The Measurement Solution, wrongly assumed to be a Problem

by Matt Jackson and Charli Cotgrove
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Essay Abstract

It is proposed that the solution to what is assumed and termed as the 'measurement problem' may resolve questions over the collapse of the wave function and uncertainty. We find that the proposed answer also allows the coherent unification of quantum and relativistic physics. We propose that the resolution lies in the details of 'detection' and the two or more spatial or temporal points required for any measurement.

Author Bio

Matt is a specialist in measurement and surveying at at various scales working with laser plasma technologies, and also a mature research student in other areas whilst working in part time private consultancy. Charli works in closed environment horticulture specialising in environmental quality and purification. Other interests of both include physics, astronomy, astrophysics and cosmology.

Introduction

We detach our thought process from the established assumptions of the past, which are still at the centre of thinking today. This avoids yet more detailed discussion of the the De Broglie relations, Schrödinger's wave function and Heisenberg probability waves. This approach allows a start from first principles, and a fresh analysis in more physical terms.

The 'measurement problem' highlights the question of how the detection of EM waves, including light, may be possible without affecting or destroying the entity being detected, whether considered as a photon or a wave. We suggest that detection may indeed affect or 'destroy' the entity, then consider the consequences and effects, and analyse matches with classical (macro relativistic) effects.

Sampling

Detection of any physical entity or fluctuation must firstly require a detector, which must, of logical necessity, consist of matter, and matter in the form of what we poorly term but are familiar with as a 'dielectric medium', normally in the form of a lens. A lens then has a surface constituted by particles which represents a refractive plane.

A single particle, charged by an arriving wavefront, may logically be considered as 'taking a sample' of the wavefront. It does not affect any part of the wavefront except that tiny part which it physically interacts with. In atomic scattering the particle will absorb, be charged by, and re-emit the wave energy 'sampled'. [1] The process is the same if the incoming wave front is considered as constituted by individual photon particles. The photon is absorbed and re-emitted. In each case then we proposes that the tiny part of the wavefront sampled may reasonably be considered as destroyed and re-emitted, so the opportunity has arisen for it to be modified in the interim. This may be equivalent to the effects of harmonic resonance in interaction, which are very familiar if poorly understood. If the particles absorb and do not re-emit any similar EM waves, then the medium is not a 'dielectric'.

But now let us consider a diffuse dielectric medium of particles sampling the arriving waves. This is not yet the complete 'refractive plane' we assume when formed by an interface with at least one dense ('solid') medium, but perhaps a diffuse gas. In this case the sampling will be progressive, and any destruction of, or change in qualities of, the EM waves will be gradual as they progress through the medium.

The 'collapse of the wave function' is so far not really a problem, as any absorption effectively forms the equivalent of what we consider in macro terms as a 'shadow'. The energy may simply be absorbed and converted to other forms or reflected.

Of course the diffuse gas or plasma medium consists of particles which may be at different local densities and moving around, so the complexity will be so great and so far from computability that we can only consider it as uncertainty. The only certain thing is that if the medium has adequate spatial extent then it will eventually effect the whole of the wavefront, and indeed all subsequent waves. The 'extinction co-efficient' is the most familiar way of expressing this effect, related to the refractive index of the medium and polarisation mode dispersion. [2] The light 'sampled', so interacting, will be slightly diffracted by the interaction, so eventually all the light will be diffracted. In a very diffuse medium such as a galactic halo or the interstellar medium (ISM) [3] the effect may therefore show up at the classical scale as a gentle curvature of the light path. Again this effect would be equivalent to what we more familiarly term as curved space time.

Emission at c

Each 'sampling' by a particle in the 'new' dielectric medium, whatever it's state of motion with respect to the old or 'incident' medium, results in a new emission (or 're-emission') at c with respect to the kinetic state of that particle. This simple logical mechanism producing the Doppler shift effect is something of an 'elephant in the room' of current physics, so far invisible to present theory. It hides itself across the surface of the lens of our eyes and instruments, changing wavelength subject to relative detector motion, and disguises itself by being so obvious that it could not possibly have been 'missed'. It has been missed.

The mechanism is simply too large and important to have been noticed and included in current theory. In reality there is no such thing as an 'ideal rigid body', and length contraction of a non-rigid entity is precisely the same phenomena as Doppler shift of wavelength due to relative motion between media. Suddenly, just by turning them around, using kinetics and and looking afresh, we find that both parts of relativity and quantum mechanisms may finally snap together to make a coherent 'locally real' model.

Self consistency and truth functional logic (TFL).

The model is however very complex, with each particle and each body as it's own inertial frame. It is so complex it looks to mere humans like complete uncertainty, only predictable via probabilities. The structure is however one of pure and simple logic.

In truth functional logic [4] any proposition can be a part of a greater compound proposition, but must be resolved of itself without regard to the greater proposition. In turn that compound proposition may be a part of a greater compound proposition, which itself may be part of a greater compound proposition. This gives an infinite construction of smaller propositions within greater propositions, only the **immediately adjacent** propositions being relevant to each.

Now we simple substitute 'spaces' with different kinetic states for propositions. We may call these inertial rest frames. We may then have an **infinite number of states of inertial motion**. Which of course it exactly what we find when we look at bodies and systems in nature and the universe. Any 'body' then has an assignable speed with a *local* limit in and with respect to it's *local* background frame, and **only** its local background. If you drive your car at 60mph, the relative speed of a passing comet has no relevance to your car, only the local atmosphere around the car is relevant. Equally, only the state of motion of the heliosphere, the space around the comet, is relevant to the comet. Light is limited to c locally in and with respect to each frame, there is no limit relevant to any other frame elsewhere, because all light there is also limited to c in that frame. Space-time is therefore simply re-interpreted, but still giving observed relativity.

The other way this elephant in the room seems able to hide from us is by having a form and a vast scale entirely different to those we have been taught. Those unwilling to exercise their brains to follow the logic seem unable to recognise it so are tempted to dismiss it as imaginary. This cunning strategy has proved immensely successful in hiding the massive truth from humankind for so long. The result of understanding and applying the hidden mechanism is that the great paradox of the 19th century is now resolved; the constant speed of light found, irrespective of the speed of the emitter or the receiver. Einstein knew his resolution was incomplete. It may now be completed to prove that his apparently paradoxical postulates can be given a fully consistent logic.

Refractive Plane

We consider the process applied to the refractive plane of a dense dielectric medium. We find that the fact that the refractive index of a medium is a constant, regardless of the relative speed of the medium with respect to it's surrounds, is ignored and violated in current theory. The wavelength is quickly changed at the refractive plane (Doppler shift) and the degree of that change will vary subject to relative kinetic state. The massive implication so far ignored is that light has then changed speed due to the relative motion of the local medium. This may be a clear and self evident truth, but it will none the less tend to slip away and be forgotten when applying it to observations or in practice.

The resulting effect is entirely additional to any change due to the relative refractive index of the media. Light in a block of ice orbiting Saturn will do c with respect to the ice locally, not another block of ice on Earth. Ergo a photon passing through both blocks of ice will have changed speed at the refractive planes of each, to propagate at c/n with respect to each, and at c/n locally through all media between them, however diffuse. In deep space c/n may only be trivially variant from c locally in each frame.

The reason a galaxy rotates 'bodily' rather than the disparate components rotating 'through space' emerges from the construction. The limits and boundary of the rotating galactic inertial frame (with the local group frame) are formed by the deep 'refractive plane' of the halo dark matter, complete with it's gravitational mass.

Wavelength.

Waves as fluctuation sequences are complex, but the basic qualities of a sinusoidal wave include amplitude, wavelength, frequency, polarity, Chirality, propagation direction and various formalisms of 'speed', which we here consider as information propagation speed, which we take as c in a vacuum. Any measurement requires a start and a finish point in space or time. Wavelength, or distance between peaks, represents those two points and is equivalent to the *period* of an event. The 'event' may take any number of wavelengths when propagating at assumed speed c or c/n. At a constant speed the time represented by that period is then a function of wavelength. The first point arrives at a new medium boundary or refractive plane before the second point. As propagation speed changes at that plane, the wavelength must then change. This then logically requires that apparent time must change between co-moving media.

This solution is of course also entirely intuitive and conserves real, if not 'apparent', causality. If an observer in a background medium moves at half the speed of sound towards a sound signal ten seconds long, the apparent length of time of the signal will be halved. Similarly a light flash ten seconds long will appear as some 9 seconds long to an observer approaching at 10% of light speed. As all lenses are media then even in deep space the light will be similarly Doppler shifted on meeting the lens and prior to recording the data which gives wavelength and local c/n within the lens.

Datum

Measurement must always be between two 'points' with some form of delta, or in relation to a fixed datum. In the measurement of light the observer is a detector so will absorb and modulate the wave function of the sample interacted with. The observer himself is then a datum. The datum may be either the start or finish of the quantity being measured, or a third quantity by which start and finish are quantified. Datums are however arbitrary and may also be in relative motion themselves, and be one point or quantity within another measurement. The is then, in reality, no absolute datum, but there must always be a local datum for any measurement.

The problem is really the solution.

The 'collapse of the wave function' on detection for measurement has been assumed as an insurmountable problem in theoretical physics. The mechanism may however be the very process that produces the observed relativistic effects on re-emission by the detector. Intrinsic characteristics of the absorbing particle include it's gravitational potential and relative state of motion which logically produce macro effects in the re-emitted signal. Science is familiar with these affects on light as Diffraction, Refraction, Scintillation, Aberration, Shapiro delays, Lensing [5], Faraday rotation and the curved space time of general relativity. Figure 1 shows 'gravitational lensing' and light delays in cluster Abell 1689. We know the light is interacting with particles as in diffraction so we must ask ourselves whether the effect may not be related to diffraction by the particles providing the gravitational mass, giving the quantum basis for the relativistic effect. Robert Dicke proposed this solution in the Branse-Dicke or Jordan-Branse-Dicke theory even prior to the knowledge that the the ISM may be able to produce the it. Aspects of the theory and relationships to general relativity have recently been reappraised by Wu, Wang and Chen (2010). [6]

Figure 1. Galaxy Cluster Abell 1689 showing light from behind lensed into arcs. Is the actual quantum mechanism producing gravitational lensing and 'curved space-time' related to the mechanism of refraction through the dark matter halo of the cluster?
Credit NASA, N Benetez (JHU), T Broadhurst (The Hebrew University), H Ford (JHU), M Clampin (STScl), G Hartig (STScl), G Illingworth (UCO/Lick Observatory), the ACS Science Team and ESA STScl-PRC03-01a.

The 'collapse' of the wave and change in wavelength and other characteristics on re-emission also renders Bells theorem invalid for the interacting parts of waves, which will ultimately reach 100% of the wavefront, theoretically allowing the Local Reality produced and retaining the real speed limit c.

The implications of this mechanism are potentially quite significant in application, requiring adjustments to the cosmological model which appear able to resolve a significant number of anomalies, a primary example being the multiple CMBR 'rest frames' [7] and scattering surfaces giving 'Compton' and 'reverse Compton' lambda /

frequency changes. Optical science is also currently not yet fully consistent with wider physical theory and a more compatible relationship also appears to be facilitated by the kinetically logical effects of the interactive detection process involved in measurement.

Credits

Our research has led us to related similar findings by many others and we particularly give credit to the work of Stephan Marinov, H W Milne, Edward Dowdye, Peter Jackson, (DFM), T.E Phipps, P Pearle [8] and Vladimir Tamari.

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