ON THE INTERSTELLAR TRAVEL

A book on Information Physics

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Because a fact seems strange to you, you conclude that it is not one. ... All science, however, commences by being strange. Science is successive. It goes from one wonder to another. It mounts by a ladder. The science of today would seem extravagant to the science of a former time. Ptolemy would believe Newton mad. ***-Victor Hugo***

Introduction

In this book we will develop a new approach to fundamental physics. It presents a different explanation for experimental findings that lie at its core. We call it *Information Physics*. As its name suggests, it is built around the concept of information. The notion of information is applied to fundamental physics in a way that is different from the current information theory, also known as Shannon's theory.

Information Physics is a scientific theory because it explains experimental results stretching back hundreds of years. It also gives new predictions that can be tested. It is an alternative to a Relativistic point of view.

Overview

Information Physics starts by intentionally ignoring Relativity, Quantum Mechanics and Newtonian physics, but reducing to all of them as a special case. The idea is that information plays a more fundamental role in Nature than we currently suspect.

One prediction of Information Physics is a physical possibility of faster-than-light motion in deep space, under conditions that cannot be achieved near large mass such as Earth or the Sun.

Because Information Physics starts before the first principles, which includes Relativity, Einstein's work is not debated, other than in a context of a historical frame of reference. For example, equations that look similar to that of Relativity are derived without it.

Information Physics uses *only three-dimensional space and linear time*. In order to explain relativistic phenomena, the need for more complex notions does not arise.

This book isn't about philosophical aspects of information in Nature, but rather about its inner workings. The main topic is the *throughput of information use* in physical systems. In the latter part of the book, we will focus on its formal mathematical results.

What is in this book?

We will start with the basic idea of Information Physics, introduced by questions and analogies. This includes "Getting started" and "Information" chapters.

Next, we'll discuss some of the relevant theories, in these chapters: "Shannon and the concept of information", "Einstein's Relativity" and "Quantum Mechanics". We'll talk only in limited terms about these theories, as much as we need for our purposes.

The following chapter, "Information Physics", introduces the essential concepts in an informal manner.

In the chapter "Why space has three dimensions?", we'll mathematically derive that the number of dimensions should be three.

In "Unification by information" we'll deduce the basics of modern physics, in a way that is qualitative. We'll also talk about some of the predictions of Information Physics.

Following this, in "The Math: Proof of concept", we will show the simplified mathematical proof of Einstein's kinematic time dilation, without Relativity or a notion of light. We'll also generalize the math to show that Faster Than Light motion is possible.

"Speed of light" chapter will touch on the concept of maximum speed in Nature, and its relation to the speed of light.

The "Mass" chapter will talk about gravitational and inertial mass and their common origin, from the informational perspective.

In "Information Physics and the Principle of Uncertainty", the notions of uncertainty and quantizing are explained from a different standpoint.

"De Sitter effect without Relativity" qualitatively explains the effect that's considered one of the principal proofs of Relativity, by using informational approach only.

In the following chapter, "The Proof: Beyond Michelson-Morley", the pillar of Special Relativity is examined, including its flaws. Experiments to prove Information Physics are proposed.

In "FTL (Faster Than Light) Motion" and "Artificial Gravity", the reasons and circumstances of these predictions are explained.

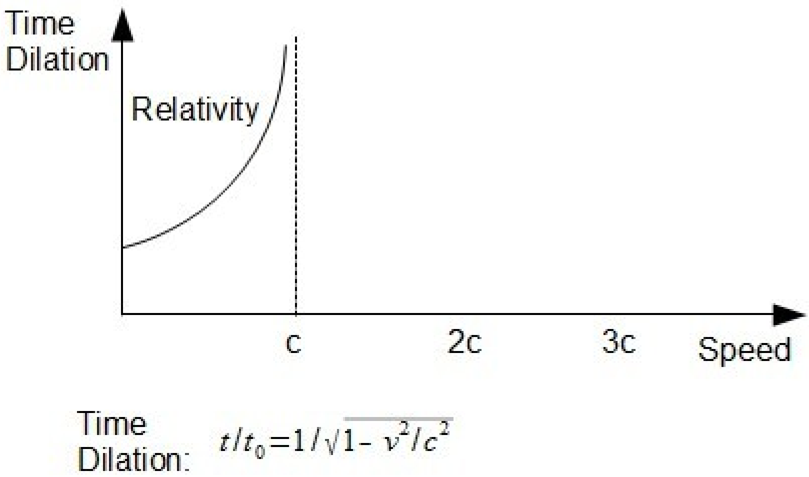
We will lean toward informal narrative here. For the formal theory of Information Physics, please read it on the Web.

Getting Started

What would Einstein say?

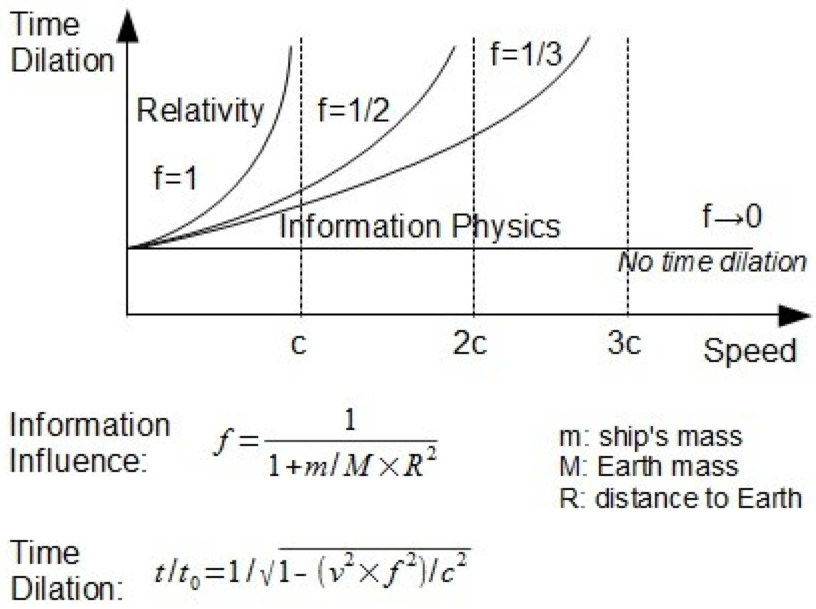
One of the most striking effects of Relativity is time dilation. It means that clocks tick slower for a body in motion. For example, time for a space ship moving close to the speed of light would slow down to a crawl.

Usually time dilation is depicted as an upward curve, where the value for time dilation approaches infinity as the speed approaches *c* (or the speed of light, 300,000 km/s). Here's a typical diagram that shows why nothing can travel faster than light:



As you can see, time dilation would effectively slow down the passage of time to a standstill as the speed of light is approached. Other effects happen as well, such as mass increase, but as an illustration, let's stick with time dilation.

Here is a diagram that exemplifies how Information Physics generalizes the results of Relativity. It shows the circumstances of a practical faster-than-light motion, in a situation of a ship moving away from Earth:



We will derive it mathematically and explain the circumstances under which it holds. *Einstein's physics becomes the left-most quadrant on the diagram*. This quadrant represents our world. The other quadrants represent the deep space outside the world of massive bodies, like Earth.

The factor *f* in the above diagram is called "information influence" and for everything we have done so far, it has the value of nearly 1. This includes all the experiments on, or near large bodies like Earth. However, this factor *f* becomes smaller and smaller the further away from Earth, and the larger the departing mass is.

For example, the above diagram shows what happens to a large spaceship. Close to Earth, its maximum speed is limited to the speed of light (300,000 km/s). A good distance from it, factor *f* becomes one-half, and the maximum speed becomes double the 300,000 km/s. Still further away, factor *f* becomes one-third and the maximum speed becomes triple the 300,000 km/s, and so on.

While this is not in accordance with Einstein's Relativity, it doesn't have to be. Why?

The theory presented here is a *generalization* of Relativity. As such, it complies with experimental data, while suggesting new experiments. Einstein's theory, when it comes to scenarios like this in deep space, *is only a theory and has not been proven*. In those scenarios, Einstein's theory is a conjecture based on indirect experiments, such as those performed on tiny particles here on Earth. In other words, we *assume* that Relativity will hold, but we *don't know* for sure. Our theory says we're in for a surprise.

The problem with laws of physics

Consider a train of thought in the form of Q&A that depicts the current view:

Step 1: Why do we have laws of physics?

Step 2: To explain non-random behavior in Nature.

Step 3: Why is there non-random behavior in Nature?

Step 4: It's because of laws of physics.

Step 5: Go to Step 1.

The above is, of course, a *circular reasoning*. Unfortunately, today's physics has nothing better to offer. The question *of why everything in Nature isn't random* remains.

Physical laws do not explain that. They describe the behavior we find in Nature, but they do not explain *why would there be any behavior that requires explaining*.

Information Physics, Relativity, QM and "It from Bit"

Information Physics brings together the two disparate views of modern physics: Relativity and Quantum Mechanics. It replaces the foundations of Relativity and Quantum Mechanics with a new concept of information.

For that reason, the theories of Einstein and Heisenberg *are not argued*, but rather, are *derived* as a special case of Information Physics.

This makes Information Physics different from any other attempt to place information at the core of physical reality, including before and after the *It From Bit* paradigm.

It's different because all other theories cannot account for Relativity. None accounts for Quantum Mechanics. And none produces experimentally verifiable results that diverge from both. That's what's needed for something to be called new physics.

What is Information Physics?

To begin with, the usual concepts you'd expect are missing. There is no mass, light, gravity, energy or force, and no principles of Relativity and Quantum Mechanics.

If you think about all these, the complexity is staggering. Is it likely that the Universe would start off with all of them? Or would it likely start with a much simpler foundation?

Modern physics rests on a general premise that physical laws govern everything.

All the while, the question remains: *why would there be physical laws*? What is it that enforces the laws? How would a particle such as an electron know how to behave?

The answer is that only the use of information can produce non-random behavior. In plain language, a *decision to act in a non-random way cannot be made without information use*.

The paradigm shift proposed is to say that even elementary particles, whatever they may be, use information to act the way they do.

Usage of information by elementary particles, whatever they may be, is why the non-random behavior is present in Nature.

How do we examine the role of information in the physical world?

What is the exact physical embodiment of information? How exactly does information use happen?

We *won't answer* these questions. That's because *we don't have to*. We are only concerned with a generic model of information use. Assuming that such a model is the simplest possible, we can avoid being trapped in a speculation about these details.

We can assume there is a physical method of information use, but what it is precisely, is not something we care about. That sort of abstraction is a good thing, because then, our conclusions will hold regardless of the actual underlying physical reality.

We certainly don't claim that the Universe is made out of information. It's worth reiterating the central premise: non-random behavior we classify as laws of physics can only exist as a result of information ***use***.

Between that, and saying that everything is made out of information, there's a proverbial Grand Canyon.

Information Physics **derives** the notion of *matter* to be the foundational entity on which information use is based. However, the origin and the meaning of the concept of *matter* is different in Information Physics.

Why is interstellar travel possible?

Information Physics predicts that, *far from stellar bodies*, time does not crawl to a standstill and mass does not exponentially increase as the speed of a large object increases.

This can be tested fairly easy with the level of technology we have today. That's the good news. However, it involves outer space, which is expensive. That's the bad news.

We currently think that nothing can move faster than 300,000 km/s. This is because today's theories suggest it. This is also because we generalized the outcome of experiments we performed with tiny particles here on Earth.

That is *lots of suggesting and generalizing without experimental backing*. Information Physics says that we're wrong about that.

At the same time, all the experiments we have performed to date are in accordance with Information Physics, just as they are with current physics.

Accelerating a tiny particle here on Earth will generally not produce superluminal speeds, however in deep space, accelerating large objects can do so, according to Information Physics. That's the difference that has never been thought of, let alone tried experimentally, because current theories do not predict it.

How to achieve interstellar travel?

Information Physics predicts that pull-based artificial gravity is possible. Ultra-fast rotational motion of heavy microscopic matter (not necessarily around the common center of rotation) is predicted to cause the same gravity as that of a massive body.

A craft can be made to "fall" in a given direction without experiencing inertial effects (just as with natural gravity), even though there is no massive body present, towards which it is falling.

Why are the predictions of Information Physics different?

Information Physics views physical reality as an information system, the kind of which has never been explored before.

It intentionally ignores the present-day physics as its foundation. Despite that, it arrives at the same conclusions where strong experimental verification exists, but at other times, the conclusions are different and lead to new physics.

Because new predictions are reported, along with proposed experiments to verify them, Information Physics cannot be a tautology (a tautology is a derivation of a premise that starts from that very premise).

Going forward

In the course of this book, we'll talk about:

... how the concept of information fits into the very foundations of reality

... how to derive Einstein's equations, like time dilation, without Einstein

... how to procure quantum basis for reality without postulating it

... how to derive Newton's Law of Gravitation without Newton

... how to deduce that mass, light and gravity have to exist, without knowing that they do

... why maximum speed in Nature is local, with the speed of light the slowest of them all

... why near Earth it's impossible to break the light barrier

... why we don't need Einstein's Relativity

... why interstellar travel is possible

... why true antigravity is possible

... why our experiments see none of this

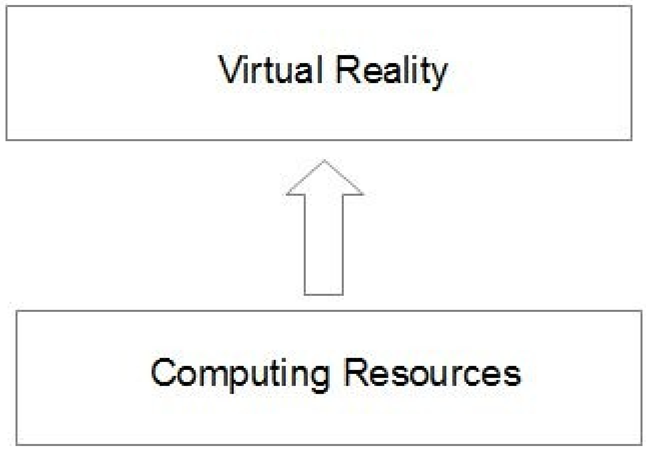
... how to test these claims.

Information

Virtual worlds

Imagine a world of virtual reality living inside of your computer. There are people in it, together with houses, streets, trees and the sky. Imagine that your computer is advanced enough, so that virtual reality is as good as the reality we live in. Imagine that laws of physics are the same in the virtual world as they are in ours. People in this reality are intelligent and self-aware, but they *don't know* they all live in your computer.

The following conceptual diagram depicts virtual reality, based on computing resources.



What is the difference between our world and the virtual world? For intents and purposes of *living in the world*, there is none. For intents and purposes of *understanding the world*, there is a difference, and it's a very important one.

Imagine if the people in virtual reality *at some point learned* they are not real, but are actually the product of information use in your computer.

Now, the virtual people could use the laws of information science to understand their world. For example, if they knew that everything that happens is a result of computation, they could use that to their advantage. How could they do that? After all, they *only know they are the result of information use, but they don't know how it's done.*

The virtual people are in luck. There are generic rules of information use, regardless of how it's done. It's important to stress that the generic rules we are referring to, do not depend on first principles of physics, such as Relativity or Quantum Mechanics.

And if their world of information is made in the *simplest* possible way, then those generic rules become even more specific. The virtual people can imagine what kind of information framework they live in. This framework is true *regardless of the physical reality of their* *world* – in this case, inside your computer, but in general case, by any possible means.

For example, in such a framework, a concept of change can exist only if there is a basic mechanism of memory. In such a world, a specific action can happen only if there is information used for it to happen. These truisms apply to any kind of information use. Once you properly take them into account, you can *understand the information-based world* a whole lot better.

Back to reality: our reality isn't virtual

Let's step back. The inhabitants of virtual reality can understand their world better, because their world *is* based on information (after all, it runs as a program on your computer). Our reality *isn't a program on someone's computer.* So how does all this deliberation help us?

In Information Physics, we say that physical matter operates by means of information use. But, there is no computer on someone's lap that runs our reality. Our reality is *naturally informational, because it has to be so.* We know of no other method of producing non-random behavior other than through the use of information. We will talk more about this in the following chapter.

A naturally informational system is in some ways similar to a virtual world we described. But this naturally informational system *doesn't run on a computer.* It runs in physical space and a constant flow of time moving forward. This is to say, it runs in a simplest version of space and time.

If this is so, then we can apply the basic tenets of information science to our world as well. By knowing our reality is naturally informational, we can also apply the apparent facts about physical space and constantly forward-moving time. For example, we know that all directions in empty space must be equal, because there is no reason for any direction to be preferred. By using facts like that, and combining it with information science, we can learn even more than the virtual people can. This is all possible if we know that our reality is a natural informational one.

But why would this be so?

Information drives reality

How do elementary particles work? The question isn't posed in the context of *what they do.* There is a good chunk of physics dealing with this question. We know that particles do specific things, such as for example, electrons attract protons and repel other electrons. The question is*, how do particles do, whatever it is they do?*

To answer that, think of the world of virtual reality. There, all that happens in a specific way happens *because there's information to guide it.* Whatever happens without information *has to be random.*

A specific behavior cannot be achieved without the use of information. This fact shouldn't be lost on us. We know that's true in our own reality, and we know it's true for everything in virtual reality. It is considered *axiomatic*, i.e. true on its face. Yet somehow, in fundamental physics, we assume that's not the case. In our example, we presume that particles *follow laws that apply to them*. We *do not* think that particles use information, so they, too, can achieve specific behavior.

The idea of Information Physics is that particles *do use information*. They too, cannot escape the conundrum of having to use information to act the way they do. It is a tenet of elementary logic that without the use of information, the resulting action is always random.

Any other way of explaining the behavior of particles reduces to magic at one point or another. This is regardless of how advanced the method of explanation is, or how good that method is in *predicting the behavior of particles.* Remember, the question we asked isn't about *predicting* the behavior of particles. The question is about why they would behave in a way that *requires predicting.*

If information is responsible for the behavior of elementary particles, then there is the question of what a true elementary particle *is made out of*? It functions solely by using information. To function by using information, there must be a mechanism that *stores, shares* *and processes* information. We will deduce a great deal about what this mechanism *does* and what *basic characteristics* it has. However, this mechanism, whatever its actual shape or form, *isn't something we can observe*. Here is why:

If we could observe this mechanism, it means we could obtain *information about it* beyond the information it serves. But then, the information it serves *wouldn't be really fundamental*. It would also mean that this mechanism is made out of other entities that, conceptually, do the same job. It would be a duplication of methods and means without any purpose. It would also lead to infinite amount of information held in a single particle, because we could repeat above dissection forever.

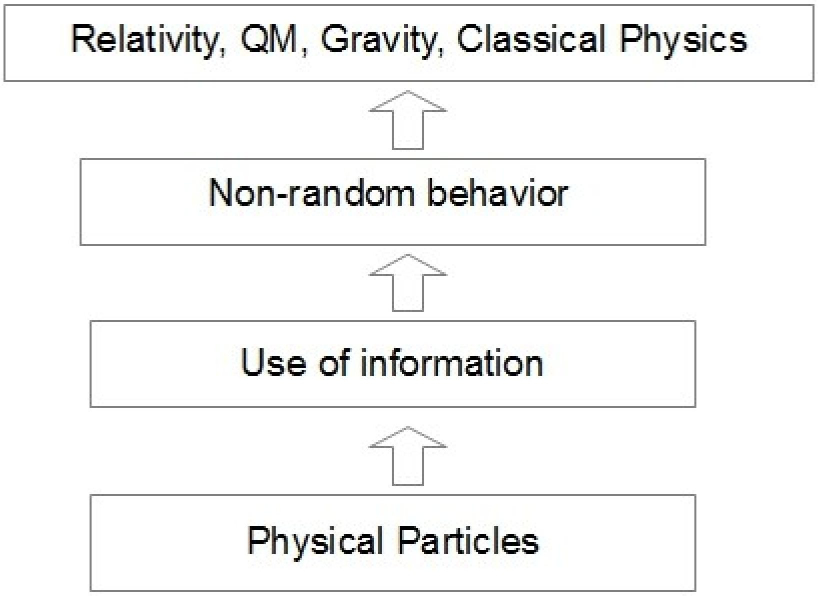
We will call this mechanism a *physical particle*. The name is obviously already used in physics to denote tiny specks of matter, classified by their behavior and qualities. While that is all fine, we think of physical particles in more general terms: they can store, share and process information. Everything else you can say about them is just reducing this information to what we can observe. We focus on *how* the particles work - which is by using information, instead of a notion that they follow laws, which amounts to anthropomorphism, borrowed from our sense of world order.

The reality unfolds by usage of information. The method of usage is given form as a *physical particle*.

What is the world made out of now? It's made out of *particles that possess and use information*. Thus we say that the usage of information is a *foundational layer of reality*, one that comes *before* the physics as we know it today.

This is *formation-by-information.* We ourselves are the result of information use, and so is the Universe around us.

A conceptual diagram depicting formation-by-information is given below.



The fact that we can build computers, or that our own minds work like that in many ways, isn't a coincidence. We live in the informational Universe, and we, and our creations, are a reflection of that, and not the other way around.

The computational qualities arising in Nature aren't *emerging*, but rather, are ultimately *foundational*.

What is matter?

In Information Physics, physical matter is the basis for the use of information. Information does not exist on its own. Physical matter is the enabler of information use. We won't get into how it enables information use, because we don't need to. We can figure out much without getting into those details.

It's all very practical in the end

Consider an *analogy* about why there's kinematic time dilation, which is the slowing down of time for objects in motion. This is a pivotal result of Einstein's Relativity. Let's figure it out without any notions of relativity or light, by using an informational approach.

Every particle in Nature works by processing information. This information comes from all particles. This drives the reality we see. Think about the *throughput* of processing information. To do that, step back to our everyday lives for a second.

Imagine you're in a fast train, looking out of the window. If you are thinking about something, you will now think slower compared to when a train was at rest. Why? This is because there are many more details to process about the surroundings outside the train, if the train moves. The faster the train, the more details there are for you to process, and the slower your mind is.

What do we conclude here? Your mind is an information system. It has a limited capacity. When there's more information to process, it slows down. When you're in motion, your mind becomes slower because there's more to take in. It's as if time itself slows down. In reality though, it is only the throughput of processing information that has declined.

Now, consider if everything in Nature works this way, including elementary particles. If they are information systems of limited capacity, then relative motion will influence them just as it influences you: they will act slower. This conclusion can be formalized, and when we do so, it will match Einstein's results for time dilation in special cases. In other cases, the equation we get becomes a more generalized version of Einstein's results.

Keep in mind that we *will often use analogies* to help visualize the concepts. For example, we will use analogies with shooting a video, just as we already used an analogy with looking out of a moving train. If you take those analogies literally, and think they are used to prove or disprove anything, *do so at your own risk*. Most every analogy used in modern physics carries in it somewhat of a *circular reasoning.* That's understood, but it doesn't diminish the value of them. The actual ideas and the formal reasoning in the full paper do *not rely* on any analogy.

Where do we go from here?

We'll first touch on the work of Shannon and the modern information theory. We'll continue with some insight into works of Einstein and Heisenberg. Others may be mentioned as well.

The physics revolution of the early 20th century (of which Einstein and Heisenberg were an integral part) was an effort by many people. Partly by reasons of clarity and partly by reasons of fame and familiarity, we'll focus on their work and perhaps a few others.

Keep in mind that the overview of the works of Einstein and Heisenberg is *not given in order to argue their points.* Information Physics takes a route that doesn't intersect with their work. There is nothing to argue. The overview is given *only* as a historical perspective into *what* we're talking about here and *why*.

Skipping to the very end, it will be demonstrated that Einstein's equations hold only in some special situations, such as when on Earth or nearby, or in general near a large mass. Some good distance from Earth and the Solar system, those very equations take a different form. Achieving speeds greater than the speed of light is no longer prohibited. *Mass will not increase infinitely and time will not slow down to zero*, as Einstein's equations predict. The flow of time will *not* reverse, as it is sometimes pointed out in the popular press, and you will not end up in the past, having a chance to ruin the date that brought your parents together.

Shannon and the concept of information

In this chapter we will discuss the notion of information used by physical particles in the present-day context.

In the late 1940's Claude Shannon developed his information theory. Shannon's theory is the basis for many aspects of modern computer science, with applications in other areas as well.

Shannon's theory introduced the concept of information as a measure of entropy, which in broader terms means the uncertainty of predicting the value of something. For example, a coin tossed will end up heads or tails. If we predict it to be heads, there is obviously some uncertainty, because we don't know for sure which one it will be. If we could predict the toss every time, then the result of tossing would never be news to us, and would have no information.