the early part of *Insight* we - or might I say, you?! - are not ready to plunge into the topic called *entropy*.

So, the problem surfaces again: what are we ready for, in this culture?

This seems an appropriate time to ponder a little about Feynman. Above I quote his remark about not knowing what energy is. It is a remark typical of his honesty, and he has such remarks regarding other areas of contemporary physics throughout his works. I have drawn attention to the cultural realization in him of truncatedness, but this does not take away from his relative clear-headedness regarding the object; rather, it shows the difficulty of breaking forward from the bone-established culture. But his honesty helps to bring out the need for what I call GEMb. The need, however, reaches down into the culture of school education. I do not wish to get into the discussion about the success or failure of Feynman's "three volume" effort, but I would claim that the students were not prepared for the stuff, even when he watered down the hard work.¹⁴

In the present instance of his remarks, however, one can sense a subtlety in his detecting honesty that points to a large cyclic challenge. "What is energy" is his question, and his answer is "we do not know". The hodic answer is a cyclic sifting of our thinking about the umber and penumbra of usages fringing "energy" in any

¹³This is a matter of the hodic cycling and re-cycling that is to emerge in this millennium. The word *embarrassed* above may recall for you one of my favorite metadoctrines: "Doctrines that are embarrassing will not be mentioned in polite company" (*Method in Theology*, 299).

¹⁴Carver Mead, in the work cited in note 11, talks in the Preface about Feynman's struggle and his exhaustion and his simplifications. We return to the question of Feynman's simplifications and popularizations in *Cantower LIV*.

language or culture. What, then, am I doing here? I am soaking up Lonergan's foundational achievement, hoping to introduce, fantasizing about introducing, a twist in the treacle of present conventions.

Back then to that paragraph from Feynman and its context. You note that I do not attempt even a description of the context given by his following sections, where forms of energy are considered in a cunningly pedagogical way. One would have to approach them as I did the principle of displacement in *Cantower XXVI*, or as I shall tackle the problem of measurement in *Cantower XXXI*. I made the point earlier that you can manage to work with me here without the text of Feynman. Plunging into the problems of this lecture's sections 2-4 would conflict with that claim. But I have also made the point that if one is serious about teaching these five chapters of *Insight*, then one needs Feynman's three volumes or their equivalent. The serious student, then, will find these volumes and face the serious reading that must be skipped here.

So, we have the limited context of the few remarks surrounding the paragraph. Let us putter around a bit in what I think is an enlightening way, a way towards reading Lonergan's dense prose on the subject.

What do **you** think of energy? Well, it's a sort of dynamic possibility? One that can be measured, strictly or vaguely. Have you the energy to continue this puzzling? Is there an energy crisis in your country? The question of "enough" comes up quite spontaneously. And the question of.... harnessing? "Save your energy", "Focus your energy",

But what, then, about unharnessed energy? Unharnessed energy is really not a dynamic possibility. Perhaps it is the harness that makes the dynamics 'really' possible? or really effectively directed? Ineffective directedness, what might that be? But, come to think of it, not really directed at all. So.... ineffective dispersedness? So, we might think of 'giving' the dispersedness a measure of directedness, of the dispersedness having a measure of directedness?

But what do we mean by measure? Feynman mentions "formulas for calculating

some numerical quantity". Quantity? Definite quantity? If you have read the beginning of chapter 16 of *Insight* you will know that we are in deep trouble here. So best call a halt, for the moment, to our puttering. But you can see, I hope, some method in the madness? Perhaps even link this puttering to the puttering necessary to come to grips with the ABC problem as it occurs in different places and different contexts in *Insight* and elsewhere?¹⁵ Pure dispersedness has, somehow, no identity of itself. When it "occurs" - whatever that might mean - it occurs in "identifiable"¹⁶ ... doses? But again, we seem to be back, or forward, at the problem of primary and secondary determinations in relations.

And Feynman's concluding comments in this lecture about the availability of energy haunts our reflections on harnessing: a sort of one-way street idea that rolls us into inventing extended 'energy words' like energy-turning, *en-trope*. A curious word and word usage. Perhaps we are drifting in our word-invention to miss the point. Real energy turning might be.... negen-tropy? Turning something negative-about-energy into....? Does it remind you of our struggle with hydrogen, or larger atoms? All that dispersiveness being turned, rounded up. Up? Are we edging towards a better glimpse of emergence? Even indeed of early emergence in those famous three minutes?¹⁷ Instead of cosmic energy "going nowhere fast" there is turning for the better?

30.3 Lonergan: "One may ask ... [about] ... energy"¹⁸

From what has been said in the previous section it should be evident that in the

¹⁵The different references to published and unpublished work are given, in a relevant context, in chapter five of *A Brief History of Tongue. From Big Bang to Coloured Wholes*, p.151, at note 43.

¹⁶Notice all the tricky aspects of "identifiability" : back to the canons of chapter three, especially the canon of parsimony. Are, for instance, quark energies identifiable?

¹⁷See notes 2 and 3 above.

¹⁸*Insight*, 443[468].

new pragmatism the one should become the many. Here I pursue a footnoting strategy that may turn the serious **one** into a serious **we**. Perhaps I am too gloom about the present bent in askance? I would like to find that I am wrong about the searching pointed to in this section and in its footnoting, a footnoting which is a step-stumbling noting on a long Parmenidian road. The step-stumbling does not seem to find a welcoming home either in the present Ken tradition or in the Zen tradition, and here more than ever in these *Cantowers* I feel the need to write of a THEN tradition.¹⁹

The notes are to a climb, doctrinal statements that are non-luminously so to the present Western culture. At least in the Zen culture there is what I might call a doctrinal ethos of minding. Further, what I am asking for in the West has its analogues there: there is physics; there Proust; there is piano playing. My asking is insufficient, inefficient: does it lack, then metaphysical beauty? Still, there is the small-seed beauty of a cry for a Proust-length book on energy.

I re-read section 4 of *Cantower XXIX* before I began this section and was freshly stunned by its inadequacy: the problem, again, of Proust-length book, or of a massive shift in ethos regarding aggreformism. In that section there is a quotation for which I footnoted in a manner that occurs only three times in these *Cantowers* : in that section, in this section, and in section 4 of *CantowerXXXIII*. In the first the text footnoted is from *The New Chemistry*; in this section we are nearer the bone, with a text from Lonergan; in the third I cut closer in footnoting a text of my own of twenty years ago, footnoting in a way that show me alien from a previous self. Am I writing now to somebody who has that ethos, that askance to become a stranger to yesterday's self? Are you one that may ask about (about about) energy in a way that is a tadpole of what I have in old-frog mind?

The title of this section abbreviates Lonergan's longer statement, "One may ask

¹⁹I am recalling *Cantower V*, "Metaphysics THEN". Involved is a deep issue of shift from Zen and Ken orientations to a luminous reach for both ontogenetic and phylogenetic growth in meaning. More on the challenge in *Cantowers XXXIX - XLI*.

whether, in the light of contemporary science, prime potency has anything to do with energy". And if you are asking about about about, you will sense the reach of ancient searchers like Parmenides and Aristotle: all is not flow or floating form, but what grounds that negative stand? But I am now passing prematurely prohibitedly, prohibitively, into my next footnotes. Let me rather swing from this introductory chording to the simple deceptive melody of the text.

"Potency is a tension of opposites.... it is the ground²⁰ of universal limitations it is the ground of the finality²¹ that carries proportionate being ever beyond actual limitations. However, this does not mean that potency is a contradictory notion, for contradiction arises only when mutually exclusive predicates are attributed to the same

²⁰The ground? The lower ground, in my terms. In a strange Epilogue to *The Shaping of the Foundations* I wrote of the upper ground of loneliness and the lower ground of loneliness, the latter echoing the reach of Aristotle for "the first thing that is not seed but the complete being" (*Metaphysics XII,1703^a1*). What is important to discover, uncover, here, is one's own molecular groaning for light, humbly reaching for light as the cosmos offers it, the light in the light of contemporary science.

²¹I write of the finality that one comes so slowly to feel in the lean-to cosmos, a background radiation of 4° K initiated in a non-beginning and rooming the ongoing symphony - for there is the real relation of final causality, a *cuius gratia*, twined in the reality of universal instrumentality. One makes a beginning on this by intussuscepting "Mission and Spirit" (Lonergan, *A Third Collection*) in its content and in the lonely practice of its recommended Aristotelian *Tao*-excellence. But key pointings are in *Collection*: "Finality Love Marriage", "On God and Secondary Causes". And you must battle with the glory of real relations: *De Deo Trino, Pars Systematica*, Appendix III. In all this you are being asked (*ibid*, quaestio xxxvi) by being to "come about" to the view that predicamental relating invites a blocking of the "come about" of the transition to methodological seriousness. I am thinking here, of course, of the text I refer to regularly here: "So it comes about that the extroverted subject..." (*Insight*, 514[537]). The extroverted subject comes about to a core poise of enlightenment. It is not easy, at least in this beginning of the twenty first century, to be "pulled neatly and efficiently out of the compromising orbit of Aristotle's physics" (*Insight*, 523[547]) out of the muddles of contemporary physics, out of the arrogance of contemporary philosophy, out of the laziness of the present theological imagination. But there is the non-metaphorical pull of finality and the efficiency of a hodic turn.

object under the same aspect. I potency there are at least the two aspects of its proper contribution to the constitution of proportionate being and, on the other, hand, its relation to the other contributions of form and act. The proper contribution of potency is limitation. But the relation of potency to the other contributions is general and indeterminate, yet dynamic and directed towards such contributions. It is the indeterminacy of that directed dynamism that makes potency the principle of the tendency to transcend limitations."²²

"Each higher genus is limited by the preceding lower genus. On the one hand, it must not interfere with the autonomy of the lower order, for if it were to do so, it would destroy its own foundations. On the other hand, the higher genus is a higher systematization of manifolds that would be coincidental on the lower level; and the higher systematization is limited by the manifolds which it systematizes."²³

Since each higher genus is limited by the preceding lower genus, it follows²⁴ that

²²*Insight*, 451[476]. You have noticed my strategy here of bringing in the finality aspect first, twisting the perspective offered by Lonergan in the two relevant sections. But the twist is seriously effective only if you maintain, or cultivate as much as possible, the context offered in the previous *Cantower*. So, you need to appeal to your enriched imagination and comprehension of the indeterminate dynamism e.g. of free electrons in relation to the limitations transcended by hydrogen's **harnessing**, of radiation **captured** by plants.

²³The appeal of the previous note continues: otherwise we too easily slide back into the zone of very empty doctrinal claims. But note that we are back now in the previous section of *Insight's* pointers regarding the conceiving contemporarily of a grounding potency in our particular finitude. The paragraph moves all the previous pointers of *Insight* and the context of answers and questions that it may have given rise to in an adequately-cultured consciousness into a deeper search for the meaning of being within this finitude. One should not lose sight, then, of the higher systematization that is the self, reading and breathing, limited by the coincidental - genetic, genital, geographic, galactic - in being a humble space-time genetic system tunneling towards integration in a cosmic whole.

²⁴Again, there is the existential challenge hidden here in the **it** that does or does not follow, the subject in the field that is self of the previous note's ending, but now the

the lower genus provides a principle of limitation for the whole domain of proportionate being.

Moreover, this universal principle of limitation resides in the potency of the lowest genus. For act corresponds to judgment, form to insight, and potency to experience of the empirical residue. But the yes of judgment is restricted to the formulation it affirms; and this formulation results from an insight that is restricted to the pattern of the data to be understood.²⁵ Accordingly, as judgment is limited by insight, and insight by data, so act is limited by form, and form is limited by potency.

It will be convenient to introduce the name 'prime potency' to denote the potency of the lowest level that provides the principle of limitation for the whole range

field (see *Phenomenology and Logic*, the index under *Field* and the comments on that notion at the end of the Introduction to the index) is calling the European existentialist out of a comfortable isolation - represented comfortingly by *Phenomenology and Logic's* division of two weeks - into the cosmos' development of logic and physics. What is this provider, the lower genus? That is a key axial question for the human group in its axial illusions and disillusiones and hastes. Is the deepest provision of energy, even at the nano-level, a limitation that is a twist towards a harnessing that is a capture of human nerves by Aristotle's more excellent way?

²⁵So, we continue the reach of the notes, adverting in particular to the patterning of data that is complexification of languages in a fermenting towards - do not the paradoxes of Russell and Goedel invite? - self-reference (see *Method in Theology*, 88, n.34). That reach would carry the existential thinker forward to the possibilities of layered patternings of "The Empirical Residence" that concern us tentatively in the next Cantower, programatically in section 4 of *Cantower XXXIII*, more concretely in *Cantowers LXVI-LXXXI*. The issue should not surprise the serious empirical resident. "Formal comprehension [of everything in a unified whole] cannot take place without a construct of some sort. In this life we are able to understand something only by turning to phantasm; but in larger and more complex questions it is impossible to have a suitable phantasm unless the imagination is aided by some sort of diagram" (Lonergan, *The Ontological and Psychological Constitution of Christ*, University of Toronto Press, 2002, 151). The fundamental issue in Galilee is a radical shift in the harnessing of energy. A theology adequate to our times cannot be satisfied with an already-out-there-now Jesus comfortable described in a cave. We shall return to this topic in *Cantowers XXXV*, *XXXVIII*, and *XXXIX*., but more thoroughly in the final eschatological *Cantowers*.

of proportionate being.²⁶

Certain characteristics of prime potency are already familiar. For potency is what is to be known by intellectually patterned experience of the empirical residue.²⁷

²⁶“Prime potency’ certainly is a convenient name, rolling forward from Aristotle. But does it, or ‘empirical residue’, have anything to say, e.g., to contemporary scientists? The problem, no doubt, is one for the missing functional specialty Communications, but is there a suggestive stop-gap? Shortly in the notes we will find characteristics of what Lonergan names “the empirical residue”, many of which are associated with contemporary problems regarding the radiation dynamics of space and time. So, there is something to be said for the Aristotelian name, *dunamis*. A passage from Edmund Whittaker is worth recalling. “A typical example of the Aristotelian natural philosophy is its interpretation of light in terms of the metaphysical notions of *potency* (*dunamis*) and act (*energeia* or *entelechia*) light was defined by Aristotle as ‘the act of a transparent body, inasmuch as it is transparent’” (*A History of Theories of Aether and Electricity*, Harper Torchbooks, 1951, vol. I, 2). Might we focus on ‘transparent body inasmuch as it is transparent’ to arrive at a better personal grip on the meaning of prime potency, at a reversal of Aristotle’s terminology, and at a perspective on prime potency that would resonate with contemporary science? There is a transparency of prime potency, a possibility of parenting reality that is transcendent. The parenting is both dispositional and instrumental, instrumental in its actuality: it becomes then the *vis viva* of Huygens or the enlivened aether or the surging of the Big Bang: a primitive energy that is never without character, but that in its primitive identity is close to merely light, but the light of elementary things. What things? We must leave that question to the Chromodynamics of the early cosmos.

²⁷The long climb pointed to in note 33 must be carried forward into a patterned minding that cherishes the “to be known” as a distant goal, cherishing then the luminous darkness of the heuristic to such an extent as to give the lie to the previous sentence, forcing and cajoling one to admit into consciousness the fundamental unfamiliarity of I Cor. 13:12-13. The actual transparency of energy is the Word of Infinite Energeia, a goal of the ultimate energy-packet infoldings that are “us ordinary folk”.

The empirical residue consists in individuality,²⁸ the continuum,²⁹ particular place and time,³⁰ and the non-systematic divergence from theoretically grounded anticipations.³¹ Since all these features of the empirical residue are to be verified in the lowest genus of proportionate being, all are to be attributed to prime potency.

However, one may ask whether, in the light of contemporary science, prime

²⁸See *Insight*, the index under *Individuality*. Beyond the simple issues dealt with in *Insight* there is the deeper issue, a part of Lonergan's worldview, of "us ordinary folk" as someways indistinguishable one from another, yet also solitary creations, immortal diamonds, white-stone selected (Revelations 2:17), scarf-joined into integral eternal energy.

²⁹The continuum was a topic of permanent curiosity for Lonergan, from his Blandyke essay, "Infinite Multitude" to his puzzling fifty years later about the meaning of Goedel's results. There are significant developments in mathematics and logic requiring attention here that at first sight might seem unrelated to problems of the spacetime continuum. I refer not only to various new geometries that tend to catch the popular imagination, but to more fundamental work on the continuum hypothesis and on the various paradoxes on physics, mathematics and logic that relate in different ways to the possibilities intrinsic to the empirical residue.

³⁰*Insight*, 26[51]. Again, the deeper issues should be sensed here e.g. the issue of a real geometry that would sublimate and integrate such different searchings as Schrodinger's reach for *Space-Time Structure* (Cambridge University Press, 1950) with the gropings of Erasmus and Hopkins for an intimate haecceitas. "There are innumerable niceties concerning notions, relations, instants, formalities, quiddities and haecceities, which no one can pry into, unless he has eyes that can penetrate the thickest darkness, and there can see things that have no existence whatever" (Erasmus, *Moriae Encomium*, 1509).

³¹The massive problem twines with the challenge of the previous footnote. One must begin by reaching for a subtle contemporary view of the non-systematic and of chance: my *Randomness, Statistics and Emergence* (Gill Macmillan and Notre Dame, 1970) and Ken Melchin, *History, Ethic and Emergent Probability* (University Press of America, 1987) may be helpful here. But the dynamics of aggregates must be reconceived heuristically in terms of the new view of energy.

potency has anything to do with energy.³² In a general fashion one may argue that, since energy may be latent or potential, it is not act.³³ Since it is relevant to mechanics, thermodynamics, electromagnetics, chemistry, and biology, it is not form.³⁴ Finally, since *it functions as a universal principle of limitation*, it must be grounded in³⁵ prime potency.

An investigation of the notion of energy lies outside the scope of the present inquiry, but it may not be amiss to put a few leading questions. In the first place, the notion of energy is reached,³⁶ not by differentiating, but by integrating. It is not

³²You notice that the drive of the notes and the introductory text is towards a perspective that makes this asking somewhat rhetorical.

³³See LM, 120-28.

³⁴We shall pick up on this topic in *Cantower XLVI*, "Energy and Entropy".

³⁵Grounded in? What might, does, Lonergan mean by that? At the end of note 47 I talk about a "core problem". It is a problem you may pick up on in chapter 16 of *Insight*. But it is as well to sense the context of that problem that you may be trapped in: the context of fuzziness regarding real relations. That context is best communicated by Lonergan in Appendix III to *De Deo Trino: Pars Systematica*, which may well be available to you in English by the time you read this. The fuzziness in question is the fuzziness of being stuck, at any stage of a scientific venture, in a muddled zone between predicamental (or descriptive) relations and explanatory relations. This appendix, with its companion section 2 of *Insight* chapter 16, held me up for months in the Autumn of 1960. I see no way round some such struggle, which shifts vastly one's view of the cosmos. The issue is the simple one, What are you asking about when you ask about quantity? One of my exercises of 1960: take a pencil of a certain length. It is equal to a sub-group of what would be acceptable under some definition of pencil. Now shorten it. What happens to the relation of equality? What you think happens depends on your view of the relation of equality. If it is something other than the reality of the pencils, then you have quite a fuzzy shuffle in the total world of pencils! So: what does "grounded in" mean? The trouble surfaces with the question, What do you mean by quantity of energy? Notice now that the trouble surfaces in different ways in the three questions that end the next three paragraphs of *Insight*.

³⁶I find it convenient here to follow the first edition of *Insight*, in which Lonergan does not footnote but adds bracketed references to Lindsay and Margenau.

surprising when differentiating, which is an abstractive procedure, yields notions of broad generality.³⁷ But energy is a notion of extreme generality yet it is reached by integrating.³⁸ Might one not say that the quantity of energy is the concrete prime

Loneragan's focus here is on the reach of their *Foundations of Physics*. A broader investigation should eventually carry the community into a range of sciences and technologies, some of which I shall touch on later. Two books that I recommend regularly in this context as Cornelius Lanczos, , and . I presume that it has dawned on the reader that this is heavy work, even for someone with qualifications in theoretical physics. But perhaps it has dawned on some reader that there is a very handy doctorate thesis here: let me know!

³⁷I remarked in the previous note that Lonergan's context here is *Foundations of Physics*, and that it is heavy work. He clearly put in a lot of hours on it, as indeed I have in the past forty years. It still remains a powerful introduction to foundational problems, even the very heavy chapter five on thermodynamics, Gibbs, etc. There I would recommend adding the context of Ian Lawrie, *A Unified Grand Tour of Theoretical Physics*, IOP Publishing, 1990, chapter 10, "Equilibrium Statistical Mechanics". There is little evidence that Lonergan battled through LM chapter 5: it would have been very tough solitary work and I suspect that it would have pushed him to write more about entropy (see *Cantower XLVI* : "Energy and Entropy").

On the present topic I see no way of the serious reader avoiding chapter 1 of LM, where pp. 29-58 deal with "the Method of Elementary Abstraction", differentiation and integration. The treatment has to be lifted GEMb style, into a richer context. The road is paved with difficulties: my own experience of teaching and reading in various countries revealed to me that the two fundamental insights of calculus are not nourished by texts, in any language that I have checked, for any generation. Terrance Quinn has filled the gap in his classic "Fundamental Insights of the Calculus", *Journal of Macrodynamical Analysis* (1) 2001. But the gap leaves me quite handicapped in my pointings here. Lonergan is turning us here brutally into the world of GEMb, and it is certainly not my place to slide you into the abominations he describes on p.145 of *Topics in Education*. Questions regarding the nature of differentiation and integration throw one into a deep end of metaphysics. But a beginner-physicist can make a start by digesting how one moves, psychologically, from a second order differential equation "down" to the concrete, adding boundary conditions as one goes and arriving at a trajectory e.g. a definite parabola, under certain assumptions. Etc.

³⁸There is the cautionary context of the previous two footnotes. Section 3.11 is titled **The Concept of Energy**, but one needs the climb of all the previous pages. One can then get the problem of integration into focus: there are two integrals of interest

potency that is informed mechanically or thermally or electrically as the cases may be?³⁹

Again, there is the curious fact that the science of mechanics can be developed logically in terms of classical laws and without any mention of energy (Lindsay and Margenau, 120), yet once the notion of energy is introduced, one can develop Lagrange's method of generalized coordinates and Hamilton's canonical equations,

that relate to the motion: the time integral (see LM 98) and the space integral (see LM 122). It is the space integral that leads to the notion of energy, involving v^2 , where v is velocity. We are heading into the context specified by the following footnote, but it is best here to raise the broader question of what you might mean by 'velocity'. If you are a Thomist-Aristotelian then you have educated into the misleading notion of incomplete act, with no distinction made between velocity and acceleration. Here, then, you have to think out the suggestions made in the Lonergan fragment that I quoted in *Phenomenology and Logic*, p.13, n.13. Then you are on the road to grasping that "the mass-velocity will be a conjugate act; the mass, defined by its intelligible relations to other masses, will be a conjugate form; the space-time continuum of the trajectory will be the conjugate potency" (*Insight*, 437 [462-3]).

³⁹Best stick here to the mechanical, the elementary, aspect. So, we may follow up on the previous note. Follow up? I have been nudging you in these last Cantowers to take seriously the struggle for metaphysical equivalence: you may practice by taking any sentence and work your way through the words. The word 'the' of course is a famous mess: think of 'the morning star' and 'the evening star' of British philosophy. At all events, we ended the previous note with the word *velocity*. How does you head towards metaphysical equivalence? You are into very tricky self-discovery as physicist, and perhaps beyond your present talents. But the core of the problem lies in grappling with section 2, on relations, in *Insight* 16, and that, core reaching into wider zones, is a serious challenge to any metaphysician. With the precision gained on quantity, backed by the context reached through the intussusceptions pointed to in the previous note, one can begin to seriously ask about the relation between quantity of energy and prime potency. It is still the problem raised in note 43, but the question at the end of this paragraph moves the clues along. The grounding has to do with concrete relations, involving secondary determinations. An affirmation of a quantity of energy intends some such concretely determined entity (but in its full concrete relations with the cosmos); is the same concretely determined entity reached by speaking of an actually informed prime potency?

which constitute the most powerful technique in mechanics.⁴⁰ Is one to say that there is a mechanics based on the laws of motion and the conjugate forms which the laws define and that there is another equivalent but more powerful mechanics *based upon limitations set by prime potency* ?⁴¹

⁴⁰I see no short cut round the few years physics required to read this sentence. One may read LM on this, but it is no replacement for the slogging involved in handling the shift to generalized coordinates and Hamilton's equations. Even with the slogging one needs a lift of perspective such as is summarized by LM or enlarged on by Lanczos. A central key to this lift is coming to grips with The Principle of Least Action (LM 128 ff.), something dear to the heart of Feynman, and to whose treatment of the topic I point you immediately and enthusiastically: Feynman II, chapter 19, "The Principle of Least Action". I recall, too, my reflections on Husserl's work in this area, a road not taken by him as he moved from Weierstrass to Brentano (see *Lack in the Beingstalk*, chapter 4). But, even without that larger context, perhaps you might get a sense of the oddity of this Principle when I note that there is something about the trajectory taken that "fits in with" a peculiar balance of kinetic - KE - and potential - PE - energy along the actual path: subtract PE from KE at any point, then add the results along the path - the sum turns out to be less than for any other path. Pretty weird stuff: how does the moving reality 'know' it is 'heading best' without checking out distant possibilities?! We return to this topic in *Cantower LIV* when we tackle Feynman's popularization of the use of the Principle in Quantumelectrodynamics. At all events, this is a principle and the powerful technique that dominates contemporary physics.

⁴¹So we arrive at the third of the three questions to which I drew attention in note 43. We have been indulging in a doctrinal climb. Perhaps you have done more, taken a month or more per paragraph? I am reminded by a story about the famous David Hilbert, who, when asked why he did not tackle Fermat's Last Theorem, replied, "it would take me three years to do the preliminary work". There is a sense in which this energy business is one of Lonergan's intriguing last theorems. (Another neglected brilliance is his solution to the oldest problem in economics: but that is a higher complexification of the dynamics of energy!) But what of this powerful mechanics? We are in the trouble of the previous footnote, adding in aspects that seem as crazy as my pencil-changing-in-the-cosmos. We are, I suspect, in the strange world of Feynman's view of the Principle of Least Action, where his perspective moves us to consider the integral over all paths connecting end points of a trajectory. (See, for example, his two books, *Quantum Mechanics and Path Integrals*, (edited by A.R.Hibbs), McGraw-Hill, 1965 and *Feynman's Lectures on Gravitation*, (edited by Brian Hatfield), Addison-Wesley, 1995. The graviton, a key player here, cries out for the analysis of metaphysical equivalence.

Further, while the notion of a quantity of energy receives its basic formulation in mechanics, still it is not restricted to mechanics. Thermodynamics conceives heat as a form of energy, which it limits by a law of conservation and a law that settles the direction of its changes (Ibid., p. 214 ff.).⁴² M. Planck has worked out Maxwell's electromagnetic equations by beginning from the notion of energy (Ibid., p. 315 ff.).⁴³ The Hamiltonian function, which represents total energy, has provided basic clues in quantum mechanics (Ibid., pp. 405, 145).⁴⁴ There is the release and absorption of energy

⁴²I postpone reflection on this aspect of energy to *Cantower XLVI*: "Energy and Entropy".

⁴³The reference on that page of LM is to Max Planck, *Theory of electricity and Magnetism*, London, Macmillan, 1932, 20 ff. There is a compact summary of Planck's view on LM 316: no point in me squeezing it further. But it is worthwhile to note a whole range of shifts since in reflections on invariants and derivations. I note one intriguing present effort: Carver A. Mead, *Collective Electrodynamics. Quantum Foundations of Electromagnetism*, MIT Press, 2000. "...We found Newton's Law masquerading as one of Maxwell's equations. We were able to derive a number of important results using only the simplest properties of waves, the Einstein postulate relating frequency to energy, the de Broglie postulate relating momentum to wave vector, and the discrete charge of the electron. It thus appears possible to formulate a unified, conceptually correct introduction to both the quantum nature of matter and the fundamental laws of electromagnetic interaction without using either Maxwell's equations or standard quantum formalism" (*Ibid.*, 28-9).

⁴⁴The second reference to LM that Lonergan gives - p. 145 - throws you right into heavy considerations of the work of Lagrange and Hamilton. LM 405 is the early stage of discussion of quantum theory, and the place of the Hamiltonian is a familiar aspect of quantum mechanics. Indeed, we already had a taste of its significance in the previous *Cantower* when we struggled a little with Schrödinger's equation for the hydrogen atom's energy levels, a particular instance of what Lonergan met in LM 426 ff. Reflection on this on this issue can now be much richer, as the previous note indicates. A context for this area of inquiry is Cornelius Lanczos, *The Variational Principles of Mechanics*, University of Toronto Press, 1950.

in chemical change,⁴⁵ and there is the role of chlorophyll in capturing⁴⁶ the energy of radiation.⁴⁷ Do these facts refer to prime potency as a universal principle of limitation?

Again, there is an inertia of energy, and there is an equation relating mass and energy. Is one to relate the inertial coefficient of mass to the prime potency it informs, and to conceive mass itself as a conjugate form that is implicitly defined by the laws that relate masses to one another?⁴⁸

⁴⁵**Absorption:** a word to ponder. It ties in with all the problems hinted at in section 4 of the previous *Cantower*.

⁴⁶**Capturing :** another word to ponder. I introduced the topic of that capture in *Cantower II*: "Sunflowers Speak to Us of Growing", without a clear heuristic of it or of energy. In the Florida Conference paper of 1970, "Image and Emergence: Towards an Adequate *Weltanschauung*", I invented what for me was important terminology for a significant shift in my view of the receptivity of radiation by, say, hydrogen and by sunflowers: there are synnomic forms and there are autonomic forms. I recall a conversation of that Easter week in 1970 when Lonergan commented to me favorably about the paper. He remarked "It just opens up area after area". I suspect that he was generously 'over-reading'. It was another 30 years before I got the metaphysics of synnomic forms into proper connection with both capacity-for-performance and *potentia activa*, and 33 years before I figured out what was probably quite obvious to him about energy when he typed this passage at the age of 45. I would note, however, that there is nothing mysterious about my slowness. There was no serious metascientific culture to support my plodding effort to follow his genius way. In this century, with the benefit of hodic cycling, there can a lift to the context of climbing, so that the character of energy will be graduate grist and within that graduate ethos will be the luminous darkness that would constitute the efficient beauty of the challenge of adult growth towards intussuscepting the remote wonder-act, *energia*, about about energy.

⁴⁷A key problem here is the character of various 'forms' of radiation in terms of central and conjugate potency, form, act. Might you envisage the struggle to reach the metaphysical equivalents of the phrase "energy of radiation"?

⁴⁸This opens up to the problem of the identity of physics. Perhaps a perusal of my previous introduction to the problem would be worthwhile: "Elevating *Insight*: Space-Time as Paradigm Problem", *Method: Journal of Lonergan Studies*, 19(2001), 203-29. I quote a key pointer from page 212: "The special aim of physics is to give a classical and statistical account of the quantodurational networking of geometrical relations,

Finally, there has been suggested a correlation between the expanding universe and the emergence of additional energy. If this happens to become accepted, is it to be explained because prime potency grounds both the space-time continuum and the quantity of energy, so that an increase of one involves an increase of the other?⁴⁹

primary and secondary, that are the actuality of the things of physics. The center stage here has come to be occupied by gauge theory, whose “geometrical nature is not always fully understood partly because gauge theory is not metrical” (Lochlainn O’Raifeartaigh, *The Dawning of Gauge Theory*, Princeton University Press, 1997, 3. I would recommend also here O’Raifeartaigh’s systematic presentation, *Group Structure of Gauge Theory*, Cambridge University Press, 1986. A more elementary presentation is Ian Lawrie, *A Unified Grand Tour of Theoretical Physics*, Institute of Physics Publishing, Bristol and Philadelphia, 1990: Chapter 8, “Forces, Connections and Gauge Theory”.

⁴⁹It seems fitting that Lonergan ends here with a question, and that my note itself points to an expansion in the universe of meaning, which is the topic of the final section. But the expansion I have in mind in this immediate context is the expansion that results from throwing in, at least symbolically, a fuller cosmological question that yet dovetails with our struggle with the meaning of quantity, with energy’s inertia, with mass as relational, with the integrality of materiality’s relations. So, I draw attention to a final chapter in an older popular book on astronomy: chapter 14 of Fred Hoyle and Jayant Narlikar, *The Physics-Astronomy Frontier*, (Freeman and Co., San Francisco, 1980). The title is “Inertia and Cosmology”: it deals with problems of origin and expansion but its center-piece is Mach’s Principle. Throw that principle into the context of Lonergan’s view of concrete relations and Feynman’s view of integration over all paths. A single non-mathematical passage gives the tone of a larger quest.

“Mach argued that Newton’s absolute space is in fact determined by the frame of distant stars. And since the concept of inertial forces is linked with this special frame, Mach went on to conjecture that the property of inertia itself somehow linked with the background of distant stars. Since inertia is proportional to mass, we have to argue that the mass of a body is not an intrinsic property of the body itself, as postulated by Newton, but related to the distant parts of the universe. This concept is known as *Mach’s Principle*. The interpretation of ‘distant parts’ has changed since the nineteenth century. Extragalactic astronomy has shown that the distant galaxies provide an even better approximation to the absolute space of Newton than the distant stars in our own galaxy. Physicists differ in their evaluation of this coincidence and of the importance to be attached to Mach’s principle. In this chapter we explore some of the cosmological consequences of taking Mach’s ideas of mass and inertia seriously. We feel a coincidence that has stood the test of time for nearly a century deserves to be

What would seem desirable is a single coherent answer to all these questions such that prime potency would be conceived as **a ground of quantitative limitations and general heuristic considerations would relate quantitative limitations to the properties that science verifies in the quantity it names energy.**"

30.4 Whatasque Energy

So there you have it: Lonergan's brief revolutionary statement on some identification of energy and prime potency.⁵⁰ The problem of the present and the next generation of Lonergan readers is to become luminous about the fact that this is all we have; a doctrinal statement, an invitation. Does it seem desirable to you? What is it worth to you? These are questions that place you, as we are now accustomed to note, in the mode of page 250 of *Method in Theology*: 'here I stand'. But the precise question about the nature of energy is not for everybody, not everybody's cup of Proustian tea, in the present culture of Lonergan studies, of philosophy, of theology, even of physics.

In *Cantower XXXV* we come at the question of 'where you stand' from another angle, a more elementary angle of asking about present collaboration in theology or philosophy, and I shall remain at that elementary level through until what I might call the crisis *Cantowers XXXIX-XLI*. Most simply, I ask you there to take a stand on a structure of collaboration that tries to implement badly Lonergan's perspective on functional collaboration. If you do take such a stand, within your concrete possibilities, than you are on track with regard to the desirable coherent answer. In a century or so of hodic cycling the pedagogically written chapter 4 of *Insight* will have been lifted into a new context of metaphysics and cosmology, quite beyond your present dreams. There

investigated further" (409).

⁵⁰How far might the identification go? Might we identify quantified energy, concretely informed energy, with concretely informed prime potency? We must push further on this in *Cantower XXXXVI*, after the doctrinal venture towards a base camp to be mentioned shortly,

will be a shared - by some creative minority - an operative foundational view that, as we may see by the end of the *Cantowers*, merges general and special categories in a yearning for and a drive towards his story's and her story's finality.

I begin the turn towards the elementary in the next *Cantower*, which deals with the two chapter fives, with Space and Time. We shall do something parallel to the exercise with water that we did in *Cantower XXVII*. As the footnotes in the previous section lead you to suspect, really grappling with the problem of space and time is a quite different ballpark, and we shall be setting up the first, the base camp, for that climb in the four *Cantowers* that follow the crisis *Cantowers*.

For many readers, then, the *Cantower* journey may end at *Cantower XLI*.

Those four *Cantowers*⁵¹ tackle the general heuristics of the *Speakable and Unspeakable in Quantum Mechanics*,⁵² John Bell's challenge. Within that challenge there is an echo of the mood of our final footnote in the previous section. Bell showed, in his reflections on various hidden variable theories, such as Bohm's, that measurements must be assumed to occur in cosmic mesh. Bell's challenge to the Bohr and von Neumann narrower interpretation of quantum mechanics is a respected possibility. "Henry Stapp of the Lawrence National Berkeley Laboratory in California called Bell's work 'the most profound discovery of science'".⁵³ Whether he is on the right track remains to be seen, but certainly the Copenhagen interpretation leaves much to be

⁵¹You have the list, in the beginning of the Website and also in *Cantower XXIV*, but no harm in naming the four here: "Quantum Mechanics and Measurement", "Quantum Mechanics and Probability", "Quantum Mechanics and Locality, Temporality", "Quantum Mechanics and Foundations".

⁵²See note 54 below.

⁵³*Physicists of Ireland. Passion and Precision*, edited by Mark McCartney and Andrew Whitaker, Institute of Physics Publishing, Bristol and Philadelphia, 2003. In the essay by Andrew Whitaker on John Bell, 279. Bell, like myself was an Ulsterman, and the Irish in me pushes me to note that some of the cast of characters in the previous section turn up in this book: Hamilton, Schrödinger, Lanczos, O'Raifeartaigh.

desired.⁵⁴

I wish to conclude this *Cantower* by focusing on the title given to the present section, but a final parallel with the work of Bell is useful. Whitaker remarks that “Bell’s work had transformed the study of the foundations of quantum theory from one of ‘armchair philosophy’ to one of ‘experimental philosophy’ . By the end of the twentieth century, theory and experiment were working hand-in-hand to provide new perspectives and new possibilities” .⁵⁵ There is the hope that, by the end of the twenty first century, theory, experiment and philosophy will be in the intimate hand-in-hand hold of GEMb, fostering the Tomega and the Childout principles as all too evident features of the human pilgrimage. A key bridge to the realization of that hope is the edging into, the cycling into, a physics and philosophy of the hearty identification of the dynamic identity of energy.

But I must cut to my few comments on the title of the section. Does the odd neologism disturb you? It is one of a series - whatas, As King, - that are scattered through these last few *Cantowers*, with layers of undertones and overtones that relate to a hoped-for mood which may render them obsolete or sublate them anastomotically. I expect a greater disturbance of methodological terminology to occur, nudging us, figuratively speaking, out of Joyce’s *Ulysses* and into *Finnegans Wake*. Simpler parallels may be less disturbing and thus more disturbing. A recent perusal of the new century’s

⁵⁴A handy survey of the present situation is Michael Redgrave, *Incompleteness, Non-locality and Realism*, Clarendon Paperbacks, 1992. The key text from John Bell is *Speakable and unspeakable in quantum mechanics*, Cambridge University Press, 1987. Follow up works are *Quantum Reflections*, edited by John Ellis and Daniele Amati, Cambridge University Press, 2000; *Quantum [Un]speakables. From Bell to Quantum Information*, Springer, 2002. There is a fresh take on the whole situation in the book already referred to (notes , above) by Mead: “To most non-specialists, quantum mechanics is a baffling mixture of waves, statistics, and arbitrary rules, ossified in a matrix of impenetrable formalism. Bu using a superconductor, we can avoid the statistics, the rules and the formalism, and work directly with the waves” (Mead, 11).

⁵⁵*Ibid.*, 280-1.

copies of *Journal of Symbolic Logic* left me in no doubt of the cultural pressure, the pressure of scientific progress, towards new meanings for old words, towards strange words with new meanings, towards layers of linguistic development. Indeed, such experiences drive me towards light on the linguistic needs of cultural discourse that become an explicit topic in the concluding section of *Cantower XXXIII*. One might brood on the simpler parallel: the image of a medieval chorister confronting the chant of Ravi Shankar.

Whatasque energy? The rambling pointers of this essay have perhaps given you some small sense of the twining of the two finalities of material finitude, of all finitude: there is elementary prime matter, and there is what Thomas called prime matter in the order of intelligibles. The essay points to a more intimate meshing, so that a hierarchized infolding of the former gives a radiant obediential meaning to that infolding in the blossoming hominidic exigence that makes “grace, the final frontier”.⁵⁶

I have a struggle to refrain from enlarging further on this, on the world view that drove the writing of the pedagogical - but heavily doctrinal - chapter four of *Insight*. This last section, indeed, could have become a switch from the lower ground of loneliness to the upper ground of loneliness, a hasty reach out to what is “all so much, so sadly much, beyond words”⁵⁷, yet speakable in a speaking about about about Speakable though Unspeakable Energy. But my struggle, and the *Cantower*, can end fruitfully by seeding in you an askance energy in a cherishing of your meaning of the question: “ ‘What, THEN, is being?’⁵⁸ for the Lonergan that wrote chapter 4 of *Insight*?;

⁵⁶The title of the final chapter in the book, *The Redress of Poise*. The word *exigence* should be followed up from the index of *Phenomenology and Logic*.

⁵⁷The final words of the last chapter, “Nor Ear Heard ...” of *Music That Is Soundness. A Fine Way for the Lonely Bud A*, Axial Press, Halifax, 2003. The book presents, in a popular fashion, Immortal Diamonds’ reach for energy’s ultimate infolding in the integral embrace of the universe.

⁵⁸*Insight*, 641[665]. The context is the reach for God in chapter nineteen.

for the Lonergan who found, founded Hodics?" The question, THEN, becomes for us "What is it to interpret Lonergan's view of world-process?" This is the question that is the core of the sequence of *Cantowers*⁵⁹ dealing with functionality.

⁵⁹The full list is in *Cantower XXIV*, but no harm in giving the numbers here: *XXXIV - XLI, LI - LII*: ten, of which two are general reflections on function.