"Physics-Metaphysics Duality: Exploring the Limits of Human Understanding and the Coexistence of Science and Religion"

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Abstract: We examine the relationship between scientific methods and religious perspectives using the example of theoretical physics' understanding of observable natural phenomena. Through a straightforward logical construction, we argue that not only are scientific and metaphysical viewpoints not contradictory, but the existence of the latter is strongly suggested by the former.

1. Introduction: Physics Intelligence Quotient

Figure 1 below schematically represents the landscape of our current understanding of the world in the realm of theoretical physics [1]. As any physics student can attest, even with textbooks on these topics written and rewritten many times over, understanding different segments of this physics space requires both serious effort and certain intellectual abilities.

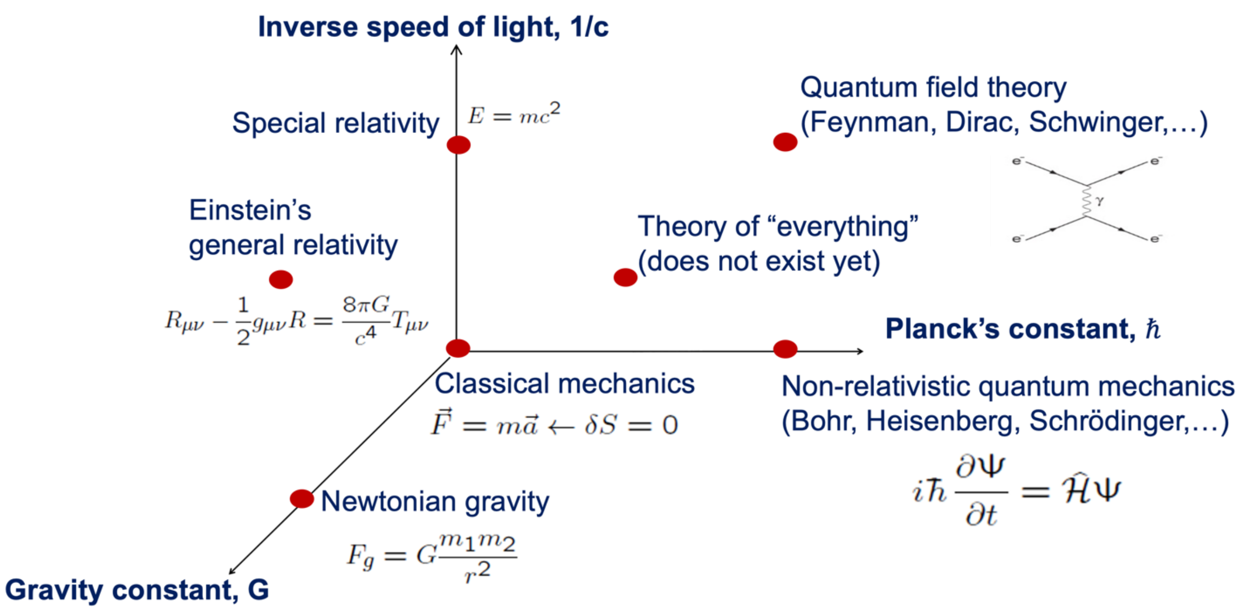

Figure 1: A schematic diagram depicting all major fundamental physics theories within a three-dimensional "space." The three axes represent key fundamental physics constants: 1. Planck constant, 2. Inverse speed of light, and 3. Gravitational constant [1]. Setting the first to zero "turns off" quantum mechanics, resulting in classical physics. Setting the second to zero eliminates Einstein's relativistic effects. Making the gravitational constant vanish removes weak Newtonian (non-relativistic) or Einstein (relativistic) gravitational forces. Various combinations of non-zero constants give rise to different major physics fields, including a potential quantum gravity theory, which remains unknown or potentially unnecessary [2]. The possibility of adding more parameters/axes to this landscape based on future observations cannot be ruled out [3].

While the precise definition of "understanding" is not a well-posed a question [4], one can objectively define it as the ability of an intelligent agent to independently solve problems from a certain field and complexity class (e.g., to find quantized energy levels of a particle in a generic quantum potential in one dimension as a proxy for "understanding" basic aspects of introductory quantum mechanics). This working definition will suffice for our main arguments. The measure of the ability for "understanding" physics either through creative discovery or/and with proper training can be referred to as the "physics intelligence quotient" - PIQ - for lack of a better term and quantified to some degree. Neither the choice of physics as a discipline (as opposed to, say, mathematics or neuroscience or a combination of disciplines) nor the precise quantification scheme is of importance to the arguments that follow. Whatever the appropriate quantification might be, it is bound to be a complex multidimensional metric [5], but for the sake of simplicity, familiarity, and concreteness, let us align PIQ with the conventional one-dimensional IQ scale. For example, we may require $PIQ > 100$ as a prerequisite to "fully understand" Newtonian mechanics, PIQ>150 as one to achieve understanding of general relativity and/or quantum field theory, etc.

Arguably, PIQ varies from individual to individual and changes for each of us as a function of age (it also fluctuates on smaller time scales, but we shall ignore that). In simple mathematical terms, PIQ(N, t) is a function of a particular individual $N = 1,2, \cdots N_{max}$ at age t (e.g., "discretized" and measured in years), and where N_{max} is the total number of humans. We are born with $PIQ(t = 0) = 0$ and we often exit the world not at the top of our intellectual abilities either. PIQ(t) typically grows rapidly in childhood and then declines in our older years, reaching a maximum somewhere in the middle [6]. We can denote the maximum physics intelligence at age t over the entire population as

$$MPIQ(t) = \max_N PIQ(N, t) .$$

There exists the absolute maximum as well,

$$PIQ_{max} = \max_t MPIQ(t) ,$$

which symbolically corresponds to a human with the highest physics IQ in their prime.

2. Physics-Metaphysics Duality

To proceed further we ask a silly-sounding question: are there 3-year-olds who can "fully understand" Newtonian mechanics (or in mathematical terms is $MPIQ(3) \geq 100$)? Arguably, no. Are there 10-year-olds who can "fully understand" general relativity? Arguably, no. This assumption corresponds to MPIQ(10) < 150 (which is a mathematical expression implying in particular that "no 10-year-old can understand general relativity and quantum field theory" in our model.)

Now, imagine a civilization in which human intelligence evolved until the age of 10 and then plateaued or declined along the same shape as it actually does for us [6], but rescaled down to smaller values. The humans of this society might still have invented the wheel and come up with a version of the scientific method. But in this model, neither general relativity nor quantum electrodynamics could be discovered or "understood." Yet, there still would have been physical phenomena that descended from these fields of physics, but they would have been squarely outside the realm of reachable science for this society.

Now, we move to principal arguments of this Letter discussed in the following two subsections.

2.1 The Existence of an Upper Bound on Physics Intelligence in a Society

Just like the aforementioned model of the $PIQ_{max} < 150$ society does not maximize physics intelligence over an ensemble of all possible societies "embedded" in this physical world (by construction), there is no reason to believe that our society does so either. In other words, we posit that there exist models of "societies" broadly defined (to potentially include more abstract entities, e.g., algorithms), whose agents would have PIQ_{max} higher (or much higher) than ours. It appears almost self-evident. For example, even within the relatively simple playground like chess (or Go [7]), we observe that machines have been created whose "chess intelligence quotient" (rating) much exceeds that of the best human players. So, it would be extremely illogical to assume that somehow our "rating" in understanding the natural world cannot be exceeded.

It is an interesting and timely question to ask whether creation of machines with a higher PIQ_{max} would constitute "understanding." If a computer can spit out an answer, it is arguably not much different from measuring a natural phenomenon as is, unless the machine can "project" its understanding to a lower-level set of concepts accessible to humans.

But what if we abandon the anthropocentric view? Is there any reason to diminish the importance of "understanding" achieved by an artificially created or hybrid intelligent entity and hence expand the frontier of science this way? Arguably, the main difference between the modern-day artificial intelligence and human intelligence is the presence of consciousness in the latter. The definition of consciousness is another outstanding philosophical issue [8, 9]. In principle apart from the possibility that its "understanding" is beyond our own grasp and belongs to the metaphysical space ("derived" below), natural explanations are also conceivable. For example, the recent success of large language models – which are based on a rather simple structure [10] – point to the relative simplicity of the natural neural network in our brains, at least as far as language processing is concerned. This neural net – our brain – is "trained" throughout our lifetime through external events and stimuli and the feedback we receive as a result. However, another possibility exists where an intrinsic training through stochastic internal processes [11] – e.g., select stochastic neurons firing randomly by sampling a certain probability distribution (which itself can be variable and deformable through training) – may also be taking place with or without external stimuli.

If we deprive a human of all sensory inputs for a period of time, the initial variables of their neural net – the human's brain – will certainly be different from the final ones in the end of such featureless sensory vacuum [12]. The only mechanism for such a "drift of learning parameters" in the neural net model of the brain is internal processes providing training input data. If such internal self-training indeed exists, it may reasonably correspond to self-awareness and/or consciousness, with more a complicated colored noise being associated with a higher-level functioning. E.g., "consciousness" of a fly may derive from almost featureless white noise resulting in a random walk in space in the absence of external stimuli, while a stochastic net of a more advanced organism, sampling a colored noise distribution and possibly involving complex correlations among "stochastic neurons," would correspond to a more complex behavior. If this or another "natural" hypothesis on the nature of consciousness is correct, then there should be no obstacle to creating a proxy of consciousness in AI systems, and hence no objective reason to exclude such artificially created intelligent agents from considerations.

However, even if we accept this point of view and declare that such artificial intelligence is potentially a way to achieve a higher-level "understanding" and push the boundaries of science, all relevant arguments about bounds on PIQ can be transplanted to such artificially intelligent agents as well. But since we do not know where the underlying concept of consciousness belongs and even how to define it properly, we put this interesting scenario mostly aside and focus on (the limits of) human "understanding" in what follows.

2.2 Understanding All Natural Phenomena May Require an Asymptotically High PIQ

Second, there is no reason to assume that all observable phenomena can be understood within our PIQ limitations now, or at any future moment of human and technological evolution.

In fact, it is conceivable that to understand natural phenomena of higher and higher complexity a progressively high PIQ may be required [13]. Even if there exists a bound on PIQ needed to "understand" all scope of physical phenomena, it would be an amazing coincidence if it were to match limitations on our individual and collective intelligence. For example, if we – the humans – believe that we can produce encryption algorithms that are not breakable by us, why can not the nature hide some of its fundamental (meta)physical laws behind "natural encryption" of the same or higher level of complexity?

We conclude therefore that just like in the model of imaginary 10-year-olds ruling the world, in our actual world, there are bound to exist observable phenomena squarely outside the realm of science. The boundary (determined by PIQ_{max}) is a grey area and may move, but it is always present. This simple mathematical/logical argument offers a more straightforward "critique of pure reason" [14] (without appealing to "experiences") and all but proves the existence of phenomena and entities outside science (i.e., whose understanding requires $PIQ > PIQ_{max}$). It is natural to dub this space "metaphysics" or a "religious realm," although what to call it is a semantic question.

Yet, its mere existence has serious implications on our lives and elevates the importance of metaphysical and religious arguments and discussions that are usually frowned upon within the traditional scientific community [15]. This natural conclusion does not justify all religious dogmas but does point to the importance of heuristic observations of the world around us and certain conclusions unsupported by the traditional scientific consensus and paradigms. Going back to the model of the society with limited intelligence $PIQ < 150$, we can imagine its agents coming up with heuristic observations that would be useful to them even without a proper scientific justification. For example, these humans may conclude from experience that jumping off a cliff is not a good idea, even if they may not be able to write down a second order differential equation that would "explain" why it is the case. Likewise, while there may not be an obvious scientific argument for why "thou shall not kill," there may exist laws of (meta)physics underlying this moral imperative as fundamental as the law of gravity but lying beyond our understanding.

Organized religions can be viewed as a collection of such moral imperatives, and which set of doctrines to follow, if any, is literally a question of personal belief or preference. While there arguably exist many religious practices that are unreasonable or outdated (e.g., consumed by the moving boundary of science), this does not invalidate the importance of systematic heuristic observations and correlations between human actions and their outcomes, and related "religious laws" they may be offering.

All in all, the arguments above suggest that there is no tension between scientific and religious views [16], but there is an organic flow of content between them. Paradoxically, the scientific method itself all but proves the existence of the metaphysical realm outside the scientific method per the simple Gedanken experiment outlined above. Also, it is conceivable that unlike the space of natural sciences ($PIQ \leq PIQ_{max}$), which has a finite "measure" at any given moment of time, the metaphysical space ($PIQ > PIQ_{max}$) may be non-compact and have an infinite "measure."

3. Conclusion

In conclusion, if we accept the existence of the metaphysical space as "derived" from physics, we can allude to other physicists – Michael Hart [17] and Enrico Fermi – to further speculate that it may be arguably more important than science. Specifically, we can invoke metaphysics to offer a possible qualitative "resolution" of a famous paradox named after Fermi. The Fermi paradox is a simple observation that human technological and scientific progress has occurred on timescales that are infinitesimal on the background of the relevant cosmological timescales. Had our civilization started a "mere" million, ten million, *etc* years earlier – a cosmological blip in all these scenarios – extrapolating progress would place its exponentially growing output to a point where it should be detectable by both similar and more primitive civilizations, like our current one. There is literally an astronomical number of potentially habitable exoplanets, whose existence and abundance were obvious to Hart and Fermi and is already a known fact to us [18, 19]. The probability theory tells us that unless we insist on our uniqueness (which would be "unscientific"), there must have been similar civilizations distributed over millions of years more or less uniformly. Hence, we must be able to detect some technological signatures of the immense scientific progress and existence of the most advanced ones at least. Yet, we see absolutely nothing. A possible common-sense resolution of the Fermi paradox is to assume that such advanced societies arrive at the physics/metaphysics duality and eventually evolve in the latter direction of metaphysics. It provides a tentative indication that despite all our technological and scientific progress recently, we may be barking up the wrong tree from the long-term perspective.

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