SIPI

SEARCH FOR INFRA PARTICLE INTELLIGENCE

Changing the "Search for Non Human Intelligence" Paradigm from Outer Space to Inner Space

Prof. Dr. Hugo de GARIS

profhugodegaris@yahoo.com
http://profhugodegaris.wordpress.com

Abstract

This essay is a tight sequel to the author's previous essay "FEMTOTECH : Computing at the Femtometer Scale Using Quarks and Gluons" It applies the same kind of ideas to the attometer (10^{-18} meter) scale using the weak force particles W^+ and W^- to create an ATTOTECH. The hypothesized SU(5) force particles of the grand unified theory, X and Y, are 1000s of times heavier than the W particles, and hence operate at the zeptometer scale (10^{-21} meter) allowing a potential ZEPTOTECH. One can generalize from all these "techs" to create the specifications for an "X-TECH". The major point of this essay however, is to claim that looking extra terrestrially for signals from hyper advanced civilizations far older than we are, may be misguided. Perhaps we should be looking inside "elementary" particles because creatures

constructed at these tiny scales would operate hugely faster, at far greater densities, and with vastly superior performance levels. We may need a paradigm shift away from outer space to inner space, from SETI to SIPI.

1. Introduction

In my essay, "FEMTOTECH : Computing at the Femtometer Scale Using Quarks and Gluons" I found (in principle) ways to use the properties of quarks and gluons to compute at the Femtometer scale. The basic ideas were to store a bit using the color charge on a quark, e.g. the red color charge for a 1, and the blue color charge for a 0. Gluons, having two colors each, e.g. a red, anti-blue, or a blue, anti-red could be used to change the color charge of a quark, i.e. it could flip the bit from a red to a blue (i.e. from a 1 to a 0) and vice versa. By sequencing the emission and absorption of appropriate color changing gluons, I was able to map the three basic logic gates of classical computing (NOT, OR, AND) into corresponding QCD (quantum chromo dynamics) phenomena (i.e. the appropriate behaviors of quarks and gluons.)

I then wondered if I could do much the same at the next size scale down, i.e. at the attometer (10^{-18} meter) using the weak force particles W, and Z. As usual I went hunting through my particle physics texts and found a way to do this too (in principle). Here is how it might be done.

2. W^+ and W^- Weak Force Particles and Interactions

The force particles of the weak nuclear force (W^+, W^- and Z^0) have very limited range, typically of the attometer scale (10^{-18} m) and they have mass, in fact they are considerably heavier than the proton, i.e. about 2 orders of magnitude heavier. I concentrate on the W particles, since I won't be using the Z particle which is uncharged. The W particles come in two forms. One is positively charged ("W^+") (i.e. it has one unit of positive electronic charge) and the other is negatively charged ("W^-") (i.e. it has one unit of negative electronic charge.)

These weak interaction particles differ from their massless cousins, the photon, and the gluons, that mediate the electromagnetic and the color (strong nuclear) forces respectively. The gluons only interact with particles that have the color charge (red, blue or green), but take no part in the weak interactions. The gluons thus have no effect on the "leptons", i.e. the *light* particles (such as the electron, the neutrino, and their cousins) but react only with "hadrons" i.e. *heavy* particles (such as the "baryons" (protons and neutrons, etc, that are constructed from 3 quarks), and the "mesons" (pions, etc) that are constructed from a quark and its antiquark.))

The weak interaction particles however are more universal. They can interact with BOTH hadrons and leptons. So from a future technologist's point of view, there may be more scope for a technology based on the weak force particles than on the color force particles, because the former offer more “scope.” However, there is a considerable downside with the weak interaction particles, and that is their interaction speed, as we will see later in this essay.

The weak particles have another feature that the gluons do not have, and that is they can change the “flavor” of a quark, whereas a gluon cant. (The “flavor” of a quark, is its “type” i.e. one of the following set of 6 {up, down, strange, charm, top, bottom}) A gluon can only change the color charge of a quark, not its flavor.

For example, a W^+ particle can interact with a “down” flavored quark (which has –1/3 of the charge of an electron) and convert it into an “up” flavored quark (which has + 2/3 of the charge of an electron). This reaction (actually an absorption of a W^+) can be represented as follows.

$$W^+ : Qd => Qu$$

i.e. the W^+ acts on the down quark to convert it to an up quark, or the down quark absorbs the W^+ and becomes an up quark. Call this process the “absorption” of the W^+

There is a corresponding “emission” process of the W^+, which goes as follows. An up flavored quark collides with a hadron (which is ignored) and “splits” into a down flavored quark and a W^+. This reaction can be represented as follows.

$$Qu => Qd + W^+$$

Note that in both the W^+ absorption and the W^+ emission processes, the total charges before and after the interactions are conserved. For example, in the W^+ emission process, the charge of the up quark equals the charges of the down quark and the W^+ (i.e. +2/3 = -1/3 + 3/3).

The above absorption and emission processes have corresponding equivalents for the W^- weak force particle. The absorption and emission processes can be represented by the following two equations.

$$W^- : Qu => Qd \quad \text{and} \quad Qd => Qu + W^-$$

We now have the necessary tools to create computation at the attometer scale, because we can emit a W+ or a W- at will, and use it so that it can be absorbed to change the flavor of a quark from up to down, or from down to up, i.e. we can change the bit on the quark. For more on this, see the next section.

3. Computing with Quark Flavors and the Ws

At this point in this essay, if you have not already read my earlier essay "FEMTOTECH : Computing at the Femtometer Scale Using Quarks and Gluons" I strongly advise you to do so, otherwise this section will be rather incomprehensible.

Once you understand readily the basic principles of the computational model in the femtotech essay, it is rather easy to create a close analogy between the quark color charges and color changing gluons on the one hand, and the quark flavors and the flavor changing Ws on the other.

You can take the implementation of the NOT, OR, AND gates in the femtotech essay and substitute the femtoscale set of {quark color charges, color changing gluons} for the attoscale set of {quark flavors and the flavor changing Ws}. The analysis is the same for both sets, except that the scale is about 3 orders of magnitude smaller, namely at the attometer scale. We are thus computing at the attometer scale, creating the beginnings of an “attotech.”

To make the above analogy more concrete, make the following substitutions. On the LHS of the following list, is a component of the femtotech story. On the RHS is a component of the corresponding attotech story. To understand how to implement the NOT, OR, AND gates of the attotech story, simply substitute the RHS components into the corresponding LHS components in the femtotech story.

A red color charged quark → An up quark
A blue color charged quark → A down quark
A red, anti-blue gluon → A W^+ weak force particle
A blue, anti-red gluon → A W^- weak force particle

4. Zeptotech?

I had to go to google to find out the name of the 10^{-21} m scale. It's a "zeptometer" and 10^{-24} m is called a "yoctometer." I can't say much about a possible "yoctotech" because very little is known about particle physics at such tiny scales. But there are theoretical models at the zeptometer level.

Once the electromagnetic and weak forces were unified into the "electroweak" force in the 1970s, particle theorists attempted to use group theory to create a "grand unified force" or "superforce" (i.e. an "electro-weak-color force") using the special unitary group SU(5). Out of this (only partially successful) work came the prediction of two superforce particles that would mediate all the interactions, except gravity. (Hopefully string theory will solve the open problem of unifying ALL the forces of nature.)

These two superforce particles are called the "X" and the "Y", and have masses about 3 orders of magnitude larger than the Ws and the Z. Hence the range they would operate under would be at the zeptometer scale. Since I don't know how they interact with quarks and leptons, there's not a lot more I can say about a possible zeptotech.

5. X-Tech

Having seen above how to implement computing at the femto and atto scales, one cant help but notice that there are commonalities between the two, allowing one to generalize the creation of future “X-techs” at ever smaller scales, where “X” is any appropriate level label, e.g. nano, femto, atto, zepto, yocto, … Plank(?).

To produce an X-tech, what do you need? Here is a short list. You need –

a) *Stable entities (presumably particles) that have at least 2 quasi stable states* (that do not quickly decay or spontaneously change into some other state). For example, with femtotech, the red and blue color charges on the quarks (corresponding to the binary states “1” and “0”), or with attotech, the up and down flavors of the quarks.

b) *At least two force particles that can be emitted and absorbed, to be used to change the states of the entities above.* For example, with femtotech, the red, anti-blue gluon (that changes a blue charged quark into a red charged quark), and the blue, anti-red gluon (that changes a red charged quark into a blue charged quark), and for attotech, the W^+ (that changes a down flavored quark into an up flavored quark) and the W^- (that changes an up flavored quark into a down flavored quark.)

Once you have such basic ingredients, it is fairly easy(?), at least in principle, to devise logic gates using them to compute any Boolean function. You have computation at the X-scale, and hence you have the beginnings of an X-tech.

6. Is Smaller Faster?

I used to be under the impression (and I still am to some extent) that as one scaled down, the greater would be the overall performance of a given level of technology. For example, a femtotech would outperform a nanotech by a factor of a trillion trillion, i.e. the density would be a million cubed times greater, and the signaling speed between the femto components would be a million times faster, because the components are a million times closer together, giving a total performance increase of a million to the fourth power = a trillion trillion times superior to nanotech. A femto machine could flip bits a trillion trillion times faster than a nano machine.

This huge superiority will put pressure on our future “artilects” (artificial intellects, massively intelligent machines) to “upgrade” (actually “downgrade”) themselves from “nanolects” (i.e. artilects based on nanotech) to “femtolects” (i.e. artilects based on femtotech). Since they will be hugely smarter than we are, they will probably then continue down scaling, assuming that each scaling down resulted in vastly superior performance, but is that assumption valid?

Let’s do the numbers.

The femtotech story in the previous essay uses gluons to mediate the color force. Typically these color force interactions occur in a time frame of 10^{-23} second, and at a range of about 10^{-15} m.

The attotech story in this essay uses the W weak force particles to mediate the weak force. Typically these weak force interactions occur in a time frame of 10^{-10} second, and at a range of about 10^{-18} m.

You may be shocked by the much slower speed of the weak interactions, i.e. about 10 trillion times slower, so how does that affect the total performance of attotech vs. femtotech?

Well, badly, actually! Of course, the density increase of atto relative to femto would be a billion times greater, i.e. a thousand cubed, but the much slower interaction speed more than overpowers the greater density impact. So, there may be 10^9 times more components per unit volume of attoteched matter, but each interaction is 10^{-13} times slower, so the total performance increase is $10^9 * 10^{-13} = 10^{-4}$, i.e. ten thousand times inferior. So much for an attotech based on the weak force!

7. SETI vs. SIPI

Does the above analysis throw a monkey wrench into the works of the idea that the hyper intelligent creatures in the universe that are billions of years older than we are, are super tiny? Not necessarily. Of course, going from nano to femto is an obvious performance enhancer, because not only is the femto scale a million times smaller than the nano scale, it uses the color force, one of the fastest phenomena that physics knows about (although big bang theory operates on a time scale of 10^{-44} second, the Plank time, so maybe there is scope for much faster processes? Further research needed here! Inflation, maybe?

Sticking with the color force – its essential ingredients, the quarks and the gluons, are essentially point like particles. They have no known internal structure, so are modeled essentially as points, so could scale down hugely.

The only reason the distance scale of 10^{-15} m is used for the color force, is because quarks are usually found bound together in 3s in baryons (like the proton or neutron) which have femtometer sizes. But if an X-tech could be used inside the volume of a baryon, i.e. inside a sphere of radius of about a femtometer (a.k.a. a “fermi”) then it might be possible to have many quarks and gluons operating in that space and at tiny tiny scales. Alternatively, one could use gluons alone, since they too are color charged and may interact with each other forming complex “glueballs” that function at color force speeds, i.e. 10^{-23} second.

It’s difficult to talk about such an X-tech because the basic physics of how lots of quarks and gluons (or glueballs) would interact in such tiny volumes (where presumably, the “quark confinement” (stretched rubber band) phenomenon would not be operating (see my earlier essay on this)) is poorly known.

Our artilects may be such superb scientists, that they may be able to create such an X-tech, and hence give themselves the option of "down-grading" themselves to achieve vastly greater performance levels. Just how far down they could go is an interesting research question. One of my ambitions over the next couple of years, is to get so familiar with string theory (now that I'm ARCing (after retirement careering), doing what I like), that I dream of creating a "string-tech."

Now to the punch line.

It should be clear from all this talk of femtotech, attotech, zeptotech, X-tech, etc that as one scales down, in general, performance levels increase dramatically. Hence one can readily speculate that any nano-based artilect, sooner or later, will not be able to compete with his femto-based cousins, and will probably downgrade itself as well. This logic applies all the way down (to Plank-tech?). Hence we come inevitably to the following dramatic conclusion.

The hyper intelligences that are billions of years older than we are in our universe (which is about 3 times older than our sun), *have probably "downgraded" themselves to achieve hugely greater performance levels. Whole civilizations may be living inside volumes the size of nucleons or smaller.*

When I first had this idea, about a decade ago, I chuckled, but now I take it very seriously, because there seems to be *so much logic behind it.*

What impact does such thinking have upon SETI (Search for Extra Terrestrial Intelligence)? Well, I think it makes SETI look rather *provincial*. I'm not suggesting that the SETI effort be canceled, but the above thinking does suggest that the intelligences "out there" i.e. extra terrestrials (ETs), who might be primitive enough to bother sending radio signals to beings like us, are NOT the most intelligent specimens in the universe. *The really smart ones I suggest are very very tiny.*

Therefore I recommend that humanity start thinking about ways to detect their presence. We need a SIPI, a Search for Infra Particle Intelligence. For example, why are the elementary particles such "carbon copies" of each other, for each particle type? Once one starts "seeing" intelligence in elementary particles, it changes the way one looks at them, and the way one interprets the laws of nature, and the interpretation of quantum mechanics, etc. It's a real paradigm shift away from looking for non human intelligence in *outer* space, to looking for it in *inner* space, i.e. SIPI.