Chapter 4. The Matter Glitch:
An alternative to the standard model[1]

"Scientists who don't question their theories are priests"

Brian Whitworth, Auckland, New Zealand

4.1. INTRODUCTION

Quantum realism isn't *physical realism* (that only the physical exists), *solipsism* (that all is a mind illusion), or *dualism* (that there is a spiritual realm beyond the physical). It is that a quantum world we don't see generates the physical world we do see. *The first chapter* showed this was a theory about this world that science can test[2], and is the simpler theory given relativity and quantum theory[3]. *The second chapter* described space as a quantum network, as Hiley says:

> "*I remember … Richard Feynman … saying that he thought of a point in space-time as being like a computer with an input and output connecting neighboring points*" (Davies & Brown, 1999) p138

This network connects in four-dimensions so our 3D space is a *surface* within it, or as Davies says:

> *"… the shape of space resembles a three-dimensional version of the surface of a sphere, which is called a hypersphere*." (Davies, 2006) p45

This hyper-sphere surface has no center or boundary and expands everywhere at once as our space does.

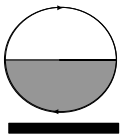
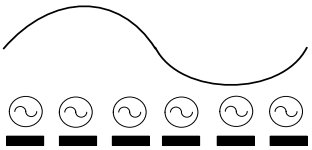
Space	***Light***	***Matter***
		
Planck program in one node	*Planck program in many nodes*	*What is matter?*

Figure 4.1. If a photon is space stretched out, what is matter?

he third chapter described light as the processing of space distributed over many nodes as a sine wave, giving the question "What is matter?" (Figure 4.1). *This chapter* addresses that question and in doing so suggests an alternative to the standard model.

4.2. THE STANDARD MODEL

The standard model of physics took over a century to build and summarizes:

> "... *in a remarkably compact form, almost everything we know about the fundamental laws of physics."* (Wilczek, 2008) (p164)

It is currently considered by physicists to be:

> *"…truly the crowning scientific accomplishment of the twentieth century.*" (Oerter, 2006) p75.

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[1] For the latest chapter versions see http://thephysicalworldisvirtual.com/

[2] The *scientific method* puts a thesis about the world, defines its anti-thesis, then picks what best fits the facts. The thesis that the physical world is virtual has the anti-thesis that it is objectively real, so the question is just which theory better describes our world?

[3] If the physical world is a virtual reality the big bang was the system boot up, the speed of light reflects the screen refresh rate, Planck length reflects the network density, Planck time is its cycle rate, quantum randomness is server generated, empty space is null processing, entanglement is merged processing and quantum collapse is a server processing restart.

Table 4.1. The standard model of particles

PARTICLES	**FERMIONS (Matter)**				
	Leptons		***Quarks***		***Anti-Matter***
	Electron like	*Neutrino like*	*Up-like*	*Down-like*	
Generation *1*	Electron (**e**)	Neutrino (**ν**)	Up quark (**u**)	Down quark (**d**)	Same mass, opposite charge
Mass (Charge)	0.511 (-1)	< 3 x 10^{-6} (0)	1.5 - 4.5 (+2/3)	5 – 8.5 |(-1/3)	
Generation *2*	Muon (**μ**)	Muon neutrino (ν_μ)	Charm (**c**)	Strange (**s**)	As above
Mass (Charge)	105.7 (-1)	< 0.19 (0)	1,000 – 1,400 (+2/3)	80-155 (-1/3)	
Generation *3*	Tau (**τ**)	Tau neutrino (ν_τ)	Top (**t**)	Bottom (**b**)	As above
Mass (Charge)	1,777 (-1)	< 18 (0)	174,000 (+2/3)	4,000 – 4,500 (-1/3)	
	BOSONS (Forces)				
Field:	***Electromagnetic***	***Strong***	***Weak***	***Gravity***	***Higgs***
Name *Mass (GeV)*	Photon (γ) (0)	Gluon (**g**) (0)	W^+, W^-, W^0 (80.4; 80.4; 91.2)	Graviton (?)	The Higgs (125)
Charge	-1 to +1	Eight "colors"	Isospin (+½, -½)	?	?

It considers all reality to be *particles*, that divide into light-like *bosons* that don't collide and matter-like *fermions* that do (Table 4.1). All the forces of physics attribute to *bosons*, while fermionic matter splits into *leptons* (electrons and neutrinos) and *quarks* (up and down). Quarks then combine into the protons and neutrons of atomic nuclei that electrons orbit around. Apart from neutrinos that seem to whizz around for no reason, and anti-matter that should be but isn't, it all seems fairly tidy, but as Woit notes:

"*By 1973, physicists had in place what was to become a fantastically successful theory … that was soon to acquire the name of the 'standard model'. Since that time, the overwhelming triumph of the standard model has been matched by a similarly overwhelming failure to find any way to make further progress on fundamental questions.*" (Woit, 2007) p1

Some fundamental questions the standard model doesn't answer include:

a. Why don't protons decay as neutrons do?
b. Why is the universe made of matter and not anti-matter?
c. Why do neutrinos have a tiny but variable mass?
a. Why are there three particle "generations" then no more?
b. Why do electrons "half spin"?
c. Why does mass vary enormously but charge doesn't?
d. Why do neutrinos always have left-handed spin?
e. Why do quarks have one-third charges?
f. Why does anti-matter have negative spin?
g. Why does the force binding quarks *increase* as they move apart?
h. What is the dark matter and dark energy that constitute most of the universe?

The standard model doesn't answer these questions and probably never will, because its two best hopes, string theory and super-symmetry, led nowhere. This chapter addresses these questions based on processing not particles.

4.3. ELECTRONS AND NEUTRINOS

The most likely candidates for the first matter are electrons and neutrinos.

4.3.1. Electrons

In the last chapter, a Planck program running in one node was space and the same program divided between many nodes was light, where:

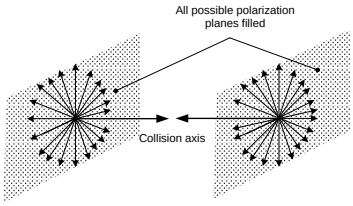


Figure 4.2. Extreme light rays collide

1. One photon enters a node by one channel[4],
2. The bandwidth of one channel is one Plank program.
3. Nodes transmit photon streams in lockstep order, so they can't overtake,
4. If two photons meet head-on in one channel, it must process both.

Ordinary photons meeting in a channel won't overload it because their sum is less than its bandwidth but *extreme light* is different. An extreme photon[5] is the smallest wavelength and highest frequency possible for the electro-magnetic spectrum. If two extreme photons meet head-on, each requesting a half Planck program, the channel will overload, i.e. they will "collide".

Extreme photons can by spin restart in another channel to disentangle, but this can't happen if they fill every channel of an axis, i.e. if extreme light *beams*[6] meet (Figure 4.2). When this happens *every* channel overloads and processing has nowhere else to go so it all reboots. This must have occurred in the early plasma by Feynman's law of all action (3.4.2).

Figure 4.3 shows the result for one channel, with every channel the same. Two photon "heads" each needing half a Planck program overload one channel, so it reboots to restart both photons next cycle. The *pass-it-on protocol* (2.5.4) that usually handles an overload in this case gives another reboot, as now the tails of the leaving photons overload. The result is a repeating reboot, as each restart gives another overload. The network that once hosted only waves now has a permanent processing bump - *an electron*. It is stable because anything hitting *on that axis* finds all the channels taken while anything at right angles just passes right through.

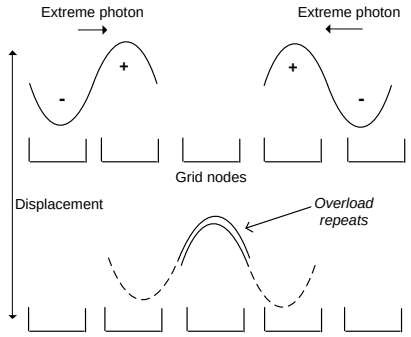


Figure 4.3. An electron channel reboot

In this view, an electron is an electro-magnetic *standing wave* i.e. a wave collision giving a stationary effect (Figure 4.4). In his PhD, Feynman partitioned the electron wave equation into opposing advanced and retarded waves but didn't pursue it, perhaps thinking that electron *particles* can't be *waves.* Since then, Wolff has argued that electrons are in and out spherical waves (Wolff, M., 2001)[7], Cramer's transactional theory uses retarded and advanced waves (Cramer, 1986), and Wheeler–Feynman's absorber theory does the same (Wheeler & Feynman, 1945). Experiments show that electro-magnetic waves can repeatedly interact to form static states (Audretsch, 2004, p23), and repeated observations can maintain a quantum state if the time delay is short (Itano, Heinzen, Bollinger, & Wineand, 1990). Electro-magnetic waves can form standing waves just as other waves do.

Figure 4.4. A standing wave on water

tandard model electrons are elementary particles not made of anything else and photons are bosons that by definition can't collide but in this model electrons are when light repeatedly overloads the channels of one axis, giving a quantum standing wave. In processing terms, matter is the repeating error every network dreads, the boundary exception when it "hangs" like a stuck record that repeats. In every sense, matter is a quantum network *system glitch*.

4.3.2. The charge remainder

[4] A node channel hosts a photon in a quantum dimension transverse to its polarization plane, into a quantum dimension.

[5] An extreme photon is the maximum frequency of the electromagnetic spectrum (of two Planck lengths).

[6] In an extreme light beam, extreme photons occupy every polarization plane on its movement axis.

[7] See http://quantummatter.com/articles_html/body_spin.html.

If mass is a quantum network glitch what is charge? Current physics defines electricity as the flow of charge and charge as the flow of electricity[8]. This circular definition, that charge is what charged particles have, tells us that we don't really know what charge is. Charge like mass is considered a *self-evident* property, and the two are unrelated.

In this model, the same event that creates mass also gives charge. If the electron mass is positive quantum processing repeatedly restarting the negative processing that doesn't run is charge (Figure 4.3). A quantum network has to keep its processing books in order, so let charge be any *permanent processing deficit.* A processing remainder can be positive or negative as charge is, and positive and negative processing cancels as charges do. Since an electron repeatedly restarts, the processing remainder will be constant, again as an electron's charge is. This model relates mass and charge, with the first being the net *processing done* and the second the net *processing undone*, per cycle.

4.3.3. The neutrino byproduct

Electrons are critical to our world, as without them there would be no chemistry and thus no life, yet the universe also contains a "little nothing" that until recently we didn't even know existed – the *neutrino*. The sun floods the earth with vast numbers of them each day, but they mostly pass through it like ghosts. The neutrino seems quite pointless, so why did nature make more of them than anything else?

In this model, the waves that meet to give an electron also give a neutrino for a different phase. Digital waves can meet in two ways: *two heads* can overload one node to give an electron, or a *head and tail* can overload two nodes (Figure 4.5) to cancel into the smudge on space we call a neutrino, i.e. neutrinos are a necessary byproduct of electrons. Note that processing that cancels can still overload a channel and a tail-tail meet isn't possible because it implies a prior head-head state.

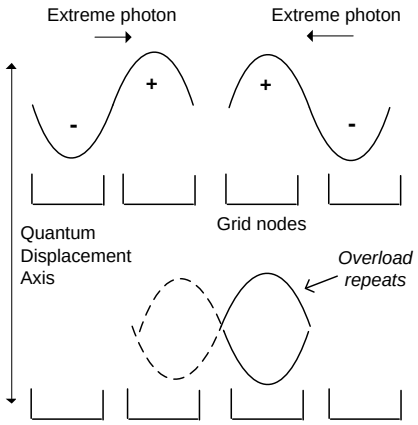


Figure 4.5. A neutrino channel reboot

The standard model expected neutrinos to have no mass at all just as they have no charge but their tiny mass was how we detected them in the first place. When asked why neutrinos have a variable *non-zero* mass but an *exactly zero* charge, the standard model is silent.

In Figure 4.5 exactly opposed photons would cancel but the quantum network like the Internet has no central control to synchronize node cycles. The universal flow of light synchronizes adjacent nodes (see 2.5.4) but this isn't perfect so the photons in a neutrino don't exactly cancel. Over many channels these asynchronies give the small processing excess we call its mass, even though the processing left over must be exactly zero. The neutrinos tiny mass but zero charge reflects the asynchrony of the quantum network.

To recap, a point of space is a network *node*, a photon is the core process that a node *channel* processes. Just as many planes cut a line, so any node axis has many channels, each with a bandwidth. The bandwidth of all the channels for one axis is a *Planck set.* Table 4.2 explains electrons and neutrinos in terms of:

1. *Total processing*, regardless of sign, that uses up the channel bandwidth. If all the channels of an axis repeatedly fill with processing, it repels external events and is *stable*.
2. *Net processing*, after cancelling out opposite displacements, defines *mass* as the processing calls needed.
3. *Net remaining processing* defines *charge* as the processing remainder carried over to the next cycle.

Electrons and neutrinos *survive* as entities by permanently denying other entities access to a quantum network niche. This *evolution of what is stable* is better than the standard model story of elementary particles that magically began at a big bang creation. This model also explains why electrons and neutrinos are brother leptons (that fill the channels of one axis) even though one is something and the other is almost nothing.

4.3.4. Anti-matter

[8] Wikipedia like others defines electric charge as causing electric phenomena and electrical phenomena as caused by electric charge.

Dirac's equations predicted anti-matter before it was found but it was never clear, even mathematically, why all matter had "evil twins" of the same mass but reverse charge. The standard model met this challenge by adding an anti-matter column without saying why, but that the matter we see has an inverse remains one of the most baffling discoveries of physics. Why does nature even allow anti-matter that can instantly annihilate matter? In this model, anti-matter is to matter as neutrinos are to electrons – a necessary byproduct.

Table 4.2. Lepton processing

Lepton	***Phase***	***Planck sets***
a. Electron	*Head* enters on axis A left	+1/2
	Head enters on axis A right	vs. +1/2
	Total processing (~stability)	**1 (full)**
	Net processing (~mass)	**+1**
	Remainder (charge)	**-1**
b. Neutrino	*Head* enters on axis A	+1/2
	Tail leaves on axis A	vs. -1/2
	Total processing (~stability)	**1 (full)**
	Net processing (~mass)	**~ 0**
	Remainder (charge)	**0**

A photon is a *finite* wave whose leading-edge amplitude must be up or down, so the first photon had to vibrate *first-up* or *first-down* on the surface of space, and all the others followed suit. Now a rotation *in* space changes its rotation direction as it moves, because clockwise from the back is anti-clockwise from the front (Figure 4.6a), but a rotation *on* a surface that is first up then down stays that way however it moves (Figure 4.6b). So *all* the photons from inflation that created matter turn the same way on space.

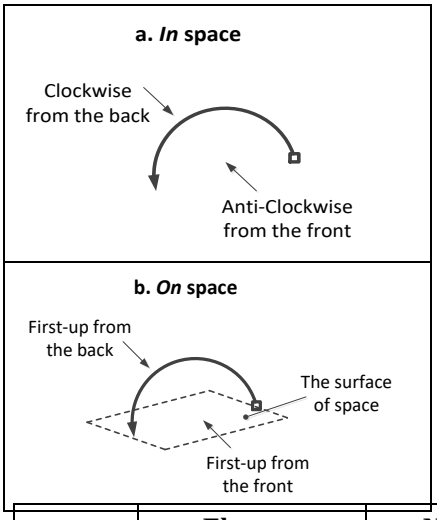


Figure 4.6. Rotation in and on space

Processing that sets a circle of values from a point can by definition set the same values in reverse by reversing each program instruction, so *processing implies anti-processing*. If an electron is two photon sets setting a circle of values one way, an anti-electron is setting the same values the other way, so reversing the processing of an electron gives an anti-electron. If *mass* is the net processing repeated and *charge* is the processing left-over, an anti-electron will have the same mass as an electron but opposite charge. All the basic leptons can now be shown as photon structures (Figure 4.7), where:

1. *Matter* is when *first-up* photons meet, giving an:
   i. *Electron*: Positive heads collide to give mass and the processing not done gives a negative charge (4.7a).
   ii. *Neutrino*: Positive heads nearly cancel negative tails giving a tiny mass, but the remainders cancel exactly to give zero charge (4.7b).
2. *Anti-matter* is when *first-down* photons meet, giving an:
   i. *Anti-electron*: negative heads collide to give mass, and the processing not done gives the positive charge (4.7c).
   ii. *Anti-neutrino*: negative heads nearly cancel positive tails giving almost no mass, but the remainders cancel to no charge (4.7d).

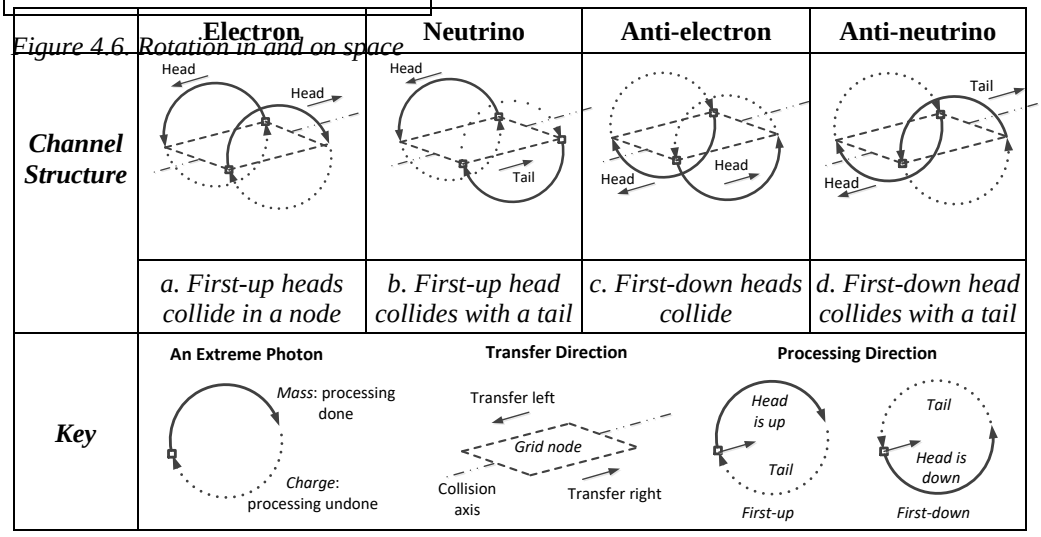


Figure 4.7. Lepton channel structures

In this approach:

1. The laws of physics are reversible because processing is reversible[9].

[9] Including the quantum wave equation.

2. Electrons and positrons annihilate into space plus photons that escape.
3. Quarks and anti-quarks as three-axis collisions don't annihilate (see 4.7.7).
4. Some mesons are their own anti-particles if their processing reversed is the same.

A standard model electron has no structure but in this model, it's photon structure defines its mass and charge.

4.3.5. Where is the anti-matter?

Anti-matter occurs in accelerator collisions but physics has never really explained it. In the standard model, matter and anti-matter are equal opposites so while negative electrons orbit atoms in our universe there could equally be an anti-universe where positive electrons orbit negative nuclei. In that world everything would seem the same to its inhabitants because the laws of physics would be *exactly* the same. So why do we see matter all around us? Did the big bang produce:

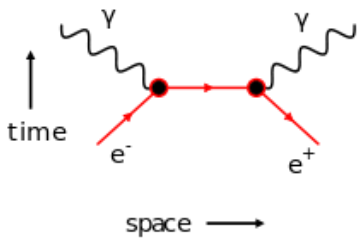


Figure 4.8. A Feynman diagram

1) No anti-matter, for some unknown reason?

2) Matter and antimatter equally, but the antimatter side of the universe is hidden?

3) Matter and antimatter equally, but matter somehow "overcame" antimatter?

Physics dismisses the first option by the standard model and the second because no anti-meteors, anti-planets or anti-stars are seen, so the current view is that the big bang made equal amounts of matter and anti-matter as per the standard model then "somehow" matter overcame anti-matter. That no data support this belief is called a "mystery" of physics:

"*The lack of anti-matter is a deep mystery that cannot be explained using the Standard Model.*" (Oerter, 2006) p101

Some say the universe is just a massive matter and anti-matter fluctuation that popped out of space and is still adjusting today, but the first event also began space, so if matter popped out of space what did space pop out of? Quantum fluctuations don't create space!

In this model, when the first photon chose processing over anti-processing it made our universe matter not anti-matter. The first light formed into matter only, not equal amounts of matter and anti-matter as the standard model says, because it all processed the same way with respect to space. The anti-matter the standard model struggles to explain away never was. The first photon chose to oscillate one way and from then on anti-matter was a path not taken. Nothing physical can explain why our universe is matter because that choice occurred before the universe began.

4.3.6. Anti-time

An objective time passes regardless, but a virtual time passes by processing cycles, e.g. games measure time in frames-per-second (fps), so a screen can literally slow to a crawl if the computer is busy with a big battle. In our world, we also measure time by the event cycles of atomic clocks that literally slow down as they move faster, i.e. are under load.

The assumption that time always works the same way doesn't apply to anti-matter (Ambjorn, Jurkiewicz, & Loll, 2008), e.g. in the Feynman diagram of an electron hitting an anti-electron, the latter *enters* the collision going *backwards in time* (Figure 4.8). The logic is symmetric, so to the anti-electron the electron is going back in time, but both electron and anti-electron are *entering* the interaction not leaving it. Feynman diagrams need dual time axes, one for matter *time* and one for anti-matter *anti-time*, because time is virtual.

Anti-processing requires a *time inverse*. Matter as processing has a tick of time for every forward cycle but anti-matter as anti-processing has a tick of time for every backward cycle. So anti-matter exists in anti-time as matter exists in time, but for matter a forward cycle is a tick of time and for anti-matter a reverse cycle is a tick of time. *To a matter being*, anti-matter runs time in reverse but *to an anti-matter being* we are running time in reverse. Matter exists by processing and anti-matter by anti-processing and their existence defines their time. This is only possible because our time is virtual.

To think that matter exists absolutely in a single time, leads to the idea of a timeless time, where every event that ever was or will be can be paged like a book (Barbour, 1999). Even Einstein wondered if we can go back and forth to different "slices" of time!

Quantum realism denies time travel because time travel denies the *choice* a virtual reality requires. Choice by definition picks an option from a finite set, any of which could be chosen. To time travel to a set point in the future the choices now must be known, else they aren't choices at all. Equally, if one can go back to redo prior choices the options now are undefined, so again time travel is impossible[10]. If the physical world is virtual, time travel is not possible.

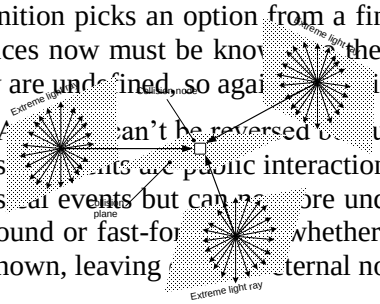


Figure 4.9. Three extreme light rays collide

Anti-time can't be reversed because by definition it loses all past data. Quantum entities try every option in private but physical events are public interactions based on a reboot that can't be undone[11]. Anti-matter can exist in anti-time *between* physical events but can no more undo its interactions than matter can. In our universe, physical events can't be reversed, rewound or fast-forwarded, whether by matter or anti-matter, i.e. there is no time travel. The past is gone and the future unknown, leaving only the eternal now.

4.4. QUARKS

Quarks constitute the nuclei of all the atoms that make up our world.

4.4.1 A triple collision

If neutrinos are strange then quarks are stranger because their charges come in unexpected *thirds* and the force binding them *increases* with distance, yet they still obey the equations of matter.

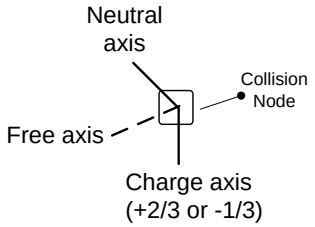


Figure 4.11. Three quark axes

The standard model sees quarks as distinct from electrons and neutrinos but in this model, they are the same thing just in two dimensions not one. Leptons are when extreme light collides on one axis with quarks the three-axis version of that (Figure 4.9). This very unlikely event must have occurred in the first plasma by the law of all action. Photons on any of the three axes half exist on the other two by the cosine rule[12], so any quark axis is one beam vs. two others at half strength, i.e. a lepton type collision. If it takes two beams to fill the channels of one electron axis, to fill the two dimensions of a plane needs four beams not three[13], so quarks can't be stable alone, which is true.

4.4.2 A three-way structure

The channel bandwidth for a node plane is two Planck sets, so in a three-axis collision each axis fills at two-thirds of a Planck set. A three-way meeting also raises the issue of order, as photons compete for channels on a first come first served basis. If a photon head entering a node meets a photon tail leaving it, the tail must start before the head or it would be a head, giving the rule that *tails fill channels first.* This gives the following options:

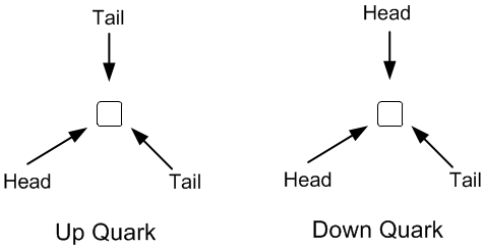


Figure 4.10. Up/down quark structure

1. *Head-head-head:* Three heads meeting at equal angles in a node allot processing equally to all axes, and so only partly fill all of them. Every axis has free channels that let other entities enter the node so the result isn't stable.
2. *Head-tail-tail:* If two extreme photon beams leave a node as another arrives, the tail sets first fill one axis with a plus two-thirds charge left over, then the remaining tails and the later

[10] If my going back in time causes my ancestor to die, I can't exist to go back in time.

[11] Networks can't *locally* reverse interactions, e.g. a browser Back button can undo passive views but it must roll back both parties for interactions like registrations. So with six degrees of separation, rolling back six events for one person could affect the entire web.

[12] A photon moving on axis X has a quantum amplitude on axis Y cutting X that decreases as Cos(θ), where θ is the angular displacement between X and Y. For a quark with three axes, each one has two others cutting it at 60^0, where Cos (60^0) is one half.

[13] Three extreme light rays colliding gives 1.5 Planck sets but to fill the channels of a plane of two axes needs two Planck sets. In Table 4.3, three half Planck sets partition as $\frac{2}{3}^{rds} + \frac{2}{3}^{rds} + \frac{1}{6}^{th} = 1.5$, where each axis fills at a $\frac{2}{3}^{rds}$ Planck set. The result is a half short of the two needed but gives an excess of free photons in one axis.

heads fill a neutral axis, leaving a sixth of a Planck set free in a third axis (Figure 4.10a). The result of one full axis with two-thirds charge and one neutral, and free photons in a third *is an up quark.*

3. *Head-head-tail:* If one beam has passed through a node as the other two arrive, the tails first cancel out the opposing heads with no charge left over, then the heads and the remaining tails fill another axis with a minus third charge, leaving again a sixth of a Planck set again free in the third axis (Figure 4.10b). The result, of two full axes, one with a minus third charge and one neutral, with free photons in a third, *is a down quark*.

Note that while the standard model *allocates* fractional charges to quarks after the fact, this model *derives* them. A tail-tail-tail meet is impossible because it implies a prior head-head-head event. A quark occupies a single node like an electron but instead of filling the channels of one axis it nearly fills those of a two-axis plane, which it completes with the help of other quarks in the next section. Table 4.3 shows details, where again mass is the net processing, charge is the net remainder and an axis is full if the total processing equals its bandwidth. Figure 4.11 shows the quark structure as:

Table 4.3. Quark processing details by axis

QUARKS	***Photon sets***	***Axis processing*** *(in Planck sets)*		
		Charge	*Neutral*	*Free*
Up Quark	*Tail* exits charge axis	-1/3	-1/6	
	Tail exits neutral axis	vs -1/3	-1/6	
	Head enters free axis	0	vs +1/3	+1/6
	Total Processing	**2/3 (full)**	**2/3 (full)**	**1/3**
	Net Processing	**-2/3**	**~0**	**±1/6**
	Remainder	**+2/3**	**0**	**0**
Down Quark	*Tail* exits neutral axis	-1/6	-1/3	
	Head enters charge axis	vs +1/3	vs +1/6	
	Head enters free axis	+1/6	+1/6	+1/6
	Total Processing	**2/3 (full)**	**2/3 (full)**	**1/3**
	Net Processing	**+1/3**	**~ 0**	**±1/6**
	Remainder	**-1/3**	**0**	**0**

1. *Charge axis*. Holds the quark charge, of up quark **+⅔** and down quark **-⅓**.
2. *Neutral axis*. Heads and tails cancel with no remainder.
3. *Extra photon axis*. The remaining one sixth Planck set of photons is "free".

The axes are at 60° although the photons met at 120° because quarks are head-tail mixes. A head has a tail behind and a tail has a head in front, so one axis always goes the other way, to let quarks link in a triangle (see 4.4.4).

4.4.3 The strong force

The strong force overcomes the huge electric repulsion of same charge protons to bind them in the nucleus of an atom. It has a very short range and the peculiar property that it gets *stronger* as quarks get further apart. It exchanges no energy so it isn't electro-magnetic, and it increases with distance so it isn't gravity. The standard model answer was a new *strong field,* new gluon *bosons* and a new color *charge*, whose red, blue and green values cancel to white as positive and negative charges give neutral. Massless gluons now carry red, blue and green charges that bind quarks in a proton, just as photons bind electrons to a nucleus but with three values not two. A red quark is turned blue by gluons, but three colors need anti-colors, so to turn a red quark blue needs an anti-red gluon and a nearby blue gluon as well. Yet the calculations worked, so when in 1978 the PLUTO project managed to interpret a three-jet Upsilon event in gluon terms, they joined the standard model pantheon. No-one asked why a *universal* field was needed for a *quark-only* effect.

In this model the strong force arises when quarks *share photons*, when an extreme photon has its head in one node and tail in another (Figure 4.12). The force increases with distance because as quarks separate the shared photon wavelength increases, releasing energy to pull them together. In the next chapter, matter moves by a reboot restart so stretching a photon increases the processing in the gap, making quarks more likely to restart there[14]. As quarks separate, more processing in the gap gives a stronger effect. Shared photons act like elastic bands, so quarks experience no force when close but as they separate more they are pulled together more. Note that:

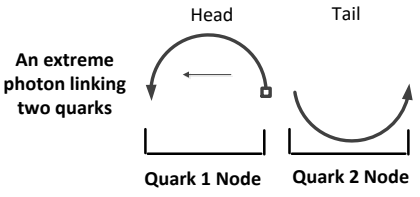


Figure 4.12. One photon in two quarks

1. One photon running in two quarks contributes all its processing, with no remainder.

[14] In the Chapter 5 all matter "moves" by probabilistic reboot, so at 10^{43} cycles a second, any processing bias gives movement.

2. Extreme photons have a two-node wavelength, so initially only form links with adjacent quarks.
3. Quark charge is unaffected because the charge axes aren't involved.

The strong force arises in quarks that have *excess* processing while electro-magnetism arises in electrons that have a processing *deficit.*

4.4.4 Protons and neutrons

The atomic nucleus, once thought indivisible, is now known to consist of protons and neutrons that in turn are made of quarks. A proton is two up quarks and a down and a neutron is two down quarks and an up, so the odd quark charges add nicely to give a positive proton and a neutral neutron (Table 4.4). If quantum entities "survive" by filling all available channels to deny other entities entry, how do quarks do this?

Table 4.4. Quarks give protons and neutrons

	Quark 1	Quark 2	Quark 3	Charge
Proton	Up $+^{2}/_{3}$	Up $+^{2}/_{3}$	Down $-^{1}/_{3}$	+1
Neutron	Up $+^{2}/_{3}$	Down $-^{1}/_{3}$	Down $-^{1}/_{3}$	0

If one quark's free photons insert their tails into another quark's neutral axis (Table 4.5A) and the displaced photons return the favor (Table 4.5B), the left-over processing cancels (Table 4.5C), i.e. the first quark completes. If the second quark does the same to a third quark it also completes, letting the third quark link back to the first to give a self-contained entity where photon sharing fills the deficit of all three quarks. This triangle structure is a proton or neutron depending on the quark mix (Figure 4.13).

Table 4.5. The strong link completes quark 1

	Quark 1 Free Axis	*Quark 2 Neutral Axis*
A. The free photons of quark1 insert their tails into quark2	[+⅙th] ---------->	(-⅙th)
B. Quark2 photons reciprocate	(-⅙th) <----------	[+⅙th]
	(-⅙th) <----------	[+⅙th]
	(-⅙th) <----------	[-⅙th]
		-⅙th
C. The quark 1 extra minus processing cancels the positive quark 2 remainder		+⅙th
Total Processing	⅔rds (full)	⅔rds (full)

Each quark needs a different axis setup to link in a triangle so the standard model's red, blue and green "charges" are *orientations*. Quarks as inert things need invisible agents to alter them, but for processing change is built in. Photons competing for channels naturally fill them not by central control but by each trying any channel it can. If a request fails because another got there first, it just tries again.

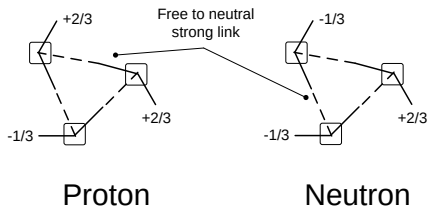


Figure 4.13. Proton and neutron structures

Processing fills channels as water fills stacked wine glasses - if one is full it just flows to the next until every full and water fills every glass. There is no central control allocating the water to glasses. In this analogy, when all the water (processing) fills all the glasses (channels) the system restarts, i.e. the glasses empty and another cycle of processing "pours" again. Protons and neutrons form because they are *stable*, i.e. resist change by filling all the channels of two dimensions, not because some invisible agent pulls them together.

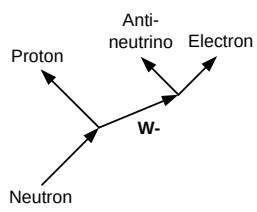
4.4.5 The weak force

A neutron that is stable in a nucleus turns into a proton after about fifteen minutes alone in empty space. One of its down quarks "flips", to become an up quark, which makes the whole a proton. The standard model needed *some agent* to cause this and gluons couldn't, so it looked for a new *weak* force that had to:

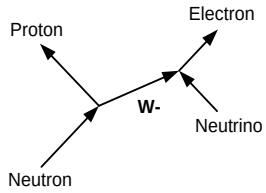
1. *Affect all particles*. Electromagnetism affects charges/magnets, gluons affect quarks, but the weak force affects all matter.
2. *Violate parity-symmetry*. Weak interactions are left-right different.
3. *Have no bound states*. Electromagnetism binds atoms in molecules, the strong force binds nucleons in the nuclei, gravity binds stars in galaxies, but the weak force binds nothing.

4. *Be asymmetric*. Neutrons decay into protons but protons are stable in space.

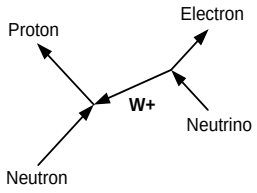
Neither strong nor electro-magnetic forces act like this, so the standard model met the challenge by the now standard practice of inventing a new *field* with new *bosons* and new *charges*. The equations worked if the new *isospin* charges (+½, -½) were retro-fitted so charm quarks interacted with down quarks but not up quarks, etc. The problem was the boson agents needed were heavier than protons and a field *absorbing and emitting mass* was unheard of. Yet by now the norm for "proving" virtual agents was that the equations worked and that the change matched energy resonances found among billions of accelerator collisions. When in 1983 CERN found million, million, million, millionth of a second values in the expected range, *weak bosons* immediately joined gluons in the standard model pantheon. On this flimsiest of evidence physicists today claim that:



a. A neutron emits a W- to decay into a proton:
$N \rightarrow P^+ + e^- + \underline{\nu}$



b. A neutron emits a W- as it interacts with a neutrino:
$N + \nu \rightarrow P^+ + e^-$



c. A neutron absorbs a W+ as it interacts with a neutrino:
$N + \nu \rightarrow P^+ + e^-$

Figure 4.14. Standard model neutron decay routes

> "*Experiments have observed three bosons that carry the weak force*" (Marburger, 2011) p221.

Yet CERN didn't observe any bosons *carrying* anything, it just observed flashes in one place that matched changes in another. Imagine if a court prosecutor claimed a knife found somewhere was the murder weapon because it was the same size! No law court in the land would accept that, so why does physics accept the equivalent? No evidence at all linked the signal CERN found to the weak effect but it became accepted that neutrons decay when a *tiny* down quark emits a *massive* W boson into an *invisible* field[15]. The equations testified that a neutron could decay in any of three ways, as it could:

1. Emit a W^- that decays into an electron and anti-neutrino (Figure 4.14a), OR
2. Emit a W^- boson that is hit by a neutrino to give an electron (Figure 4.14b), OR
3. Interact with a neutrino and a W^+ boson to give an electron (Figure 4.14c). Three different causes for one effect might seem better than one, but are three different alibis for a murder better than one? That a quark *could* emit a W- into a field or *could* absorb a W+ from one is the sort of after-the-fact reasoning science was designed to protect us from. The equations were also reversible, leading to a fruitless thirty-year search for proton decay. Currently, the massive Kamioka experiment estimates the free proton half-life at over a billion, billion, billion years. Yet the goal of field theory never was to predict but to justify *renormalization*, the mathematical trick that pulls physical reality from the quantum hat[16].

Reverse engineering offers another alternative. If a down quark is a *head-head-tail* photon mix, and an up quark is *head-tail-tail* set, a neutron will become a proton if a set of photon *heads become tails*. If a neutrino hits a quark the right way the processing can rearrange so every quark head becomes a tail for one axis, as Figure 4.15 shows for one channel. This doesn't alter the net remainder so it isn't electromagnetic, no photons are shared so it isn't strong, and it affects any head/tail photon mix, i.e. all matter.

[15] A down quark of mass 4.8 MEv "emits" a W boson of mass 80,400 MEv!

[16] Renormalization makes the infinities of field theory go away by requiring particles to interact via other particles not directly, in what are called Yang-Mills interactions. Digitizing the interactions has the same effect.

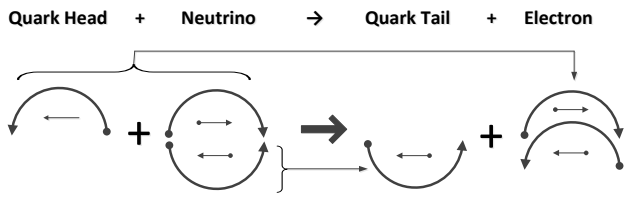


Figure 4.15. A neutrino converts a quark head into a tail

If a neutrino hitting a neutron just right can make it a proton then beta decay, as its equation implies[17], is due to neutrinos all around us, which predicts that a neutron in a space with no neutrinos won't decay. Conversely, a proton needs an electron hit to turn its tails into heads, but to get an electron next to a quark takes a lot of energy, so proton decay only occurs in the hearts of stars. W bosons, like gluons and fairies at the bottom of the garden, are made-up agents.

4.4.6 The Higgs fairytale

The mass of weak bosons had to come from somewhere, so the answer was of course *another field!* This was needed to sustain what sustained the particle business, so the search for The Higgs became the holy grail of physics, attracting over 30 billion dollars in funding. Then in 2012, after a fifty-years searching, CERN found a resonance in the right *range*[18] and physicists all over the world breathed a sigh of relief - the standard model lived on! Finding a million, million, million, millionth of a second 125GeV signal meant the fairy-tale lived on, but as some noted the Higgs:

1. *Adds no value.* The Higgs flash adds no value to general relativity, our best theory of mass to date, nor does it explain the dark energy and dark matter that is most of the universe. Its only role to rescue the standard model:

   "… the Higgs field allows us to reconcile … how … weak interactions work, that's a far cry from explaining the origin of mass or why the different masses have the values they do." (Wilczek, 2008) p202

2. *Is circular logic*. A Higgs with mass creating mass is circular, as what gives it mass? If another Higgs, what gives it mass and so on? A Higgs that begets itself is indeed a God particle! If *the field itself* creates the mass as some say, what does the Higgs boson do? Wasn't it to avoid invisible fields causing visible effects that bosons were invented in the first place? That like must create like is a medieval idea. In science, water comes from hydrogen and oxygen gases that aren't themselves watery, and in quantum realism mass comes from massless photons.

3. *Contradicts quantum theory*. All quantum particles with mass are spin-half particles and mass without spin contradicts quantum theory, so a massive spin-zero point particle is impossible (Comay, 2009). All point particles spin and only matter-antimatter mixes like mesons have spin zero.

4. *Isn't proven*. No evidence links the signal CERN found to mass creation. If finding a resonance proves a virtual agent does not finding one deny it, as no gravitons have been found? One can't have it both ways.

5. *Could be a meson*. In a carefully crafted press release, CERN claimed that zero-spin would confirm the Higgs, then found it so. But not-yet-found higher order mesons also have zero-spin, are in that mass range and have the same photon decay and detection frequency. There is a good case that this is a top or anti-top meson.

The *Higgs emperor has no clothes*. It explains at best 4% of the mass of the universe, is circular logic, contradicts quantum theory, has no causal basis and could be a high order meson. That what at best explains at best a tiny percentage of the mass of the universe is now seen as the origin of mass is a tribute to the power of marketing, not science. The Higgs boson is a virtual agent created by an invisible field to explain another virtual agent created by another invisible field to explain an actual effect (neutron decay). As one invisible field is invented to explain another, the standard model today is a theoretical house of cards.

4.4.7 Mass is processing

In physics, mass began as weight or *gravitational mass*, but after Newton it also became the force needed to move it, i.e. *inertial* mass. They are not the same, as an object that is weightless in space still needs a force to move it, i.e. has

[17] In beta decay, neutrons convert to protons by the equation: $N + \nu \rightarrow P^+ + e^-$, as a neutron is hit by a neutrino. Protons become neutrons by inverse beta decay: $P^+ + e^- \rightarrow N + \nu$, as a proton is hit by an electron. Why insert fictional bosons into these equations?

[18] The researchers note: "*The theory does not predict a specific mass for the Higgs boson*." (CMS collaboration, 2012), so any high mass particle would have done the job.

inertial mass. If momentum is mass times velocity, a massless photon should have no momentum but solar sails move when the sun shines on them and photons are bent by the gravity of the sun, so Einstein proposed that a photon with no *rest mass* gains *relativistic mass* as it moves giving momentum[19]. While mass began simple it is today a complex concept, as some even wonder if dark matter is a property of space, i.e. if space has mass.

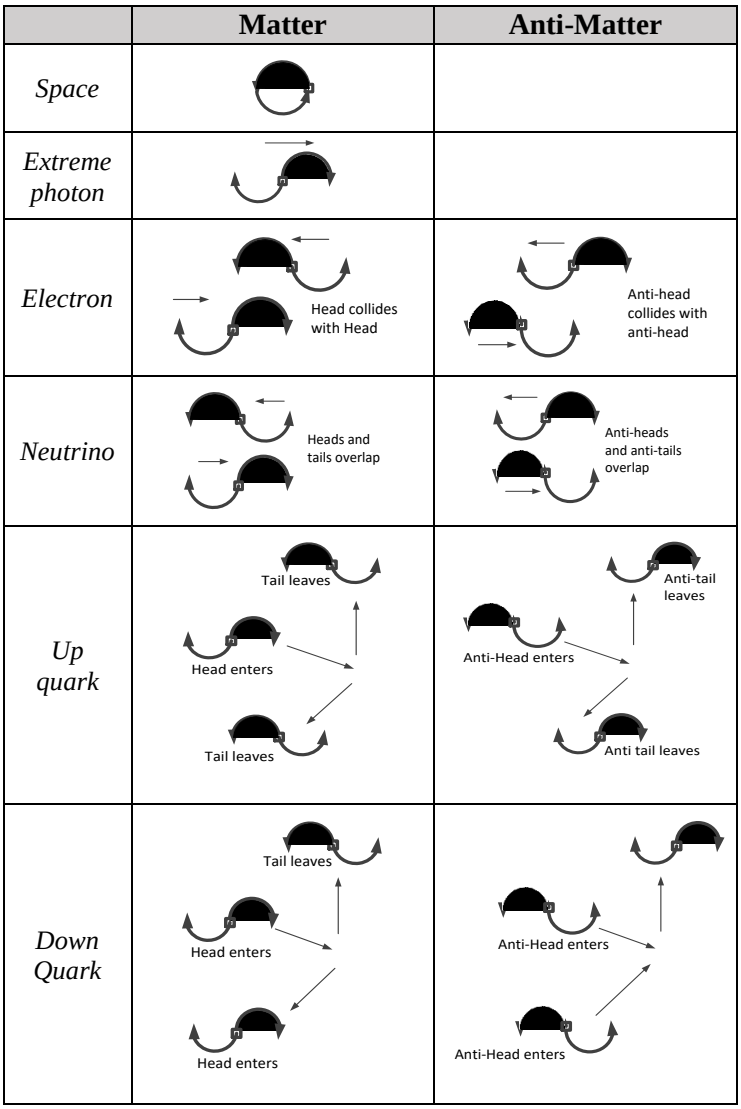


Figure 4.16. The basic processing combinations

In Chapter 2 empty space was a null program, so it isn't empty at all. In Chapter 3 every photon was the same processing distributed more or less, and the entire electro-magnetic spectrum was just variations in the processing transfer rate, i.e. energy. In this chapter matter is a system glitch, a program exception that repeats forever and charge is the left-over code that never runs. The mass, energy and charge of quantum entities then connect as follows:

1. *Space.* Empty space is one Planck program running in one node. The net processing is zero so it has no mass, the transfer rate is zero so it has no energy and a zero remainder means no charge.
2. *Photon.* A photon can't stop to be weighed but its net processing per cycle gives it mass, it transfers processing at some rate so has energy, and no processing left over means it has no charge.
3. *Electron.* An electron fills the channels of a node axis with positive instructions. It has net processing so it has mass, and the remainder gives a negative charge. The next chapter covers kinetic energy.
4. *Neutrino.* A neutrino's axis channels are filled with positive and negative instructions that nearly cancel to give a tiny mass while the remainders cancel to zero charge. Unlike space, it is two Planck programs not one.
5. *Quark.* A quark is a three-way photon collision that can't quite fill the channels of a plane. Being symmetric its net processing repeats so it has mass, and the remainder gives one-third charges according to phase (up or down).
6. *Anti-matter*. Anti-matter versions of electrons, neutrinos and quarks are derived by reversing the processing. The net processing demand is the same giving the same mass, but an opposite remainder gives an opposite charge.

All the basic entities of physics can be represented as processing combinations (Figure 4.16).

4.4.8 The energy of matter

Bohr's equation is that the energy of a photon is its frequency multiplied by Planck's constant (see 3.2.8). If a photon is a Planck program spread out, the data throughput per node, or energy, reduces as more nodes share the same program, so as wavelength increases energy decreases. Conversely as wavelength decreases, fewer nodes running the same program increase the energy transfer rate. Each node of a shorter wavelength gets a bigger share of the program and so runs it more often per second, so photon energy increases with frequency. More exactly, if Planck's constant is the transfer of one

[19] Relativistic mass is defined by special relativity. Rest mass is mass with no relativistic effects.

Planck program per second, the node transfer rate (energy) will be Planck's constant times its frequency, i.e. Bohr's equation[20]. It is also Planck's constant divided by its wavelength times the speed of light[21].

Einstein's equation, $E=mc^2$, does for matter what Bohr did for light – defines its energy. In 1905 he deduced that the energy of matter is its mass times the speed of light squared, and nuclear bombs confirm this, but it has never been clear why mass relates to light at all. If mass is something inherent, why does its energy relate to the speed of light? In this model, an electron is many channels filled with light waves repeatedly colliding. Each channel contains the equivalent of a photon with a one node wavelength, whose energy by Bohr's equation is Planck's constant times the speed of light divided by one Planck length. Planck's constant is one Planck program of mass transferred over a Planck length squared per Planck time, so substituting for Planck's constant in Bohr's equation gives Einstein's equation for mass and energy[22]. $E=mc^2$ because matter is light condensed.

4.5. FIELDS UPON FIELDS

A century of physics has produced a model of invisible fields whose virtual particles cause all the forces of nature. The equations work, but does empty space really consist of fields upon fields?

4.5.1 The frog in the pan

Faraday's invention of an invisible field around an electric charge was considered fanciful until Maxwell's equations defined it but today fields explain everything in physics. A field is a *disembodied force* that can act at a distance, and even Newton, centuries earlier, had issues with this:

"*That gravity should be innate, inherent and essential to matter, so that one body may act upon another at a distance thro' a vacuum, without the mediation of anything else … is to me so great an absurdity, that I believe no man … can ever fall into it. Gravity must be caused by an agent…*" (Oerter, 2006) p17

Maxwell deduced his equations from ball-bearings twisting in vortex tubes, but his physical model didn't work out. The Newtonian mindset needed a force-carrier, so when a magnetic field moves an iron filing some *agent* must do that. *Field theory* came up with the idea of *boson agents*, virtual particles that cause an effect and are instantly consumed by the act e.g. the graviton is the invented boson agent for gravity. The standard model was born when Maxwell's equations were interpreted as virtual photon transfers caused by Faraday's invisible fields. An invisible field that existed itself was not ok but an invisible field that created particles was. Particles that can't be observed contradict science, but physicists could *see them in the equations*. Recognizing invisible photons no-one could see acting seemed a small price to pay to confirm that only particles caused forces and carry on calculating.

Unfortunately, the model then grew by analogy as new forces coming along needed new fields: the strong force needed a strong field, the weak force needed a weak field and weak particles needed the Higgs to explain their mass. Each new field came with virtual particles to cause its effects: electro-magnetism had photons, the strong field had gluons, the weak field had W bosons and the Higgs field had the Higgs boson. The force of gravity stubbornly resisted as no gravitons were found, but as physics pasted field upon field, the original massless, charge-less photons were joined by gluons with color charge, weak bosons with mass, and a Higgs so big it needs a billion-dollar accelerator to find it. All this, to support the canon that:

"…the forces of Nature are deeply entwined with the elementary particles of Nature." (Barrow, 2007) p97

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[20] Let one photon be a Planck program distributed over the nodes of its wavelength. If energy E_P is the net transfer rate at a node, Planck's constant h_P is the transfer of one Planck program a cycle, and the frequency f is how often a photon program cycles per second at a point, the net transfer rate at a node must be the transfer rate of one Planck program per cycle times the frequency, i.e. $E_P=h_P.f$, or Bohr's equation $E=h.f$.

[21] If wave velocity $v=\lambda.f$ then for a photon $c=\lambda.f$. So $E_P=h_P.f$ becomes $E_P=h_P.c/\lambda$ for any photon.

[22] In this model, the speed of light $c=L_P/T_P$, for L_P Planck length and T_P Planck time. A photon's energy $E_P=h_P.c/\lambda$, for h_P the energy of a Planck program transfer, c the speed of light and λ the wavelength. In an electron λ is one node, so $E_P=h_P.c/L_P$. If mass m_p is the program that repeats, h_p transfers m_p over a Planck length square every cycle, i.e. $h_P=m_p.L_P.L_P/T_P$. Substituting gives $E_P= m_p.L_P.c/T_P$, or $E_P=m_p.c^2$. This derivation doesn't prove $E=mc^2$. Einstein did that based on how our physical world behaves. It just finds this model consistent with Einstein's equation.

In current physics, invisible photons pop in and out of space to cause electro-magnetic effects. They can't be seen because the field creates them and the effect absorbs them, so to see one is to destroy it. All we really know is that electro-magnetic changes occur in photon amounts and that photons exist, and virtual photons were *deduced* from this. Once the logic was accepted, one just needed an energy spike matching an equation term to invent a virtual boson. Virtual particles are the physics equivalent of a blank check, as they can explain any energy effect if particle accelerators find a match among their billions of events. Once physics accepted invisible causes it couldn't go back. Each new creation weakened it scientifically like a frog in a pan of water heating up[23], until physics is now enmeshed in a fiction it can't escape from.

4.5.2 Boson inventions

A processing model sees the same facts but explains them differently. Electro-magnetic effects occur in photon units because the photon's processing is the basic network operation. Electromagnetic effects *look like photon effects* because the same processing underlies both. The network changes in photon amounts that is its core command. The link between photons and electro-magnetism is correlation not causation, and confusing these is the oldest error in science[24].

In dynamic systems, things change because they can with no agents needed, e.g. an electron can fall to a lower energy orbit without an "orbit boson" to make it do so. In this model, the "forces" of physics are just natural effects:

1. Electro-magnetism. Where the standard model sees virtual photons a processing model sees a processing network changing in Planck program units, so photons exist but virtual photons don't.

2. The strong effect. The standard model needed a new field, three charges and eight bosons to explain the strong effect, but in this model quarks just share free photons to strongly link. The color *charge* is just an axis *orientation* that varies naturally until a stable result occurs, with no magical gluon agents needed.

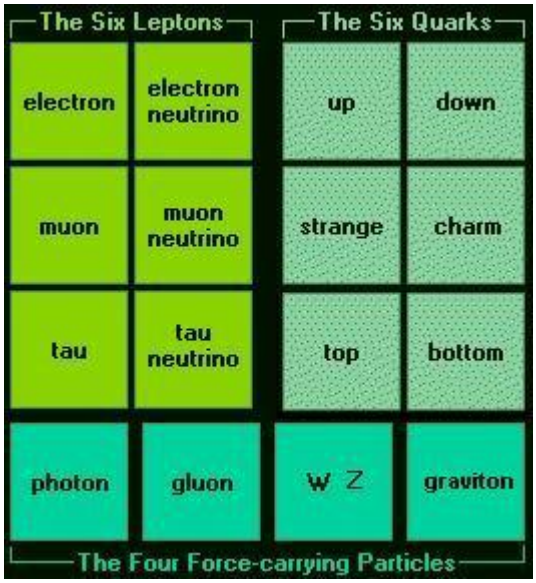

Figure 4.17. The standard model *iconography*

3. The weak effect. The standard model needed another field, three more bosons and two new charges to explain beta decay, and still couldn't say why protons don't decay. In this model it is just a neutrino effect, and reverse beta-decay is an electron effect that only occurs in stars. Weak bosons are again unnecessary imaginary agents.

4. The Higgs. If weak bosons don't exist the Higgs boson isn't needed. CERN just added yet another species to its already overflowing menagerie of pointless "particles", as what is transient is what failed in the evolution of matter.

5. Gravity. Gravity was the first field and every attempt to find gravitons has failed, but standard model iconographies still display it as if it were proven (Figure 4.17). No particle exchange model of gravity can ever emerge, as bosons **in** a space-time canvas can't alter space or time as gravity does. In Chapter 5 gravity is the *grid processing gradient*.

As the standard model pastes *field upon field*, the virtual particles they create must interact, as the Higgs boson interacts with W bosons to give them mass. So what rules define the interactions of this new world of virtual particles? A quark feels the electric, magnetic, strong, weak, Higgs and gravity forces, so if a virtual photon, gluon, weak boson, Higgs and graviton appear *at the same time*, how do they interact? If a Higgs creates matter and an anti-Higgs creates anti-matter, what happens if they meet? To say that virtual bosons only interact to make our equations work is quite unsatisfactory.

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[23] In this story, a frog dropped in a pan of hot water jumps out immediately, but if put in tepid water that is slowly heated, by the time it sees the problem it is too weak to jump out.

[24] The number of ice-creams sold in America correlates with deaths by drowning, so do ice-creams kill? In Europe, the number of stork nests correlates with human babies born, so do storks bring babies? In both cases, X and Y correlate because both are caused by a third agent Z, namely the weather, not because they cause each other. Correlation is not causation.

For each new *effect* the standard model has a new *field* but this model has only one *quantum field* with one core *Planck process*. Why invent virtual particles to do the dirty work of fields if electro-magnetism is a photon change, the strong effect is photon sharing, the weak effect is a photon head-tail swap, and the Higgs and graviton are just fictional?

4.5.3 Occam's Razor

Occam's razor, not to multiply causes unnecessarily, is the pruning hook of science. Last century the physical realism was a simple theory of mass, charge and spin, but today the standard model needs isospin, hypercharge, color, chirality, flavor and other esoteric features to work. This model of sixty-two core particles[25], five invisible fields, sixteen charges and fourteen bosons has so many ad-hoc properties that if it were a machine, one would have to hand-set over two dozen knobs just right for it to light up (Table 4.7). If physical realism is preferred today, it isn't because of its simplicity.

For this complexity one might expect completeness, but the standard model doesn't explain gravity, proton stability, anti-matter, quark charge, neutrino mass, neutrino spin, family generations, quantum randomness or inflation. Nor does it explain dark energy or dark matter, i.e. *most of the universe*. And *it grows* with each new thing, so inflation needs an inflation field[26] and neutrino mass needs another 7-8 arbitrary constants:

"*To accommodate nonzero neutrino masses we must add new particles, with exotic properties, for which there's no other motivation or evidence.*" (Wilczek, 2008) p168.

Table 4.7. Fields, charges and bosons of the standard model

Field	Charges	Bosons
Electro-magnetism	+1, 0, -1	Photon (1)
Strong	Red, Green, Blue, White, Cyan, Magenta, Yellow, Clear	Gluon (8)
Weak	+½, 0, -½	W^+, W^- & W^0 (3)
Gravity	1?	Graviton (1?)
Higgs	1?	Higgs particle (1?)
Total = 5	**Total =*16***	**Total =*14***

Like the plant in The Little Shop of Horrors movie, the standard model *feeds* on what is around it rather than adding value.

4.5.4 The standard model toolkit

The standard "model" is actually a *toolkit* designed to handle results *after they occur*. It absorbs rather than predicts data so when anti-matter was found it added new columns and when family generations came along it added new rows. When mesons were discovered someone said "*Who ordered that?"* but then they became bosons that carried no force! When new facts arrive, the standard model uses an existing structure or builds a new wing to accommodate them.

It is hard to pin down a "model" that morphs with each new result, e.g. the standard model includes gravitons that a long search hasn't found, so was that a fail? It predicted proton decay but twenty years of experiments have pushed their lifetime to that of the universe, so was that a fail? It considers matter and anti-matter symmetric, so does our universe of matter contradict it? It expected massless neutrinos until oscillation experiments gave them mass, and penta-quarks and strange quarks until a two-decade search found neither. Today it predicts that weakly interacting particles (WIMPs) will explain dark matter, but again a long search has found nothing. When the facts cut off one standard model "head", like a hydra, it just grows another. Indeed it is unclear what exactly it would take to falsify a model whose failures are called "unsolved problems in physics". Each failure is just another opportunity to tweak or grow it.

Standard model equations can calculate results to 10^{12} decimal places but *reliability isn't validity*. Equations that *interpolate* between known points aren't theories that *extrapolate* to new points. An equation is a summary of current data while a theory is vision of the future. Generations of physicists, fed on equations not science (Kuhn, 1970), confuse equations and theory. As Georgi says:

"*Students should learn the difference between physics and mathematics from the start*" (Woit, 2007) p85.

[25] Two leptons with three generations plus anti-matter variants is 12. Two quarks with three generations plus anti-matter variants and three colours is 36. Plus one photon, eight gluons, three weak bosons, one graviton and the Higgs is another 14. The total is 62.

[26] A hypothetical *symmetron field* has been proposed to explain inflation post hoc.

The standard model claims that it predicted top and charm quarks before they were found, but after three generations of leptons and two of quarks, expecting a third quark generation was like predicting the last move in a tic-tac-toe game. It also says it predicted gluons, W bosons and the Higgs, but inventing invisible agents based on data-fitted equations isn't prediction. Fitting equations to data then matching their terms to transient resonances in billions of accelerator collisions is the research version of tea leaf reading – look hard enough and you'll get a result[27]. The standard model grew itself not our understanding. Its answer to why a top quark is 300,000 times heavier than an electron, which is "*because it is"*, doesn't work. What baffled physics fifty years ago still baffles it today because equations can't go beyond the data set that created them. The last time such a barren model dominated thought so completely was before Newton.

4.5.5 The last standard model

In the second century, Ptolemy's Almagest let people predict the movements of the stars for the first time, based on the idea that heavenly bodies, being heavenly, moved in perfect circles, or in circles within circles (epicycles), around the Earth. *It wasn't true,* but the equations worked so for centuries Ptolemy's followers calculated the stars by epicycles. As new stars were found, they amended the model, making it more complex and themselves more expert. This medieval standard model only fell when Copernicus, Kepler, Galileo and Newton developed a causal model to replace it. Today's standard model operates like the Ptolemaic standard model because both are:

1. *Descriptive*. Descriptive models describe what is but not why it is so. Describing data patterns is the first step of science, as it develops *causal theories*.
2. *Parameterized*. Ptolemy's model let experts choose the free parameters of epicycle, eccentric and equant to fit the facts, just as the standard model of today lets experts choose the free parameters of *field, bosons and charge*.
3. *Retrospective*. Ptolemy's model defined its epicycles *after* each new star was found, just as today's standard model bolted on a new field *after* each new force was found.
4. *Barren*. Descriptive models can only interpolate, so the Ptolemaic model would *never* have deduced Kepler's laws, and likewise today's standard model will *never* deduce that matter is made of light.
5. *Complex*. Medieval astronomers tweaked Ptolemy's model until it became absurdly complex, just as today's standard model equations fill pages and those of its string theory offspring fill books.
6. *Normative*. The Ptolemaic model was the norm of its day, so any critique of it was seen as an attack on those in charge, and likewise today any standard model criticism is seen as an attack on physics itself (Smolin, 2006).
7. *Wrong*. Ptolemy's model *mostly worked* although planets don't move in circles around the earth, and likewise today's standard model calculations *mostly work* although virtual particles don't actually exist.

The standard model is a *descriptive model* that should have evolved into a *causal theory*[28], but it couldn't. This left physics with these options: to deny meaning (Copenhagen), to fantasize about many worlds (Everett, 1957) or to go it alone with pure mathematics (string theory). None of them worked out, leaving physics with a *descriptive model it doesn't believe in.* Physics today is about electro-magnetic vibrations in a plane that doesn't exist and quantum waves don't *really* spread or collapse, i.e. it is in semantic denial of own theories!

When the medieval church pressured Galileo to recant they didn't ask him to deny the earth went round the sun, just to call it a mathematical fiction used by astronomers, not a reality description. Today, physicists *voluntarily* talk of quantum theory this way, as a mathematical fiction not a reality description, following Bohr's statement:

"*There is no quantum world. There is only an abstract quantum mechanical description*." Newton, p244

Quantum realism is the opposite view, that there *really is* a complex dimension beyond space and that quantum waves *really do* spread collapse instantly to a point from anywhere in the universe, i.e. quantum theory is literally true.

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[27] The folded paper fallacy is to think of a shape, fold a paper many times, unfold it and look at the creases until the shape thought of appears. If not try again, as by Wyszkowski's Second Law *anything can be made to work if you fiddle with it long enough*.

[28] In research methodology, after describing patterns comes finding correlations and finally attributing causes (Rosenthal & Rosnow, 1991). In scientific method terminology, current physics has stalled at the descriptive level.

4.5.6 The particle myth

The particle myth is that physical reality breaks down into fundamental particles and smashing things apart is how to find them. Physical reality *divides* into the fermionic matter we see and virtual bosons that explain distant effects (Figure 4.18). The world *breaks down* into parts that are fundamental if *we* can't break them down further. Current physics sees everything as a particle as a boy with a hammer sees only nails, but it can't say what its *particles* are actually made of. If pressed it retreats to wave equations that don't describe particles at all. This bait-and-switch, showing a particle but giving a wave equation, works because they are trained not to look behind the curtain of physical reality[29]. When asked what it all means they refer you to esoteric equations they say are just fictional! Feynman explains how this double-speak began:

> "*In fact, both objects (electrons and photons) behave somewhat like waves, and somewhat like particles. In order to save ourselves from inventing new words such as* wavicles, *we have chosen to call these objects* particles." (Richard Feynman, 1985) p85

So instead of searching for a fundamental wave, physics spent most of last century and billions of dollars trying to batter matter into its basic bits. It found "fundamental particles" that are:

1. *Transient*. Is a million, million, million, millionth of a second energy spike a particle? Do particles come and go like that?
2. *Variable*. Particles should have mass by their inherent substance, but mass today is a running value that varies with context.
3. *Classifiable*. Fundamental particles shouldn't be classifiable but a tiny electron, a massive Tau and an anti-electron are all leptons.
4. *Subject to decay*. If a top quark with the mass of a gold nucleus of 79 protons and 118 neutrons is "fundamental" why does it decay? When a neutron emits an electron to become a proton, three fundamental particles become four, so how are they fundamental?

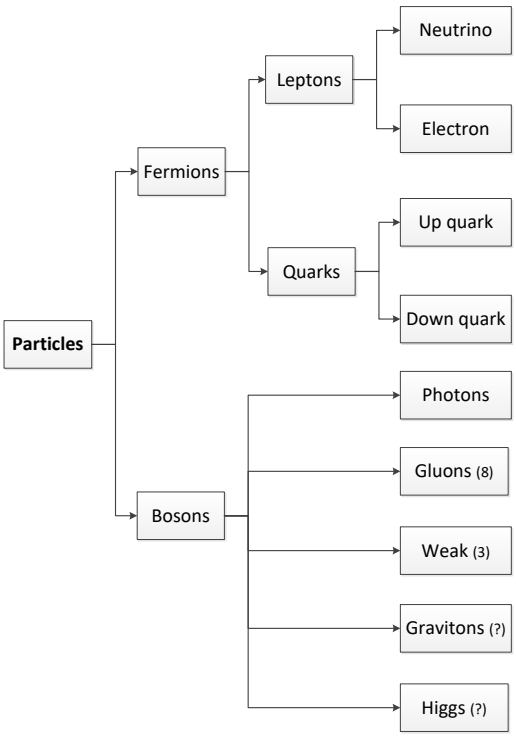

Figure 4.18. The particle model

Entities that decay and transform into each other aren't fundamental, because fundamentals don't break up or reform. Nor can one classify the fundamental as classifying requires something in common that must be more fundamental. If a particle is substantial by its mass why does mass change with speed? A lightning flash is long-lived compared to the particles of physics today. We don't call a brief eddy in a stream a thing so why does physics call transient quantum eddies particles? It is now obvious that the fundamental particles of the standard model are *neither fundamental nor particles.*

4.5.7 Quantum wave theory

The alternative to particle theory is quantum wave theory, that reality consists of quantum processing waves. While inherent particles can only combine by *aggregating*, waves can *superpose*, and processing waves can also *restart*. Particle theory doesn't let massless photons combine to create mass, but quantum waves on a network can give the standing quantum waves we call electrons. In this view, the *fundamental process* is the Planck program that underlies not only all photons but also all matter (Figure 4.19), so it is possible for one photon to boot-up everything. In the *first event*, a primal reality "moved", like a drop of water falling on a still pond, creating ripples we still feel today. In this view:

1. Matter is made of light.

[29] The Wizard of Oz tells Dorothy: "*Pay no attention to that man behind the curtain*", to distract her from what is really orchestrating events. Likewise, physicists are asked to pay no attention to the quantum waves behind the curtain of physical reality.

2. Everything is quantum waves.
3. The universe is evolving.

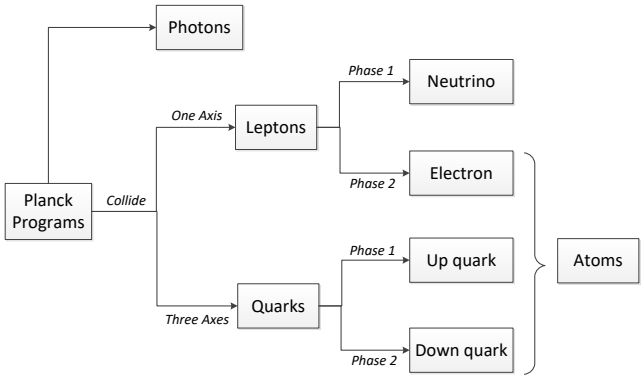

Figure 4.19. A quantum processing model

4. Matter and charge are related
5. The universe came from something.
6. The particle zoo that particle accelerators found are wave mixtures that failed the test of evolution - survival.
7. Virtual bosons are made-up inventions.

The particle model tries to reduce the *complexity* of life to a Lego-set of fundamental pieces and fails. In a wave model, complexity is *simplicity combined*, just as one line of complex code repeated gives the endless Mandelbrot set (Figure 4.20).

4.5.8 Testing the theory

According to the standard model, matter collides by a basic substantiality that light does not have, so:

"*Two photons cannot ever collide. In fact light is quantized only when interacting with matter.*"[30]

Quantum realism predicts that *extreme light in empty space will form matter*, and lest this seem fanciful note that:

1. *Photons confined have mass*. A free photon is massless but if confined in a hypothetical 100% reflecting mirror box it has a rest mass, because as the box accelerates unequal photon pressure on its reflecting walls creates inertia (van der Mark & t'Hooft, 2011). By the same logic, photons tangled in a node will have mass.
2. *Einstein's formula.* That matter is energy works both ways, so if nuclear bombs can turn mass into energy, photon energy can create mass. In the Breit-Wheeler equation, high energy photons can create matter.
3. *Particle accelerator collisions* routinely create new matter. Protons that collide and stay intact give new matter that didn't exist before. If this matter comes from the collision energy, why can't high energy photons do the same?
4. *Pair production.* High-frequency light near a nucleus gives electrons and positrons that annihilate back into space.
5. *Light collides.* When high-energy photons at the Stanford Linear Accelerator Center hit an electron beam accelerated at almost the speed of light, some electrons knocked a photon back with enough energy to hit the photon behind it, giving matter pairs that a magnetic field pulled apart to detect (Burke & et al, 1997).

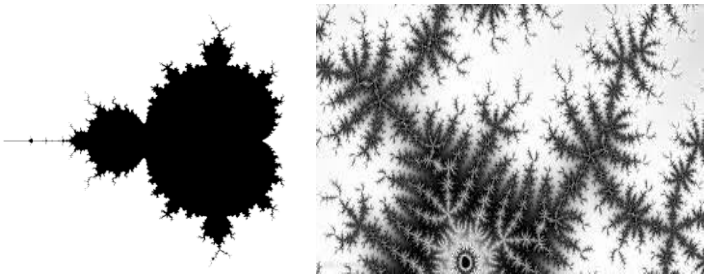

Figure 4.20. Mandelbrot's set, a. Main, b. Detail

That light alone can form matter is a testable prediction but the definitive experiment that contradicts the standard model hasn't been done yet. When beams of pure light in empty space create matter the boson-fermion distinction will fall, and with it the standard model. The future of physics lies in merging light not smashing matter apart, as a wave can't be understood by trying to divide it. Evolution is about what survives, so the accelerators that physics has poured its money into are just finding evolutionary failures. When mankind builds light colliders instead of matter colliders it will learn that light created matter.

4.6. THE EVOLUTION OF MATTER

The matter of our universe didn't arise all at once but evolved over time in a process called *nucleosynthesis*, the building up of complex matter from simple matter.

[30] Accessed August, 2010 from http://en.wikipedia.org/wiki/Two-photon_physics

4.6.1 Nuclear evolution

In the periodic table (Figure 4.21), a hydrogen nucleus has one proton while a helium nucleus has two protons plus 1-2 neutrons, but no-one knows what the extra neutrons do: *"… all the stable nuclei have more neutrons than protons (or equal numbers), and the heavier nuclei are increasingly neutron-rich.*" (Marburger, 2011) p254

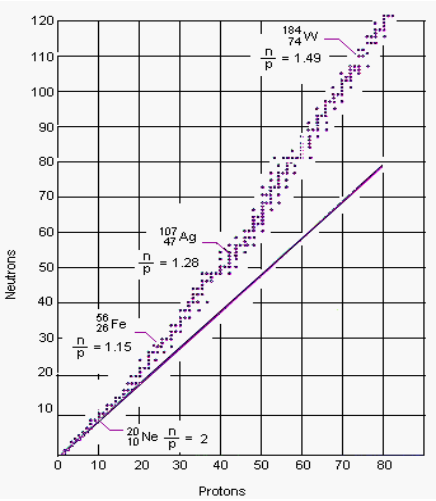

Figure 4.22 Nuclear neutrons by protons

Heavier nuclei need more neutrons to be stable until in Uranium proton repulsion overwhelms the quark links and the nucleus breaks apart in nuclear radiation (Figure 4.22). Shell models don't work because some nuclei aren't spherical and the current "bowl of fruit" model isn't very useful.

If protons and neutrons are quarks sharing photons in a closed triangle, they can open up to recombine in longer quark strings if the same rules are satisfied: namely a closed shape with the internal angles of an equilateral triangle. Higher nuclei would be quark strings bound as protons are by photon sharing. Each link must bend the string 60º but a quark can rotate to make the connection, so nuclei can build up into 3D shapes that fold in space as proteins do. Photon sharing needs proximity, so neutrons are needed as string buffers to stop same-charge protons being side-by-side. Folded quark strings will be compact almost spheres as observed and larger nuclei will need more neutrons to avoid fold-back loci that make protons adjacent. Hydrogen can add a second neutron to become Deuterium, the hydrogen of heavy water, but such isotopes[31] are less stable because quark strings need the tension of proton repulsion to fold.

In this *nuclear evolution* certain combinations are more stable:

"*Nuclei with either protons or neutron equal to certain "magic" numbers (2, 8, 20, 28, 50, 82, 126) are particularly stable*." (Marburger, 2011) p253

Table 4.7. Particle shell and sub-shell predictions

Shell	Sub-shell							No
	s	*p*	*d*	*f*	*g*	*h*		
1	1s=2							2
2	2s=2	2p=6						8
3	3s=2	3p=6	3d=10					18
4	4s=2	4p=6	4d=10	4f=14				32
5	5s=2	5p=6	5d=10	5f=14	5g=18			50
6	6s=2	6p=6	6d=10	6f=14	6g=18	6h=22		72
7	7s=2	7p=6	7d=10	7f=14	7g=18	7h=22	7i=26	98

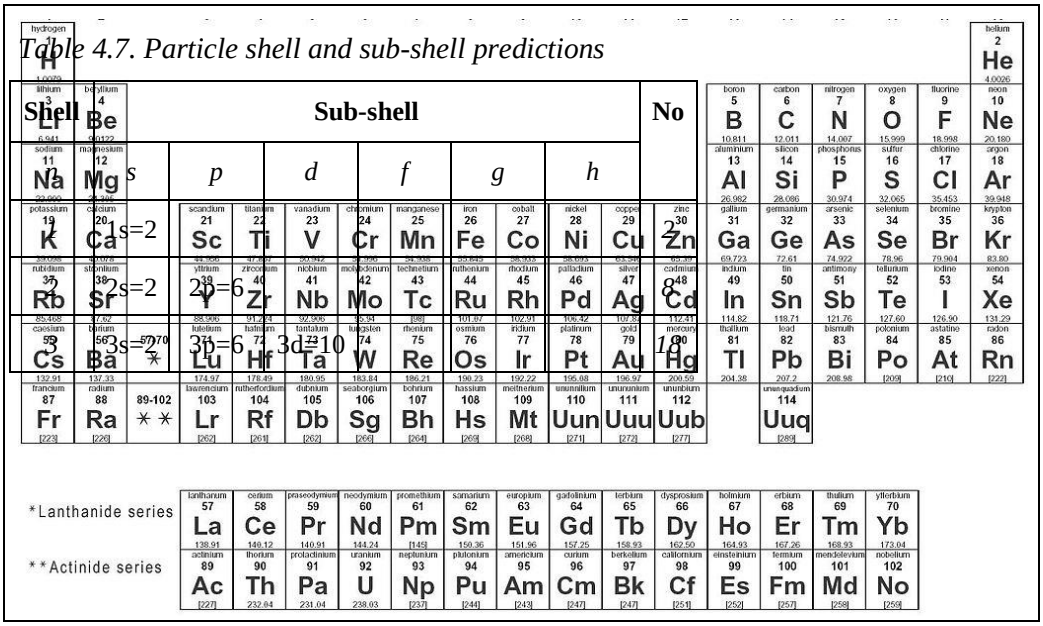

Figure 4.21. The Periodic Table

If periodic table nuclei are folding quark strings, nuclei with a magic number of nucleons are more stable because they form the symmetric shapes that gave rise to magic numbers in the first place. A quark string model explains the properties of atomic nuclei and the role neutrons play in their creation.

4.6.2 Electrons in orbit

[31] Isotopes of an element have the same number of protons but a different number of neutrons.

4	4s=2	4p=6	4d=10	4f=14			*32*
5	5s=2	5p=6	5d=10	5f=14	5g=18		*50*
6	6s=2	6p=6	6d=10	6f=14	6g=18	6h=22	*72*

In current physics, an electron is a particle when in space but a wave when in an atom, by the miracle of wave-particle duality. Everyone knows a particle isn't a wave nor a wave a particle but this "miracle" lets physics choose the equations that work[32] so no-one asks "How does *the electron know* to be a particle here and a wave there?" Quantum waviness is permitted by *Pauli's exclusion rule*, that entities with different quantum numbers can overlap like waves, which numbers we can devise after the fact, e.g. the shell model lets electrons co-exist in orbits by quantum numbers we set, that aren't based on, or even compatible with, any other physical laws.

If electrons orbited atomic nuclei as planets orbit the sun they would occasionally collide, but they *never do*. A lead atom with 82 electrons whizzing around in close proximity is stable for billions of years, so how do all those electrons never meet? And a mass in orbit is accelerating, so it should lose energy and spiral inwards, but electrons don't do this. Are the laws of physics different for electrons in atoms? For example, how fast do electrons move in atoms? Are they slower than light as they are in space? Or if they have light speed orbits why don't they move that fast in space? Current theory handles such problems by inventing a cloud of virtual photons that shield electrons from the nuclear attraction and the repulsion of other electrons, so again invisible causes make it so!

In this model, an electron is one-dimensional matter, so it is like matter on one dimension but like light on the other two. In three-dimensional space, being light on two dimensions but matter on one makes the electron slower than light, on average. In the two-dimensional orbit of an atom however it can be entirely light, i.e. entirely wave. A particle circling a center needs an agent to stop it falling in, but wave can pulse forever if the circumference matches its wavelength. It can't spiral in because its wavelength implies a minimum orbit (see next section). Electrons as matter-light hybrids explains both how they behave in space and in atoms.

4.6.3 Electron shells

In the periodic table, an element's its outer shell electrons define its chemical properties, e.g. elements like Neon are *inert* because their *full* outer shells don't exchange electrons in chemical reactions. Every chemical effect from acidity to oxidation is atoms exchanging electrons to complete shells in the now familiar search for stability. In stable molecules, atoms with extra electrons donate them to those with deficits in chemical bonds that complete both parties.

The current electron shell description involves two quantum numbers:

1. *Shell* ***n*** (: 1, 2, 3 …), began as the orbit radius.
2. *Sub-shell* ***l*** (s, p, d …), no clear meaning.

The s, p, d sub-shells were deduced from spectroscopic data analysis to contain 2, 6 and 10 electrons, and electrons fill shells and sub-shells according to the quantum numbers we allocate. In the initial model, inner orbits with fewer electrons filled before outer orbits with more electrons, and so the periodic table grew. Doubling the first orbit of two electrons quadrupled the area to allow eight electrons, tripling allowed eighteen, quadrupling it thirty-two, and so on. Hence Hydrogen and Helium are the first row, and the second row has eight elements Lithium-Neon, but the third row is still only eight elements including the carbon and oxygen we need to live, and the expected eighteen elements only occur in the next row. The predicted periodic table rows of 2, 8, 18, 32, 50 and 72 (Table 4.7) were instead 2, 8, 8, 18, 18, 32 and 32. So in the by now well-established practice, we tweaked the quantum numbers so the *sub-shells* fill in this odd order:

1. 1s — Hydrogen-Helium (two elements)
2. 2s, 2p — Lithium-Neon (eight elements)
3. 3s, 3p — Sodium-Argon (eight elements)
4. 4s, 3d, 4p — Potassium-Krypton (eighteen elements)
5. 5s, 4d, 5p — Rubidium-Xenon (eighteen elements)
6. 6s, 4f, 5d, 6p — Cesium-Radon (thirty-two elements)

[32] Wave-particle duality lets physicists choose one set of equations for electrons in orbits, and another for electrons in space.

7. 7s, 5f, 6d, 7p Francium-? (thirty-two elements)

The third shell "fills" with one of its sub-shells empty, so generations of chemistry students have had to learn that Argon completes the third shell without the 3d sub-shell, even though that denies what a sub-shell *means*. If they asked why, the answer was *because it does!* In contrast, a model based on electrons as waves expects these properties:

1. *Orbit*. The minimum orbit for a wave is a half its wavelength.
2. *Harmonics.* The same orbit can be occupied by higher wave harmonics.
3. *Direction.* Waves at right angles don't interfere.

The periodic table can now be explained in terms of electron waves as follows:

1. The first shell has a half wavelength circumference, where a bipolar wave going up and down on alternate cycles is the *1s sub-shell*, or *first harmonic* sub-shell (Figure 4.23a). A sphere allows two such waves at right angles that literally don't exist to each other, so the first shell has two electrons and ends with the inert gas Helium.

2. The second shell has a one wavelength circumference. The first harmonic again alternates up and down at this wavelength and another at right angles gives the 2s sub-shell two electrons. The *second harmonic* (Figure 4.23b) lets two electrons fill one circumference, which for two axes is four in total. The extra harmonics of two-dimensional waves like on a drum surface allow two more electrons, giving six in total for the 2p sub-shell. This gives the second shell eight electrons and the second periodic table row of Lithium to Neon.

3. The third shell has a one and a half wavelength circumference, tripling the first radius. This again gives 3s and 3p sub-shells but the next harmonic can't occur. A bipolar (up-down) wave can vibrate once on a string half its wavelength and twice on a string of the same wavelength, but it can't do more on a string one and a half times that as the result self-destructs. Adding another half-wavelength adds no new harmonics so the third shell, like the second, has only eight electrons. *A harmonic wave model has no 3d subshell*.

4. The fourth shell has a two-wavelength circumference. Four times the first radius allows a new harmonic that allows four electrons per circumference, which for two axes is eight, plus two complex harmonics is ten (Figure 4.23c). This plus the first (4*s)*, second (4p), and complex harmonics gives the eighteen elements of the periodic table fourth row.

5. The fifth shell, like the third, allows no new harmonic, so its 5s, 5p and 5d subshells repeat the previous total of eighteen, giving the periodic table fifth row.

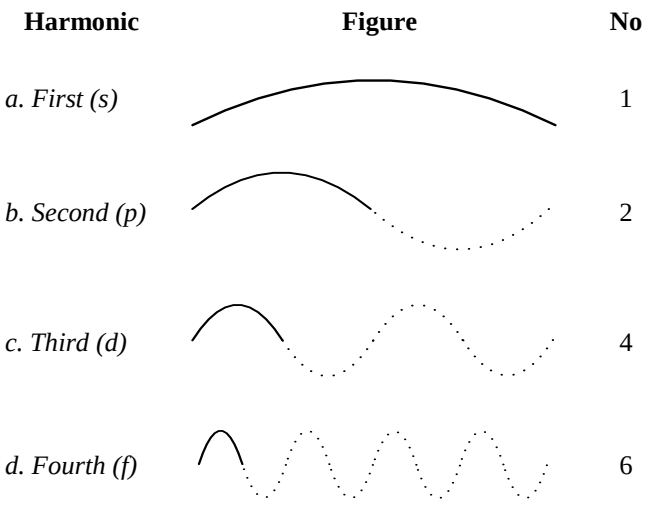

Figure 4.23. Wave harmonics for a length

6. The sixth shell allows a new harmonic with six electrons per axis (Figure 4.23d), which doubled again is twelve, plus two complex harmonics is fourteen. This plus eighteen from the s, p and d harmonics gives the thirty-two elements of the sixth periodic table row[33], and the seventh orbit also has 32 elements.

An electron wave model fills the periodic table as follows:

1. 1s Hydrogen-Helium (2 elements)
2. 2s, 2p Lithium-Neon (8 elements)
3. 3s, 3p Sodium-Argon (8 elements)
4. 4s, 4p, 4d Potassium-Krypton (18 elements)
5. 5s, 5p, 5d Rubidium-Xenon (18 elements)
6. 6s, 6p, 6d, 6f Cesium-Radon (32 elements)
7. 7s, 7p, 7d, 7f Francium-? (32 elements)

[33] If the first shell has circumference C, the sixth shell has circumference 6C, with subshell harmonic wavelengths: 6s (λ=12C), 6*p* (λ=6C), 6*d* (λ=3C) and 6f (λ=1C).

Electrons now fill shells and sub-shells in strict order, with no strange jumping between them, based on:

1. *Shell.* A circumference of wavelength 0.5, 1, 1.5, 2, …
2. *Harmonic*. Orbit circumference/wavelength, where s=1/2, p=1, d=2, etc.
3. *Magnetic moment*. The great circle axis orientation.

Electrons fill in the order they do based on:

1. *Shell order*. Each shell is a greater circumference. If an electron were pure light a longer wavelength would be less energy, but it has mass so larger orbits require more processing, i.e. more energy. Shells fill in the order 1, 2, 3… because smaller orbits need less processing.
2. *Harmonic order*. Each subshell harmonic is a shorter wavelength for the same orbit circumference, so it involves more energy. Subshells fill in the order s, p, d… because lower harmonics need less processing

An electron wave model explains the shells of the periodic table based on circumference wavelengths and sub-shells as wave harmonics so the electrons fill the shells and sub-shells with no tweaks needed.

4.7. MORE ANSWERS

A processing model suggests answers to matter issues that have plagued physics for some time.

4.7.1 Charge neutrality

As our galaxy is largely charge neutral, physicists generally suppose the universe as a whole is the same. Yet if charge is an inherent property arbitrarily given, why did the big bang dole out equal amounts of it? The current answer, that charge neutrality was set so when the universe began is unsatisfactory.

In the particle model, matter began like Venus from the sea, complete and perfect, but in a processing model matter had to evolve, just as life on earth did. Quantum events repeat at a fantastic rate, so anything not 100% stable reconfigures sooner or later. *Every* option is tried until one "sticks", i.e. doesn't change. This is how electrons, neutrinos and quarks survived the initial chaos, and the first atom was born because a proton plus an electron survive better together than apart. In this view the universe is electrically neutral because it evolved so, as ordinary matter is mostly charge neutral atoms. The universe is charge neutral by evolution not by some design fiat.

4.7.2 Matter "half spins"

In current physics, an electron is a dimensionless point of no extent so it can't physically spin. Hence physicists have given up on quantum spin in general, let alone how matter *half-spins*:

"*We simply have to give up the idea that we can model an electron's structure at all. How can something with no size have mass? How can something with no structure have spin?*" *(Oerter, 2006) p95*

In this model, a photon vibrates into a quantum dimension orthogonal to its polarization plane so it *really does spin*[34]. This fourth dimension adds *three new quantum directions* at any point, all at right angles to both our space and each other[35] (Figure 4.24). A photon is a two-dimensional structure in a four-dimensional quantum space, so like paper sheet it is invisible when viewed edge-on. Horizontal filters stop horizontal but not vertically polarized light because photons polarized at right angles occupy different spaces that don't exist to each other. An electron is photons filling the channels of one axis, so for any line of view only half of them are visible. If one photon is 100% visible another at right angles will be 0%, for 99% there is a 1%, and so on. If only half an electron's photons register with us, we can only measure half its spin, and so say it *half spins.*

[34] For a photon moving in direction X, its quantum amplitude A vibrates in plane AX. The structure AX can then spin.

[35] The orthogonal directions X, Y, Z of space give three orthogonal planes XY, YZ and XZ. A fourth dimension A adds three more orthogonal planes A_1X, A_2Y, A_2Z, where A_1, A_2 and A_3 are at right angles.

Turning an object 360 degrees in our space returns its original state but turning an electron 360 degrees only half-turns it - it takes 720 degrees of turning to return an electron to its original state. This is impossible in three dimensions but an electron in four dimensions has two planes to turn into not one. Turning in one dimension only turns half its photons - another turn is needed to turn the other half. We forget that we are the Flatlanders in a four-dimensional quantum reality (Abbott, 1884).

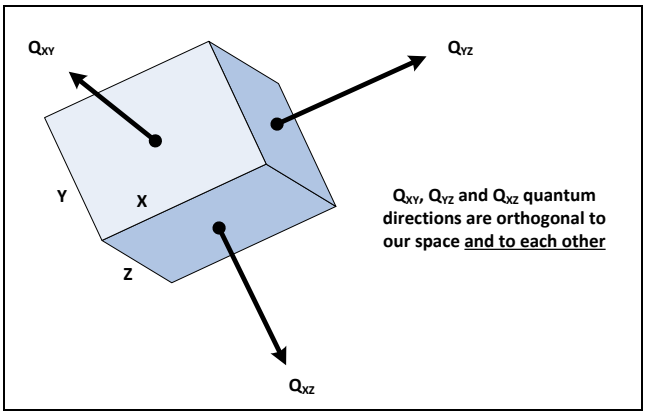

Figure 4.24. Quantum directions

4.7.3 Neutrino asymmetry

If the laws of physics varied with position, each new location would need new rules. Fortunately, the view changes the values but not the equations. Spatial symmetry is basic to physics itself, but neutrinos *always* have left-handed spin, an asymmetry that is reflected neither in the world we see nor the laws that describe it. As Pauli said:

"*I cannot believe God is a weak left hander*" (Lederman & Teresi, 2012) (p. 256)

What is handedness? If you point your left thumb forward, the curled fingers of that hand are left-handed spin, and if you point your right thumb forward, the fingers are right-handed spin. As your hands move forward, the two spins are always different, but while electrons spin either way, *all* neutrinos are left-handed and *all* anti-neutrinos are right-handed. By spatial symmetry an entity and its mirror image should be the same, and an electron inverted in a mirror is an electron, but a neutrino in a mirror is an anti-neutrino. Why this is so, the standard model can't explain.

In this model, as the first photon had to move up or down on space to make matter or anti-matter, so it had to spin left or right with respect to its movement, and apparently it went left. Yet spin should change with direction as reversing a photon's direction reverses its spin. So even if every electron spun left initially, after bouncing off many things they should now spin both ways, and indeed they do. One might expect the same for neutrinos, but neutrino mass comes from *one* of the two photon sets colliding, that both spin left with respect to their direction. A neutrino reversing direction changes phase, *so the left spinning photons going the other way now create its mass*. When electrons reverse direction their mass origin doesn't change, but when neutrinos change direction the *other* colliding photons create their mass, and they always spin left.

Since anti-clockwise processing always spins right, for our universe anyway, anti-neutrinos have right handed spin for the same reason. Neutrinos spin left and anti-neutrinos spin right because when they reverse direction the source of their tiny mass changes. A processing model can explain why neutrinos *always* spin left and anti-neutrinos *always* spin right.

4.7.4 The mass problem

A proton's charge is one, the simple sum of the charges of its quark constituents, but its mass is a hundred times that of three quarks. When quarks combine their charges just add, but for some reason their masses compound:

> *"… though the actual value of the basic electric charge … remains a theoretical mystery … all other charges found in the universe are … multiples of this value. Nothing like this appears to be the case for rest-mass, and the underlying reason for the particular values of the rest-masses of … particle types is completely unknown.*" (Penrose, 2010) p153.

Current physics attributes this extra mass to virtual gluons binding the quarks, but how do *massless* gluons make all that extra mass? And why doesn't their interaction affect charge too?

In this model, charge as left-over processing is limited to one Planck program per channel so why isn't mass, the net processing done, limited to the same bandwidth? In decentralized networks, when two programs seek the same resource at the same time they *interfere* so at least one must retry, which wastes processing. If two cars come to the same intersection at the same time both cannot go. Likewise, for quarks in a proton, photons competing for overlapping channels must interfere. Only one photon can finally fill a channel, so if two try one must try again, and more processing is more mass.

Interference also explains why a down quark is heavier than an up quark. If an up quark is two sets of photon tails colliding with one set of photon heads (Table 4.3), the two tails access channels first leaving one set of heads to fill the

remaining channels. In a down quark, one tail set gets first access, leaving two sets of photon heads to fight over the rest, giving more interference and more mass. The masses the standard model just *allocates* could *be derived* from photon simulations, i.e. we could *discover* why down quarks are heavier than up quarks by simulating them.

4.7.5 Family generations

Electrons, quarks and neutrinos have family generations, each like the last but heavier, e.g. an electron has a *muon* elder brother of the same charge and spin but two hundred times heavier and a *tau* eldest brother three and a half thousand times heavier! Up and down quarks have heavier *charm* and *strange* quark older brothers, and *top* and *bottom* quark eldest brothers but again after three generations no more. If these particles are the building blocks of the universe, they are like a Lego set with one brick 75,000 times bigger than another, as a top quark is 75,000 times heavier than an up quark! The standard model *describes* family generations, but it doesn't say:

1. Why do family generations occur?
2. Why three generations, then no more?
3. Why are the higher generations *so heavy*?

Family generations are natural to this model, as if an electron fills the channels of *one* axis, a muon could do the same on *two* axes and a taon on *three* (Figure 4.25). All are still point entities, and no more generations can occur in a space of three dimensions. Each is heavier than before because overlapping channels *interfere* increasing the processing that is mass. Taons are *so* heavy because interference cumulates as one traffic obstruction can cause another. If a muon is an electron collision doubled, why doesn't it have a minus two charge? It does, but we can only measure charge one axis at a time, and after each measurement the system resets. On any one axis, a muon's charge is minus one.

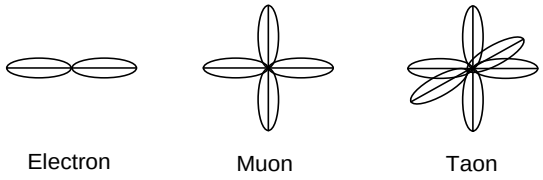

Figure 4.25. Electron generations as dimension repeats

One can't dimensionally repeat a quark structure three times, so quark generations aren't simple duplicates, but the tail-tail-head planar *triangle* of an up quark could form a charm quark *pyramid* whose every side presents an up quark's charge but with more mass by interference. A tail-head-head down quark could likewise form a strange quark pyramid. Top and bottom quarks then fill a node with two up and down quark planes at right angles, with more mass again by interference. The mysterious generations of matter arise from the dimensions of space and their high masses from processing interference.

4.7.6 Dark energy and dark matter

While the Higgs is a purely theoretical concept, dark matter and dark energy refer to actual effects. Dark matter is the force that binds galaxies together and dark energy is what stops gravity from collapsing the universe. The particle myth focus is the matter we see, so when cosmology found that there is five times more *dark matter* than matter it inspired a costly search for WIMPs[36] that was fruitless, like that for gravitons and squarks, despite talk of super-WIMPs (Feng, Rajaraman, & Takayama, 2003). It is often forgotten that since it can't explain dark matter or dark energy that is 70% of the universe the standard model only explains only 5% of the universe. It isn't even close to being a theory of everything.

Dark energy is a negative gravity that pushes the universe apart, to accelerate its expansion against gravity that pulls it together. It is a weak effect, spread evenly through space that hasn't changed much over time. In equations. it makes space flat, so some call it a property of space itself, but a property of space should increase as space expands, and any "thing" floating in an expanding space should weaken over time. Currently, no-one has any idea what it is.

In this model, our space is the inner surface of a four-dimensional hyper-bubble that *adds nodes* as it expands. New points of space are adding all the time, and for their first cycle these nodes receive but don't transmit, giving a negative energy effect. Spread over all space, this is dark energy. If new space adds at a constant rate the effect will be constant, and that dark energy comes from new space means that no physical cause will ever explain it. Our universe must lose energy as expanding a box must cool the gas within it.

[36] WIMPs are Weakly Interacting Massive Particles.

Dark matter presents as a halo around the black hole at a galactic center that holds its stars together more tightly than their gravity allows. It isn't the matter we see because no light can detect it, it isn't anti-matter because it has no gamma ray signature and it isn't a black hole because there is no gravitational lensing, but without it the stars of our galaxy would fly apart. Dark matter binds galaxies together but no one knows how.

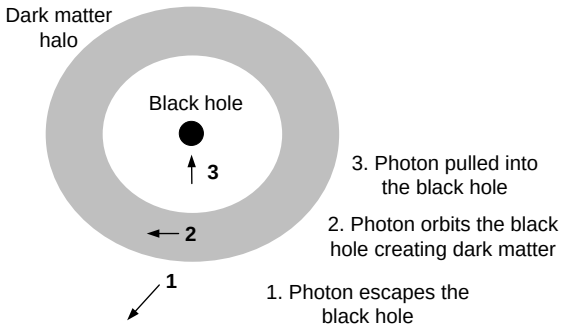

Figure 4.26. Dark matter is light in orbit

Quantum realism's pass-it-on protocol makes nodes *interrupt driven*, so each cycle they *first* pass on current processing *then* receive any input to process. Infinite pass-it-on repeats are avoided because any excess is sooner or later absorbed by a new node, but for light orbiting a black hole new space doesn't add fast enough, giving a permanent excess, i.e. matter (Figure 4.26). The pass-it-on protocol doesn't work around black holes. As light trapped in a node is ordinary matter, so light trapped in an orbit around a black hole is dark matter. It is a halo because light close to the black hole is pulled in and light far away escapes. It isn't seen because photons don't collide with it, and when galaxies collide the dark matter stays with its galaxy as they separate. Normal and dark matter are in processing terms the same, but the latter is spread over a vast halo while the former is confined to a node.

4.7.7 Mesons

Electrons annihilate anti-electrons in a blaze of energy but quarks and anti-quarks quietly form semi-stable mesons like the pion (Annex B). Particle physics reifies each meson with a Greek letter name, but an Eta that exists for a million, million, millionth of a second is hardly a particle! Yet pions are relatively long lived, so "*Why are pions so stable?*"

In this model, the three quarks of a proton share photons, each linking its extra photon axis to another neutral axis in a triangle. Three quarks are stable but two quarks aren't unless they are opposite *quark/anti-quark pairs*[37]. These pions survive for what in the quantum world is a relatively long time. In this model, to share photons quarks must:

1. *Be adjacent*. The axes that share photons must align and be adjacent,
2. *Share processing*. The net processing must not cancel.

A strong link arises when two quarks share the same processing, but when quark/quark pairs share photons the result cancels to give no net effect but for *quark/anti-quark* pairs it doesn't. The opposite charge axes of up/anti-up and down/anti-down pairs attract to stop the free axes closing to link, but for pions the same charge axes repel letting the extra photon axes link. Pions both share processing and have the charges to align their free axes. The result is incomplete so they aren't stable in our terms, but four outward facing full axes shield the deficiency.

The standard model calls an up/anti-down quark a pion *particle* and a down/anti-up mix an *anti-particle*, but actually both are matter/anti-matter mixes and the particle/anti-particle idea is an anachronism. Matter photons spin one way and anti-matter photons the other, so mesons have no spin because their spins cancel not because they don't spin. The standard model presents mesons as zero-spin bosons with mass and charge yet they aren't like light and none of them carries any known force. Mesons as matter/anti-matter hybrids are not fundamental but just another combination that was tried.

4.8. SEEING THE WORLD IN A NEW WAY

Physical realism[38] sees a world of *real particles* that forces like magnetism move using *virtual particles*. *Particles rule*, but today the balance of power has shifted towards the virtual:

"*The Higgs mechanism is often said to account for the origins of mass in the visible universe. This statement, however, is incorrect. The mass of quarks accounts for only 2 percent of the mass of the proton and the neutron,*

[37] Namely the up/anti-down and down/anti-up pions observed.

[38] Physical realism is the idea that only the physical world is real. See What is Reality? for a discussion.

respectively. The other 98 percent, we think, arises largely from the actions of gluons. But how gluons help to generate proton and neutron mass is not evident, because they themselves are massless." (Ent, Ulrich, & Venugopalan, 2015)

An atom's mass comes mainly from its nucleus of protons and neutrons, and most of their mass comes not from their quarks but the virtual gluons that bind the quarks together. It follows that nearly all the mass we see around us comes from massless particles! How ironic that Aristotle's a mechanistic universe is now justified by a fairytale physics (Baggot, 2013) based on virtual causes! On this shaky foundation, current physics presents a vision of a universe with:

1. *No plan*. Inert matter created galaxies, stars, planets, life and us by accident with no design or plan. If anything made our universe, it long ago abandoned it to the random interaction of particles.
2. *No choice*. The laws of physics control everything from people to galaxies, so human choice is just an illusion and consciousness is an epiphenomenon of system complexity (Zizzi, 2003), i.e. there is no choice really.
3. *No future*. The laws of thermodynamics doom everything to run down, whether our bodies, the sun or the universe. What began in a big bang must end in a "big freeze", an infinite future of eternal nothingness.

This *cosmic nihilism,* like other nihilisms before, is leading nowhere. It calls itself the voice of reason, but reason tells us that a universe that began came from something else, that quantum randomness is a non-physical choice and that a universe that always decays must have started ordered, which the primal chaos wasn't. When examined, the myth of a world *going nowhere that accidentally made us* makes no more sense than that of a world *built for us by a supreme being*.

It is time to recognize that physical realism is *just a theory* and scientists who don't question their theories are priests. Last century it was the only game in the town, but today quantum realism is the alternative that space is a processing *network,* a point is a processing *node,* time is processing *cycles,* the photon is the basic *process,* matter is light *entangled,* quantum states are *pixels* and the physical world consists entirely of *reboot events.* If this is wrong, let the facts decide.

Table 4.8 compares a processing explanation of physics with the static particle view, e.g. did matter pop out of nowhere ready-made, like Venus rising perfect from the sea, or did the universe *boot up*[39], making matter along the way? When a computer system boots up it begins small, e.g. Windows boots from a tiny CMOS that loads a *kernel* that loads a bigger *BIOS*[40] that loads the full *operating system.* Booting up a computer isn't booting up a universe, but it could be the same on a vast scale if one photon spawned the first light that merged into matter, life and eventually us. This view has no divine shortcuts, as every element had to be *built,* in the matter factories we call stars or in a supernova sacrifice. Nothing can come from nothing[41], so light had to create matter, matter had to create life and life had to create sentience, i.e. us. Darwin discovered *biological evolution* but *physical evolution* was occurring long before biology came along.

Is there a plan? If the universe is following a pre-set route to a pre-defined end-state we are pointless cogs in a big machine, powerless to change the divine plan. Conversely if there is no plan, the corollary *that nothing really matters at all* denies the accountability that societies need to work (Whitworth & Ahmad, 2013). If it were true, human society would collapse and we would not be here. Yet even for processing systems, the plan vs. no-plan dichotomy doesn't work.

For example, a home heating system has no fixed plan of when it will and will not turn on and off. It just has a desired temperature and rest occurs dynamically without external control. Likewise, a universe *structured to evolve* doesn't need to be told what it can discover. Evolution doesn't need approval, as myriad creatures were borne, struggled and died not knowing their part in an evolution we know happened. Evolution needs only its own conditions, such choice, e.g. quantum randomness seems pointless to us but it is the physical evolution equivalent of genetic variation in biological evolution. Some conclude from biological randomness that there is no design, but one can argue from quantum randomness that *evolution is the design*. Our universe wasn't built as a watchmaker builds a watch, to a fixed plan, but like a baby not knowing where it is going or why. Evolution, like justice, is blind, but a universe that went from light to matter to life and sentience isn't going nowhere. The ability to evolve was built in. *Evolution was the plan.*

[39] Based on the idea of "*pulling yourself up by your own bootstraps*".

[40] BIOS stands for **B**asic **I**nput **O**utput **S**ystem.

[41] The Latin *Nihil fit ex nihilo* is attributed to Parmenides.

In this view, every parameter the universe required to evolve was there from the start, including the speed of light, Planck's constant, the electron charge and the size of space[42]. If the quantum bulk that created our universe made other bubble universes they would have the same laws of physics, although the initial symmetry might break the anti-matter way. If processing cycles create *change* and quantum randomness gives *variety* then stable end-states will be *naturally selected* in a physical evolution. The only thing missing is the one thing that information cannot exist without – an observer. A vision emerges of a cosmos that evolved from the very beginning, because it had:

1. *Change*. Light never stops because change is built into it as quantum processing. Matter *seems* passive but as light bottled up it is also active. Everything changes is the first rule of our world because evolution needs it.
2. *Choice*. Information by definition needs a choice (Shannon & Weaver, 1949) and virtual worlds need information. If electrons make free quantum choices so must we! Choice was also built in because evolution needs it.
3. *Consciousness*. All information needs a *sink* or *source* to define it and likewise every science including physics needs an observer. A virtual reality can create space and objects but the observing *consciousness* must be given.

Change means following the Star Trek directive: *To boldly go where none have gone before*, choice means *we can't know the future*, and consciousness is where everything comes from and goes to. Without an observer information doesn't exist, just as data-flow diagrams need end-points to create and receive information. We give ourselves consciousness but allocate it parsimoniously to others[43]. Yet a causal chain links each of us to the first mother[44], the first animal, the first cell, the first atom and the first light, so when in this evolution did consciousness begin? Logic dictates that if I am conscious so is everything else (Conway & Koch, 2006), even an electron. We differ from other species in self-awareness not consciousness (Whitworth, 2009). In this view, the virtual world exists because *everything observes*.

Homo-sapiens was the lucky ape that won the evolutionary lottery but that on some planet in all the galaxies some species did so was inevitable. That evolution is random doesn't make it uncertain, because by the law of all action what is possible will happen. Even if we are the first sentient beings (unlikely) we won't be the last, so if this *experiment of consciousness* doesn't work another one will take its place.

Does all this mean that life has no purpose? One can create a *thing* and walk away but a *virtual reality* must be *sustained* every cycle. The images you see on the screen now only exist because they refresh many times a second. A virtual universe must not only be created but also sustained, up to and including this moment. If our universe is a joke, it is an expensive one in processing terms. It beggars belief that the investment needed to create and sustain a simulation as big as our universe for fourteen billion years was for nothing, so that our universe is virtual suggests it has a purpose, whether we realize it or not.

Table 4.8. Physical realism vs. quantum realism on matter

Physical realism	**Quantum realism**
Matter. Is made of *fundamental particles* with: a) *Mass*. An inherent property, for some unknown reason b) *Charge*. An unrelated other property, for some reason c) *Space*. Nothing, because it isn't a particle d) *A photon*. A "particle" without mass or charge! e) *Anti-matter*. A matter inverse that exists for some reason	*Matter*. Is a processing *standing wave* with: a) *Mass.* Any processing demand that repeats b) *Charge.* Any processing remainder that repeats c) *Space*. A null program in one node d) *Photon.* The same program in many nodes e) *Anti-matter.* Matter processing in reverse
Electron. A fundamental particle that has: a) No structure at all, because it is a dimensionless point b) An inherent mass from its substantiality c) A negative charge, because it just does	*Electron.* A one-axis, *head-head* photon collision that has: a) A one-dimensional collision structure b) Moves like matter in one-dimension only c) Negative charge by the negative processing left over

[42] The speed of light in a vacuum is the default grid cycle rate, Planck's constant is a Planck program transfer, an electron charge is a one Planck set processing remainder and the size of space is the network density.

[43] As Robert Owen put it: "*All the world is queer save thee and me, and even thou art a little queer*"

[44] Mitochondrial DNA evidence suggests that all humans today came from one mother who survived the trek out of Africa.

d) An imaginary spin, half the usual for some reason e) Constant movement slower than light, for some reason f) Doesn't collide in an atom orbit, for some reason	d) Half spin as only half its photons show for any axis e) Moves like light in two dimensions only f) Moves entirely like light in a two-dimensional orbit
Neutrino. A fundamental point particle of tiny mass with: a) No structure at all b) A tiny mass that varies, for no known reason c) Zero charge, for some reason d) Electron-like properties, for some reason e) Left-handed spin, for no known reason	*Neutrino*. A one node *head-tail* photon collision with: a) The channels of one axis permanently locked b) Processing that doesn't quite cancel by asynchrony c) A processing remainder that cancels exactly d) Electron-like because it is also a one-axis entity e) Left-handed spin because reversing swaps its mass
Quark. A fundamental particle that has: a) No structure at all, being a point particle b) Up and down versions, for some reason c) No ability to exist alone, for some reason d) Has unexpected one-third charges e) The ability to bind to other quarks by the strong force	*Quark.* A one node three-axis photon collision that has: a) A charge, neutral and free axis structure b) *Head-tail-tail* (up) or *head-head-tail* (down) phases c) Not enough processing to fill a plane so isn't stable d) Expected one-third processing remainders e) The ability to bind to other quarks by photon sharing
Strong force. An invisible field that: a) Generates virtual gluons with a color property b) Give quarks a red green or blue color *charge* c) Makes quarks form a proton if the colors cancel to clear d) Creates massless gluons to make the proton *very heavy* e) Creates links that somehow increase with distance	*Strong force.* Quarks sharing photons means that: a) Gluons don't exist at all b) A quark's "color" is its *orientation* c) Quarks in a proton orientate to share photons d) Photon interference makes the proton very heavy e) Shared photons have more effect when "stretched"
Weak force. An invisible field that: a) Generate massive virtual particles called W bosons b) Makes a neutron a proton by turning a down quark up c) Needs a massive W boson to turn a neutron into a proton d) *Never* turns protons into neutrons for some reason	*Weak force.* A neutrino effect that: a) Doesn't need W bosons at all. b) Turns photon heads into tails to convert a neutron c) Needs a tiny neutrino to turn a neutron into a proton d) *Never* turns protons into neutrons
Atoms. Electron *particles* orbit a proton-neutron *nucleus*: a) Periodic table elements fill shells/subshells based on data-fitted quantum numbers that represent nothing b) Protons and neutrons cram into the atomic nucleus like a plum pudding mix, with no structure c) Higher nuclei need more neutrons for no reason	*Atoms*. Electron *waves* orbit a folded *quark string*: a) Electrons fill atomic shells based on radius, wave harmonics and great circle orientation b) Protons and neutrons form quark strings that fold back into closed triangle shapes c) Long quark strings need more neutron buffers to fold
According to the particle model: a) The universe arose Lego-like from 5 fields, 16 charges, 14 bosons, 62 particles and 23 data-fitted parameters b) The dark energy and dark matter that cosmology says are over 95% of the universe must come from particles too c) Family generations exist for no known reason d) Fields create virtual bosons to cause effects e) The Higgs boson creates the W bosons that cause the weak force f) Mesons are bosons that mediate no field forces	*According to the processing wave model*: a) The universe came from one fundamental process, one quantum network and three data-fitted parameters[45] b) Dark energy is from the ongoing creation of space, and dark matter is light in orbit round a black hole c) Family generations are dimensional repeats d) All the bosons of physics are imaginary agents e) The Higgs is the imaginary cause that explains another imaginary cause that explains an effect f) Mesons are matter/anti-matter hybrids

[45] The network refresh rate is represented by the speed of light, the network density is represented by Planck's constant and the basic process is represented by the mass or charge of one electron. From these, a simulation could derive all the other parameters.

The physical world is *decaying, accidental and inert*	*The quantum world* is *changing, choosing and conscious*

DISCUSSION QUESTIONS

The following discussion questions are addressed in this chapter:

1. Why are electrons and neutrinos classified in the same lepton group?
2. Why do neutrinos have a tiny mass but no charge?
3. How do mass and charge relate?
4. What came first, matter or light?
5. Why is the universe made of matter instead of anti-matter?
6. If anti-particles can go backwards in time, can causality be reversed?
7. Why does quark binding increase with distance?
8. Why do quarks have one-third charges?
9. Why do atomic nuclei need neutrons?
10. Why aren't the fundamental particles of the standard model fundamental?
11. Why are neutrinos always left-handed?
12. What causes the strong force that links quarks in the nucleus of an atom?
13. What do the "colors" of the standard model represent?
14. What causes neutrons in space to turn into protons?
15. Why don't protons decay like neutrons?
16. Why was the Higgs field needed? Does it explain mass? What did CERN probably find?
17. How is the standard model of physics like the standard model of medieval astronomy?
18. Why don't electrons in atoms collide with each other?
19. How do electrons occupy an atomic orbit?
20. Why do leptons and quarks have three family generations, then no more?
21. Why are the higher generation particles so heavy?
22. How can point-particles without structure or extent spin? How do electrons half spin?
23. Why do mesons have no spin? Can a point entity have no spin? Why are some mesons their own anti-particles?
24. How does a processing model classify quantum entities?
25. If biological evolution involves a natural environment, genetic variety and species options, what are the equivalents for physical evolution?
26. Is there a quantum world? If so, what does this imply about reality?

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ANNEX A: FAQ

1. *A universe as big as ours must be real.*

   Answer. It is only "big" relative to our bodies within it.

2. *A universe that has been going for billions of years must be real.*

   Answer. Again, only relative to us. With enough processing power, one could run a program of the history of the universe in a few seconds.

3. *It would take a computer bigger than the universe to simulate it.*

Answer. Physicists already speculate a multiverse, so if you accept a system bigger than our universe, why not one big enough to output it? In this model, a same size universe generates the physical world because quantum processing is so powerful.

4. *So who is the programmer?*

Answer. I don't know. I guess everything is.

5. *Computers need physical hardware so the argument is circular. Processing based on the physical world can't simulate the physical world. That's recursive.*

Answer. A physical world can't create itself, but a non-physical *quantum world* can create a physical virtual reality. Processing defined as the changing of information (Shannon & Weaver, 1949) isn't defined in physical terms, so quantum processing doesn't need a physical base. There is no circularity.

6. Can we hack into the system?

Answer. Quantum computers already do that.

7. *Is this like The Matrix, with Keanu Reeves as Neo?*

Answer. No. Neo escaped from the Matrix into another *physical world*. In this theory, the physical world is the output of a *quantum world* that, according to quantum theory, doesn't behave like our physical world at all.

8. This just defers the problem of fully explaining everything to another level, so it can't be a theory of everything (TOE).

Answer. Quantum theory and general relativity dispelled the myth that science can explain everything last century. The idea that an equation can describe everything is a mirage - a part can't explain the whole! TOE is a dream but science as way to ask questions of our world is not. Quantum realism is a *query of everything* (QOE) not a TOE.

9. If virtual reality calculations are performed by "something", then it would be a system (like our Universe) that would need its own explanation, and we are back to square one, so to speak.

Answer. The "something" you refer to is described by the advance of quantum theory. Quantum theory did not leave us "back to square one" but one square further on. We need humility to see that we can't have science the way we want it.

10. *A theory that some other world creates this world is not testable*.

Answer. Of course it is. A theory about heaven is not testable but a theory about *this physical world* is. We can test if it is an information output because we know how the physical world behaves and we know how information behaves.

11. *It is all just meta-physics, like the number of angels on a pinhead*.

Answer. Meta-physics is untestable speculation on unknowable things, but the virtual reality conjecture targets *the world we see*, so it is not just meta-physics.

12. *This theory is unproven*.

Answer. So is the objective reality theory alternative. Would you fail one candidate by a test the other also fails? If science compares alternatives and picks the best, this theory explains more and assumes less.

13. *This theory is based on assumptions.*

Answer. So is every scientific theory. The method of science is to assume a hypothesis then test it by physical world data. Reverse engineering the physical world, by the method of design science, takes that approach.

14. *Denying the axiom that there is nothing outside the physical universe opens the floodgates to let anything convenient through, no matter how unlikely or even absurd.*

Answer. No floodgates open if we keep the scientific method of collecting data and making predictions. To ask a question about the physical world *is* science, even if it happens to be "*Is the physical world a processing output?"*

15. This theory would end science, as you can't study what you can't by definition see.

Answer. Not true. Science studies quarks no-one can ever see and it is still fine.

16. *A theory that postulates the unseen is not scientific*.

Answer. That science is about the seen is *logical positivism*, a simplistic nineteenth century view now discredited in almost every discipline. Physical visibility is not a demand of science, and never was, but physical testability is.

17. *This theory can never be decided*.

Answer. Not true. Science decides theories based on likelihood. It was able to decide whether our universe had a beginning, so it can decide whether or not it is a processing output.

18. *The theory contradicts Occam's razor.*

Answer. Occam's razor takes the simplest theory to fit the facts. Last century it favored an objective world but today space bends, time dilates and quantum entities teleport, so the razor cuts the other way. Compare the one grid network and one Planck program of this model with the five fields, thirty-eight basic particles, sixteen charges, fourteen bosons and twenty-four result-fitted parameters of the standard model. A processing model is much simpler than a particle model!

19. *This is not mainstream physics*.

Answer. Of course it isn't. Nothing new ever is.

20. *This is a crazy idea*.

Answer. That doesn't make it untrue. Science advances by crazy ideas. Even if this theory is found to be wrong we might learn something. Some scientists have always been called crazy – that is what real science is about.

21. *This is just another God theory*.

Answer. No it isn't. God theories put no constraints upon God, but reverse engineering the physical world requires consistency. Everett postulated universes beyond ours but no-one thinks he is a God theorist! Just because a theory suggests there is a something beyond the physical universe doesn't make it a God theory.

22. *Who is the programmer? Is it God?*

Answer. Don't worry, whether the virtual reality conjecture is true or false we can continue to argue about God! It doesn't change that argument one way or another. Some say God is the programmer, some say advanced aliens and others even suggest ourselves from the future! In my view, every choice made alters the program, including ours.

23. *This model implies a phantom spirit world reality, alongside the physical world*.

Answer. No it doesn't. Dualistic religions imply a spiritual or heavenly world alongside the physical world we see, but quantum realism is a monism, i.e. it has just one reality, the quantum world, and the physical world is the phantom reality. In the observer-observed interaction, it just takes the observer as real instead of the observed.

24. *It isn't possible that everything we see is information!*

Answer. We already *know* that we see only information as neurons are on-off devices like transistors. Yet quantum realism isn't solipsism, that the universe is created by our minds. A dream doesn't exist without the dreamer, but this universe doesn't need humanity to dream it. It dreamed itself for billions of years before we came along. If we die out something else will take our place - maybe rats will evolve an intellect.

25. *Where are the equations?*

Answer. They are already there in quantum theory, e.g. Schrödinger's equation describes a processing wave expanding in three-dimensions. Physics has enough equations already. Let me ask you - where is the meaning?

26. *Equations that work are enough. Physics doesn't need meaning.*

Answer. Physicists today mostly just calculate and only rarely stop to think what it means. Copenhagen enshrined this *carry on calculating* approach. If you like that then fine, but why stop others wondering what it means?

27. I don't think the world is a fake.

Answer. Neither do I. A virtual world is a *local reality* not a fake. It doesn't exist in or of itself, as an objective reality, but to those within it, it is as real as it gets. There is a real world "out there" generating our experiences - it just isn't the

world you see. In quantum realism, the physical world is just your interface to the real world.

28. *If the physical world is virtual, we don't really exist!*

Answer. Yes and no. My physical body is virtual like the pixels of an avatar in a game, but the observer in a game is always outside it, i.e. not made of pixels. Reality 101 is that the observer *must* be apart from the observed. Each of us knows personally that we exist - even if we know nothing else our *being* is intact. In contrast a purely physical world has no basis upon which to observe anything.

29. Whoever is playing my character is pretty boring.

Answer. Sorry about that. Have you tried all the options?

30. *This contradicts common sense*.

Answer. Common sense also told us that the sun went around the earth.

31. *This is not a new idea.*

Answer. True. It goes back at least to Plato's prisoners in a cave, taking their shadows on the wall as reality. Modern precedents include Conrad Zuse, Edward Fredkin and Tom Campbell.

32. *Why would anyone create a world like this?*

Answer. We can only guess. Perhaps reality wanted to know itself and this was the only way?

33. *This theory makes no difference in practice.*

Answer. Yes it does. If matter comes from light, the money spent colliding protons should be spent colliding photons and the $30 billion Higgs project just found another species in an already full particle zoo. How much money was spent looking for proton decay that doesn't happen, gravitons that don't exist, and WIMPs that will never be found?

34. *Is this the end of science?*

Answer. No. Science works just as well in a local reality as in an objective reality.

35. *Are paranormal powers like healing and precognition implied?*

Answer. They are not ruled out, but if you built a virtual world would you let the players flout the rules? I don't see too many holes in this system.

36. Could the experiments at CERN start a new big bang? (Dunning, 2008)

We affect physical outputs not the quantum rules behind them. Our universe arose in a once-only chain reaction, as the quantum network consumed itself to make the free processing of our universe, which since then has been constant. For billions of years the system has experienced extremes beyond anything we know, and it still works. To think that our accelerators can harm the quantum world is like online Sims thinking they can hurt our world.

ANNEX B. MESONS

Particle	Symbol	Anti-particle	Makeup	Rest mass (MeV)	Life (secs)	Decay
Pion	π^+	π^-	$u\underline{d}$	139.6	2.60×10^{-8}	$\mu^+\nu_\mu$
Pion	π^0	Self	1.	135.0	0.83×10^{-16}	2γ
Kaon	$\mathbf{K}^+$	$\mathbf{K}^-$	$u\underline{s}$	493.7	1.24×10^{-8}	$\mu^+\nu_\mu$, $\pi^+\pi^0$
Kaon	$\mathbf{K}^0_S$	$\mathbf{K}^0_S$	1*	497.7	0.89×10^{-10}	$\pi^+\pi^-, 2\pi^0$
Kaon	$\mathbf{K}^0_L$	$\mathbf{K}^0_L$	1*	497.7	5.2×10^{-8}	$\pi^+e^-\underline{\nu}_e$
Eta	η^0	Self	2.	548.8	$<10^{-18}$	2γ, 3μ
Eta prime	$\eta^{0'}$	Self	2.	958	...	$\pi^+\pi^-\eta$
Rho	ρ^+	ρ^-	$u\underline{d}$	770	0.4×10^{-23}	$\pi^+\pi^0$
Rho	ρ^0	Self	$u\underline{u}$, $d\underline{d}$	770	0.4×10^{-23}	$\pi^+\pi^-$
Omega	ω^0	Self	$u\underline{u}$, $d\underline{d}$	782	0.8×10^{-22}	$\pi^+\pi^-\pi^0$

Phi	Φ	Self	$s\underline{s}$	1020	20×10^{-23}	$K^+K^-, K^0\underline{K}^0$
D	$\mathbf{D}^+$	$\mathbf{D}^-$	$c\underline{d}$	1869.4	10.6×10^{-13}	K + _, e + _
D	$\mathbf{D}^0$	$\mathbf{\underline{D}}^0$	$c\underline{u}$	1864.6	4.2×10^{-13}	[K,μ,e] + _
D	$\mathbf{D}^+_s$	$\mathbf{D}^-_s$	$c\underline{s}$	1969	4.7×10^{-13}	K + _
J/Psi	J/ψ	Self	$c\underline{c}$	3096.9	0.8×10^{-20}	e^+e^-, $\mu^+\mu^-$...
B	$\mathbf{B}^-$	$\mathbf{B}^+$	$b\underline{u}$	5279	1.5×10^{-12}	D^0 + _
B	$\mathbf{B}^0$	$\mathbf{\underline{B}}^0$	$d\underline{b}$	5279	1.5×10^{-12}	D^0 + _
B_s	$\mathbf{B}_s^0$	$\mathbf{\underline{B}}_s^0$	$s\underline{b}$	5370	...	B^-_s + _
Upsilon	ϒ	Self	$b\underline{b}$	9460.4	1.3×10^{-20}	e^+e^-, $\mu^+\mu^-$..

Notes: Adapted from http://hyperphysics.phy-astr.gsu.edu/hbase/particles/meson.html#c1
Anti-quarks are indicated by an underline, e.g. $\underline{d}$ is an anti-down quark.
1. An up/anti-down down/anti-up combination. 2. Down/anti-strange and anti-down/strange mixes.

REFERENCES

Abbott, E. (1884). Flatland: a romance of many dimensions. Retrieved February 22, 2010, from http://www.gutenberg.org/etext/201

Ambjorn, J., Jurkiewicz, J., & Loll, R. (2008). The Self-Organizing Quantum Universe. *Scientific American*, *299 July*(1), 24–31.

Baggot, J. (2013). *Farewell to Reality: How fairytale physics betrays the search for scientific truth*. London: Constable.

Barbour, J. (1999). *The End of Time: The next revolution in physics*. Oxford: Oxford University Press.

Barrow, J. D. (2007). *New theories of everything*. Oxford: Oxford University Press.

Burke, D. L., & et al. (1997). Positron Production in Multiphoton Light-by-Light Scattering. *Phys. Rev. Lett.*, *79*, 1626–1629.

CMS collaboration. (2012). A New Boson with a Mass of 125 GeV Observed with the CMS Experiment at the Large Hadron Collider. *Science*, *338*(December, 6114), 1569–1575.

Comay, E. (2009). Physical Consequences of Mathematical Principles. *Progress in Physics*, *4*(October), 91–98.

Conway, J., & Koch, S. (2006). The free will theorem. *Found. Phys.*, *36*(10), arXiv:quant-ph/0604079v1.

Cramer, J. (1986). The Transactional Interpretation of Quantum Mechanics. *Reviews of Modern Physics*, *58*, 647–688.

Davies, P. (2006). *The Goldilocks Enigma*. Penguin Books.

Davies, P., & Brown, J. R. (1999). *The Ghost in the Atom*. Cambridge: Cambridge University Press.

Dunning, B. (2008). Will the Large Hadron Collider Destroy the Earth? *Skeptoid Podcast*. Retrieved from http://skeptoid.com/episodes/4109

Ent, R., Ulrich, T., & Venugopalan, R. (2015). The glue that binds us. *Scientific American*, (May), 32–39.

Everett, H. (1957). "Relative state" formulation of quantum mechanics. *Rev. of Mod. Phys.*, *29*, 454–462.

Feng, J. L., Rajaraman, A., & Takayama, F. (2003). SuperWIMP dark matter signals from the early universe. *ArXiv:Quant-Ph/9912088v1*. Retrieved from http://www.nature.com/news/2003/030708/full/news030707-2.html

Kuhn, T. (1970). *The Structure of Scientific Revolutions* (Vol. Second Edition, Enlarged). Chicago: The University of Chicago Press.

Lederman, L., & Teresi, D. (2012). *The God Particle: If the Universe Is the Answer, What Is the Question?*

Marburger, J. (2011). *Constructing Reality*. Cambridge University Press.

Oerter, R. (2006). *The Theory of Almost Everything*. London: Plume, Penguin.

Penrose, R. (2010). *Cycles of Time*. Vintage Books.

Richard Feynman. (1985). *QED, The Strange Theory of Light and Matter*. Princeton University Press.

Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of Behavioral Research; Methods and Data Analysis* (Vol. Second). Boston: McGraw-Hill.

Shannon, C. E., & Weaver, W. (1949). *The Mathematical Theory of Communication*. Urbana: University of Illinois Press.

Smolin, L. (2006). *The Trouble with Physics*. New York: Houghton Mifflin Company.

van der Mark, M. B., & t'Hooft, G. W. (2011, May 22). Light is Heavy. Retrieved from http://www.tardyon.de/mirror/hooft/hooft.htm

Wheeler, J. A., & Feynman, R. P. (1945). Interaction with the Absorber as the Mechanism of Radiation. *Reviews of Modern Physics*, *17*(2–3), 157–161.

Whitworth, B. (2009). A Comparison of Human and Computer Information Processing. In M. Pagani (Ed.), *Encyclopedia of Multimedia Technology and Networking* (p. 230–239, http://brianwhitworth.com/braincomputer.pdf). Hershey PA: Information Science Reference.

Whitworth, B., & Ahmad, A. (2013). *The Social Design of Technical Systems: Building technologies for communities*. The Interaction Design Foundation.

Wilczek, F. (2008). *The Lightness of Being: Mass, Ether and the Unification of forces*. New York: Basic Books.

Woit, P. (2007). *Not even wrong*. London: Vintage.

Wolff, M. (2001). Spin, the Origin of the Natural Laws, and the Binary Universe. Presented at the American Physical Society Meeting, Wash. DC.

Zizzi, P. (2003). Emergent Consciousness; From the Early Universe to Our Mind, arXiv: gr-qc/0007006. *NeuroQuantology*, *3*, 295–311.