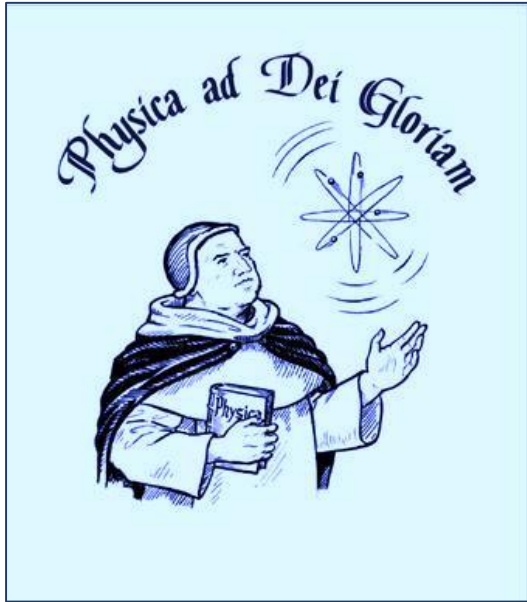


Science before Science Study Group

Week Fourteen



*St. Thomas Aquinas,
Pray for us.*

*St. Albert the Great,
Pray for us.*

Prayer before Study

Almighty God, You who are the creator of all things and our loving Father, send us Your Holy Spirit to illuminate our minds so that we can understand how You have revealed Yourself to us through the world around us.

Grant to us
keenness of mind
capacity to remember,
skill in learning,
subtlety to interpret,
and eloquence in speech.

May You guide the beginning of our work, direct its progress, and bring it to completion.

We ask this through Thy Son, Jesus Christ, Our Lord.

Amen



Questions

- Define Ontological Knowledge
 - Knowledge having to do with real being
- Define Empiriometric Knowledge
 - Knowledge whose mode of explanation is mathematical but it is trying to explain the physical
 - Approach that enabled modern physics and other sciences to the extent that it can be understood through the property of quantity
- Relationship of the ontological with the empiriometric
 - With empiriometric it is not often clear what it is saying about real being
 - The ontological forms the basis for the empiriometric
 - Empiriometric results need to ontologically understood

The **power of the empiriometric** to mathematically “explain” and thereby predict the measured quantitative interrelations **is hard to overestimate.**

But.....

The **predictions** of the theory and the theory itself **hide** as much (usually much more) than **they reveal** about the **ontological nature** of the beings that manifest themselves in the theory.

The empiriometric may describe a real effect but in a misleading way. By now we have come to expect the latter.

Time Travel (General Relativity)

- GR predicts one can go forward and backward in time
- GR predicts that “space” is not Euclidean
- GR unites SR and gravitational force in one theory
- SR is included by way of the equivalence principle
 - Object that is falling under force of gravity – and all nearby objects are in an inertial reference frame
 - E.g. jumping off a dive with a ball – don’t feel the gravity
 - All inertial frames are said to be equivalent
- Such brief statements cannot give a real taste of the grandeur of GR
 - Beautiful in its order, unity and intelligibility (as an empiriometric theory)

Euclidean and Non-Euclidean Geometry (1)

- What is space?
 - Leave behind all material being accidents but quantity
 - E.g. imagine a large rectangular piece of furniture – take it away except for the place that it occupied – that is space
 - We are left with a 3D Euclidean space – 3 axes
 - Left/right; backwards/forward; up/down
 - We make up a concept called physical space – a being of reason-only exists in the mind
- Genius of Einstein
 - Took seriously - empiriometric nature of physical space
 - He let the space-time continuum be the primary concept
 - He came up with equations that were self-consistent
 - Matched by no other theory – even today
 - Number of degrees of freedom is minimal
 - Only those needed to verify measurements (choice of labeling events)
 - In process he used a geometry introduced by Gauss
 - It is non-Euclidean – two parallel lines can meet; distance between two point can be zero

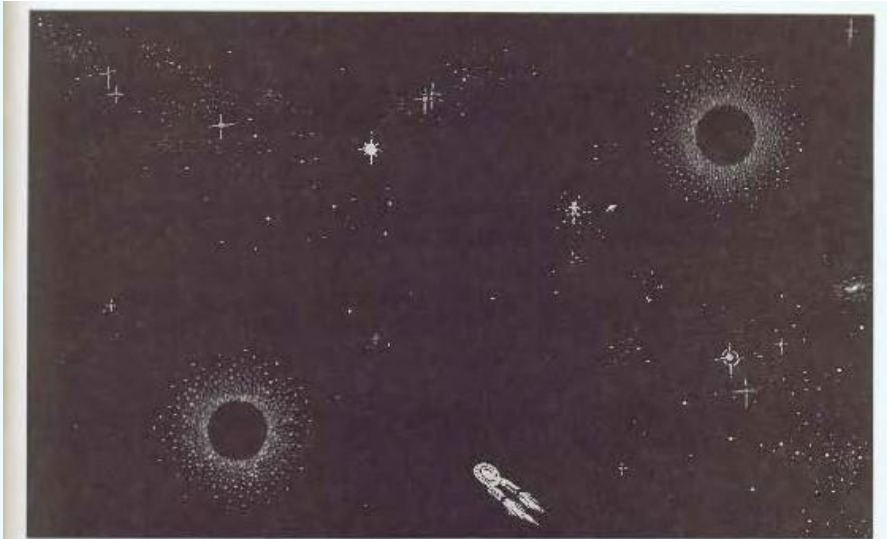
Euclidean and Non-Euclidean Geometry (2)

- Non-Euclidean geometry is **not abstracted from the world in an ontological way**
 - We abstract Euclidean geometry from the real world
 - Then we piece together Non-Euclidean geometries
 - Gödel demonstrated the proof of self-consistency of a system must come from outside the system
 - Non-Euclidean geometries are proven self-consistent by reference to Euclidean geometry (we know from the physical)
- This sort of thinking – has to be done each time we try to understand the **ontological** implications of an **empiriometric** theory.

Time travel into the future is rather easy, as your voyage among the holes has shown. Not so travel into the past. In fact, such travel might be completely forbidden by the fundamental laws of physics. However, DAWN tells you of speculations, dating back to the twentieth century, that backward time travel might be achieved with the aid of a hypothetical space warp called a *wormhole*.⁴⁴ This space warp consists of two

entrance holes (the wormhole's *mouths*), which look much like black holes but without horizons, and which can be far apart in the Universe (Figure P.7). Anything that enters one mouth finds itself in a very short tube (the wormhole's *throat*) that leads to and out of the other mouth. The tube cannot be seen from our Universe because it extends through *hyperspace* rather than through normal space. It might be possible for time to hook up through the wormhole in a different way than through our Universe, DAWN explains. By traversing the wormhole in one direction, say from the left mouth to the right, one might go backward in our Universe's time, while traversing in the opposite direction, from right to left, one would go forward. Such a wormhole would be a time warp, as well as a space warp.

The laws of quantum gravity demand that exceedingly tiny wormholes of this type exist,⁴⁵ DAWN tells you. These quantum wormholes must be so tiny, just 10^{-33} centimeter in size, that their existence is only fleeting—far too brief, 10^{-45} second, to be usable for time travel. They



P.7 The two mouths of a hypothetical wormhole. Enter either mouth, and you will emerge from the other, having traveled through a short tube (the wormhole's throat) that extends not through our Universe, but through hyperspace.

must flash into existence and then flash out in a random, unpredictable manner—here, there, and everywhere. Very occasionally a flashing wormhole will have one mouth near the ring world today and the other near Earth in the era 4 billion years ago when you embarked on your voyage. DAWN proposes to try to catch such a wormhole as it flickers, enlarge it like a child blowing up a balloon, and keep it open long enough for you to travel through it to the home of your youth.

But DAWN warns you of great danger. Physicists have conjectured, though it has never been proved, that an instant before an enlarging wormhole becomes a time machine, the wormhole must self-destruct with a gigantic, explosive flash. In this way the Universe might protect itself from time-travel paradoxes, such as a man going back in time and killing his mother before he was conceived, thereby preventing himself from being born and killing his mother.⁴⁶

If the physicists' conjecture is wrong, then DAWN might be able to hold the wormhole open for a few seconds, with a large enough throat for you to travel through. By waiting nearby as she enlarges the wormhole and then plunging through it, within a fraction of a second of your own time you will arrive home on Earth, in the era of your youth 4 billion years ago. But if the time machine self-destructs, you will be destroyed with it. You decide to take the chance . . .

Backwards Time Travel

- Wormhole – what is it?
 - Kind of like a bridge in space-time between two points (x,t) creating a short cut between the two.
- Scenario
 - Man creates a wormhole
 - Puts one end in his study and the other end in a spaceship in his backyard
 - His wife is in the spaceship
 - Can put his hand through the wormhole and hold hands with his wife
 - The distance to her is always less than about a foot
 - The spaceship takes off near speed of light
 - After 10 minutes he hears a loud noise
 - Looks through the worm hole to the rocket and out the window of the rocket
 - Sees that the rocket has landed in his backyard
 - He looks though his study window to his backyard and there is nothing there
 - After many years the rockets does indeed land in his backyard
 - He gets into the rocketship and sees a much younger self on the other side of the wormhole
 - He climbs through the wormhole and there he is standing next to his younger self
- This is what the empiriometric implies
 - Caveat – we don't know if the theory allows such wormholes – would not be stable
 - But if the empiriometric does allow it – what?

Backward Time Travel (2)

Here lies the fundamental problem with our culture. Nobody knows the fundamental philosophy that we have been talking about. So when it comes to understanding the empiriometric, we are easily fooled because we do not have the basic principles that need to be upheld firmly in our understanding of the real.

- Can we really go back in time?
 - Of course not! The past is past. It is no more.
 - What is not it not accessible in anyway
 - Empiriometric put time and space on same footing – leads us to believe otherwise
 - Are wormholes then useless?
 - REMEMBER: even though direct ontological interpretation may be completely wrong, there may be a way to interpret the predictions in an ontologically consistent way. There may be a real effect there in the empiriometric.

Backward Time Travel – Possible Interpretation

- Different ways of looking into the past
 - Seeing effects of past events (e.g. sunburn, looking at the stars)
 - This is a sort of ‘going into the past’ – can watch but cannot participate [Show Stellarium](#)
- Ontological ‘predictions’ of the empiriometric are wrong – the empiriometric fails in a way
 - But it’s only empiriometric not ontological
 - But we need to adjust the theory itself
 - E.g. recognize limited domain of some variables or the like
 - Or develop a new empiriometric theory (as difficult as that is!)
- Back to the Scenario
 - Thorn sees wife land in backyard through the wormhole – is only an appearance of the future
 - Maybe there is some kind of precursor wave (in a world without free will all would be determined); same with his other view after the spacecraft lands – he sees only an appearance of the past
 - We do not expect GR to take into account free will – it is, after all, mathematics
 - GR doesn’t include free will; describes being under certain conditions.
 - We should consider inanimate objects rather than humans – red and blue balls (that can see)

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But.....

The **predictions** of the theory and the theory itself **hide** as much (usually much more) than **they reveal** about the **ontological nature** of the beings that manifest themselves in the theory.

The empiriometric may describe a real effect but in a misleading way. By now we have come to expect the latter.

Backward Time Travel – Possible Interpretation (2)

- **Kip Thorne's alternate scenario with inanimate objects**
- Initially blue ball and a pink ball are close to each other on different sides of the wormhole
- After 1 hour blue “sees” (an observer on the blue ball?) the spaceship land in his backyard looking through the wormhole
- After many years, there is an explosion, and the blue ball is move by the force of the explosion to the backyard, into the rocket and into the spaceship-end of the wormhole – where it hits his younger self.

Backward Time Travel – Possible Interpretation (3)

- When blue ball flies into the hole (through the spaceship), it cannot hit the blue ball in the past because the past is gone
- Empirically the blue ball did not move until the explosion yet it moved long before the explosion if it came through the wormhole
- It cannot move and not move even in mathematics – result or interpretation is inconsistent
- Thorne addresses this problem by saying only self-consistent solutions are allowed.

The Scenario – Once Again

- Blue sees entire trip of the pink ball up till just after it appears to land (looking through the worm hole)
- Blue ball rockets into orbit; orbit decays; reenters to land at same place Pink spaceship lands
- Blue flies into Pink's spaceship and then its wormhole entrance
- Wormhole is playing movie – starting when Blue saw Pink's apparent landing
- Blue enters bounces off its past self
 - What did blue bounce off of? Not his past self since that no longer exists
- Suppose that both the 'future' movie and the 'past' movie are physical being and their interaction causes the motion seen
 - Then these physical things are really present but not the things they look like and act like
- This is simplest explanation – starting point

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But.....

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The empiriometric may describe a real effect but in a misleading way. By now we have come to expect the latter.

The **empiriometric physical consequences** should be taken seriously but so must **ontology** – or end up in absurdities

The empiriometric theory **will hardly ever be** what the empiriometric theory suggests on its face

Big Bang Theory

- Is there a universe?
 - Kant called into question
 - Little errors in the beginning lead to big ones
 - Stanley Jaki's book "There is a Universe" to understand more about this
- Is there a beginning to the universe?
- What is big bang theory?
 - Solution to Einstein's equations of general relativity (general relativity is broader theory than special relativity)
 - Discovered by Fr. Lemaitre (Einstein applauded him : "This is the most beautiful and satisfactory explanation of creation to which I have ever listened")
 - What does the theory say?
 - First there is a very hot dense state where no particles can exist
 - Then as things cool down – one finds stable protons and electrons – prohibits light from travelling very far
 - Neutral atoms then form and light can travel much further
 - Light red shifts; we see this in the cosmic background radiation
 - Gas condenses to form stars; heavy elements are formed that eventually form planets

Big Bang Theory

- Theory is very heavily confirmed by observation – a well-established empiriometric theory
 - What happens at earlier and earlier times? Go back about 15 billion years – a mathematical singularity – a point – all mathematics breaks down
 - At this point empiriometric theory predicts that space and time began – but we are after real beings not beings of reason
- What is happening ontologically? If it is the beginning of the universe – then we are saying it came into existence – and we are talking about ‘being’ and the empiriometric cannot approach this.
 - Universe is the sum total of all things – being one – it has unity – many different parts but all related
 - Multitude of form-matter composites
 - Change is the characteristic of the material world (forms are lost but the matter is preserved. Potentialities remain even when we cannot actualize them)
 - Matter is neither destroyed nor created
 - Universe cannot be said to have a beginning or end based on its own nature
- Does not exclude God – it just that we cannot deduce a beginning of time with certainty from the material world
- Big bang indicates that something is happening near the point of the infinitely dense fireball
 - It lends support to, not proof, to the idea that universe came into being by an act of God

Quantum Mechanics

- All forces except gravity unified to some degree – quantum mechanics describes
 - Describes the world of very small particles
- Copenhagen interpretation of QM
 - Properties of objects only exist in conjunction with measuring devices
 - Taking the empiriometric directly as ontological
 - Stanley Jaki – inability to make exact measurements does not equate to the inability for something to exist in a definite state or change in a definite way
 - Another example of taking the empiriometric directly as ontological
 - “moon is not there when one is not observing it” - how can this be?
 - Heisenberg’s uncertainty principle
 - Bell’s theorem – some say the greatest discovery of all of science!

Quantum Mechanics

- Uncertainty Principle
 - Cannot measure both position and momentum simultaneously
 - This is due to wave nature of the theory of quantum mechanics
 - Use theory for electrons and light
 - To say “the electron is no place until you measure it”
 - Particles pop out of nothing and fall back into nothing as long as you couldn't see it happening
 - Jaki: inability to make exact measurements does not equate to the inability for something to exist in a definite state or change in a definite way
 - Einstein: ‘do you really believe that the world is not there when you're not looking at it?’
- Bell's theorem
 - Theorem's success in verifying a part of quantum mechanics as directly ontological.

Quantum Mechanics – continued

- The measurement problem in QM
 - How do we interpret a measurement in QM
 - We get a measured value relating to some aspect of our study
- Many infinite worlds interpretation
 - ‘each time a measurement is made the universe splits into a number of universes, corresponding to the number of possible options open to the measurement’
 - Cannot have an infinite number of anything
 - Reality is definite; infinity is indefinite
 - Talk about an infinite number of things is basically saying there is no bound
 - Physicists avoid infinities

Quantum Mechanics (Rizzi's PFR QM)

1. QM is statistical (describes ensembles and not individuals)
2. Each member of the ensemble has more than one entity at play
 - Particle with a guiding structure that is quite complex
3. Its deals with measurements that can drastically change the system
 - including the very thing one is measuring

Bell's Theorem

- Gödel's theorem and Bell's theorem
 - If one thinks all he knows is the empiriometric – he can doubt 'being' itself
 - Seems we have to decide between
 - Giving up on the *reality* of things, or
 - Acknowledge that *action at a distance* (i.e. super-luminal – faster than the speed of light or non-local effects) occurs
 - Need to look at EPR (Einstein, Podolsky and Rosen)paradox
 - Meant to show that Quantum Mechanics was a incomplete description
 - Assumes wavefunction describes a single particle (not an ensemble)
 - Leads to assuming super-luminal effects
 - Bell's argument is a *Ratio ad absurdum* that there is a way to explain QM results without assuming *superluminality*

Bell's Theorem – Rizzi (PFR)

- Much research in to Bell's thought experiment
 - Up to and including work by Hanson *et al* in 2015
- Three types of non-locality/superluminality
 - Interaction that occurs instantaneously across a distance without needing to influence the intervening environment
 - An interaction that occurs through the intervening bodies but does so with an instantaneous change (i.e. not properly speaking change at all in the first sense)
 - An interaction that travels faster than light at a finite speed, but that is not detectable so as not to violate relativity.

The Empirioschematic Sciences

- Empirioschematic Science
 - Do not rely on mathematics as does modern physics
 - It relies on observations and experiments
 - Creates beings of reason in a world that is parallel to the ontological
 - Interested only in material causes
 - Because of its predictability
 - Can take averages and get stable answer that will be the effects from various real beings
 - Being of reason will replace the real being
 - Immaterial effects not included in schema
 - Either not recognized as different if they tend in the direction
 - Or if they are outside the schematic is considered 'chance'
 - Chance is irrationality – it means there is no reason
 - Like the empiriometric manifests underlying real being but hides the real being in some ways

Evolution

- Evolution states
 - The world began and gradually more and more complex substances developed
 - Atoms, stars, galaxies; our sun and solar system; then later simplest forms like proteins and eventually simple life; plants and animals (philosophical terms); more complex and then finally man; some things survived and others didn't (like dinosaurs)
 - Where are these new beings coming from? Two answers-
 - First: They are already in matter in a hidden way from the beginning
 - Second: (A less general way since it only applies to life) – the action of God – God super-performing action bring the first life form into being
 - Take the first way:
 - Electron and proton – brought together in the right way will form hydrogen
 - Electron and proton are both different forms and hydrogen yet a third form whether does this new form come from? Electric field, electron and proton act in complimentary ways that activates different potencies giving rise to the new form (actuality)

Evolution (continued)

- Crossing from the organic to life
 - There is nothing in the material universe in act in any way like nutritive life
 - Life sustains itself by immanent action (action from the whole)
 - There is no substance that is ordered toward growth, maintenance and reproduction of others of its kind in the inanimate universe
 - Remember: nothing can change itself; something can act only as far as it is in act.
 - There must be an outside agent
 - Matter has the potential to become living things because they are here
 - What activated the life potentiality?
- Forced to consider the second way mentioned in the last slide
 - Action of God – that does not appear until life can appear
 - After many years of inanimate evolution – matter is brought to the point of calling for the first life form
 - This action ‘automatically’ brings the first life form into being
 - The potencies are there in the matter at the first moment
 - This is no way is an interference of God in creation
 - God bound Himself to make this action necessary
- Evolution of life forms
 - Environment acts on this simple new life form – minute changes and modifications result that are the actualization of potentials that are realizable because of the presence of the new form.
 - At some point a member of the strain reaches a point where it can receive a new form – that of a second species
 - The supeforming action of God automatically brings the new form into being
 - This continues and the branch of form and spread

Evolution (continued)

- Evolution of man
 - At some point – a overdeveloped animal in its sensorial powers – the equal of man
 - Overdeveloped – has power beyond what is needed for its suitable survival
 - Empirioschematic scientists refer to this as ‘primitive man’
 - Penultimate man – can start fires and make spears
 - Between man and penultimate man – there is an infinite abyss – man can abstract ideas – an intellect
 - A unique action of God is required to bring into being the soul of the first man
- The first man
 - Most important transition in the universe
 - Transition from a material universe - to one that has intelligence and can know
 - Both a material transition and the direct creation of the soul
 - Scenario
 - A particular penultimate man falls asleep
 - Natural factors – for example, cosmic rays and natural ground radioactivity set by God
 - Direct activity of God – refashions sensorial knowledge and his physical appearance
 - Manifest the radical and complete internal change that is wrought by God’s infusion of the human soul
 - Scenario may not be best possible one but it is meant to give a clear sense of the key issues involved

Chance

- Where is the role of chance?
- Why does chance appear in explanations?
 - When there are being or modes of being in the universe that cannot be represented in the empirical modes of explanation
 - When there are entities that can be incorporated but have not yet been
 - When the causes are outside the universe
- Chance is the absence of an explanation
 - “that happened by chance” means “I don’t know why happened”
 - Philosophical definition of chance
 - Intersection of two independent lines of causality
 - Asteroid and the earth, for example
 - Two balls on a pool table – hit by chance
 - There is no being in the system that can be considered responsible – appears irrational
 - Explanation of life – from chance?
 - Given enough time anything will happen – not true!
 - Given laws and initial conditions – what can happen is completely determined
 - What is the probability that life will occur?
 - But the whole enterprise of evolutionary science depends on the fact that we already know it is possible!
 - If empirical science doesn’t implicitly contain the description of the appearance of life – it will never be there
 - Intelligence is evidenced in all the being of the universe even the simplest
 - It is because of the ‘is’ of the universe that ‘what is not in the universe’ of relative chance is based.
 - I cannot talk about ‘flipping a coin’ without the reality of the coin and other substances that make the flip possible.

Chance (continued)

- Intersecting independent lines of causality
 - Cannot cause a real being, a new being 'to be'
 - Efficient cause of a new being must remain outside the universe
 - H_2 and O_2 and spark – new being cause in the system not the result of chance
 - Perhaps the spark was caused by chance – but that is not the cause of the new being
- Cannot a monkey given a computer and keyboard write a Shakespeare play, say Hamlet, given enough time?
 - No, an untrained monkey can type forever and it will never create Hamlet
 - However, a man standing next to him could
 - Sits and waits and reads everything monkey types
 - Extremely inefficient way to type Hamlet

Summary

- We have illustrate the irrationality that enter science neglecting the real
- We have seen possible ontological interpretations
- General point:
 - empiriological science cannot undermine the philosophical proofs made in Chapters 3,4, and 5
 - These first parts of physica are not based on the empiriological sciences but are proved before we start them
- Second general point:
 - Empiriological science needs to be at the service of Physics
 - And also *Metaphysica*
 - Basing philosophy on modern science is starting from the wrong place
- Philosophers should
 - Recognize that the specialized sciences fertilizes philosophy, fleshes out and deepens it
- The work of extracting the ontological from the specialized sciences is little done (at least correctly)