Light: The Rope Hypothesis

Bill Gaede

ViNi

Frankfurt, Germany

***Abstract*— We propose a physical model that provides a rational interpretation to the fundamental properties of light. The Rope Hypothesis justifies and simulates basic features and behaviors such as straightness, speed, and orthogonality, and merges light with gravity into a single mechanism.**

Keywords- light, gravity, rope hypothesis, electromagnetic wave, particle.

I. A Brief History of the Nature of Light

For most of human history, enthusiasts have regarded light to consist of discrete particles. It wasn't until about 400 years ago that the wave model began its slow ascent and grew to be so popular by the 19th Century that theorists practically abandoned the particle. In the first quarter of the 20th Century, researchers merged both models into a mathematical duality known as 'wave-packet'. The Complementarity Principle still in vogue today resolved that light has both particle and wave characteristics and that the nature of the experiment determines which of these aspects light will exhibit.[1] Theorists had by then lost hope of discovering what light 'is' and turned their attention to describing how it behaves during an experiment.

Today, a little over 80 years since the seminal 5th Solvay Conference, we present a new physical model that stands in parallel with the particle, the wave and the wave-packet. We begin by assuming that a physical medium underlies the phenomenon known as 'light' and that this entity takes on the configuration of a rope. The rope hypothesis provides a wholly different perspective to the workings of the Universe.

II. A Physical model of light?

The mere suggestion that light could be mediated by a physical entity may sound strange and anachronistic to many a reviewer. We have not pondered such questions since the early 20th Century when researchers and theorists finally abandoned classical models. And yet again, we are able to interrupt light with our hands and generate shadows. In unusual circumstances, it is sometimes necessary to exhume the body and perform a new autopsy in order to reassure all sides of the debate and remove any remaining doubt. It behooves us as scientists to reconsider the decision to regard light as immaterial, especially when a new proposal is on the table. A physicist seeks more than just mathematical symbolism and wishes to understand how Mother Nature actually performs her invisible tricks. This noble quest should not be summarily taken away in one fell swoop through censorship.

Einstein, for one, tacitly invoked a physical model to explain the photoelectric effect, and although his was primarily a mathematical theory, he did insinuate and explain that discrete bundles of light knocked out discrete electrons from the atoms comprising the polished metal.[2] We may also argue that the particles of the Standard Model of Quantum are not really physical, but all explanations that invoke particles by default treat them as such.

III. The EM Rope is Quite Unlike a 'wave'

At face value, the rope doesn't appear to be much different than the electromagnetic (EM) wave of Classical Mechanics. The EM wave would seem to be but a cross-section of a rope.

However, a couple of distinctions are in order. Whereas the Fresnel - Maxwell classical wave is an abstract mathematical artifact, the rope is postulated as a real physical medium that binds any two atoms of the real world. The plane transverse wave is an ad hoc, two-dimensional tool that few Scientists if any, argue exists out there. The EM rope, on the other hand, is proposed as a real entity comprised of two threads twined around each other like strands of DNA (Fig. 1).

From a dynamic perspective, the EM wave propagates in a single direction. The EM rope, instead, is a structural entity that twirls *in situ* and sends torsion waves simultaneously in both directions.

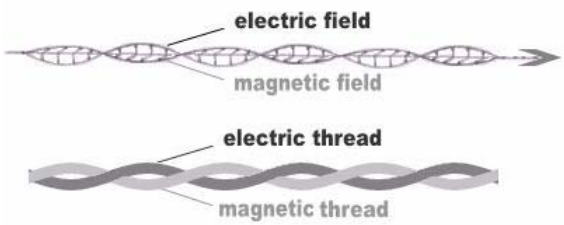

Fig. 1 Wave vs. Rope

IV. How the Rope Model Measures up

As a bare minimum, an impartial juror should check that a physical candidate be able to simulate the most fundamental properties and behaviors of light. Consequently, we list ten of the most salient structural and dynamical features that any candidate should exhibit before it can be considered as a serious contender for the job.

A. Frequency, wavelength and amplitude

Whereas Wave Theory treats frequency, wavelength and amplitude as dynamic parameters, the rope model treats them as architectural attributes. An EM rope has structural frequency in the number of links, and wavelength, in the length of each link. The amplitude is given by the height of the link.

B. Speed

The EM wave has been calculated to travel at 300,000 km/sec, which is widely regarded to be the speed limit of the Universe. Orthodoxy has never explained why light travels so fast. It is pertinent to note that longitudinal P-waves have been timed to travel almost twice as fast as transverse shear waves during earthquakes.[3] If we extrapolate the analogy to longitudinal sound and transverse light waves, we would hear the sound of thunder before seeing the lightning flash.

A torsion wave leaves both longitudinal and transverse waves standing still. A simple experiment shows just how fast they are: it is practically impossible to film the speed of signal transmission along a torqued rope. By merely touching a clothespin at one end of a clothesline, the one at the other end moves 'instantly'.

It is also calculated that light travels around 220,000 km/sec through glass. The classical wave fails to explain the mechanism or agent that accelerates light back to 300,000 km/sec after the beam returns to the atmosphere or vacuum. Certainly, the different colors generated by light refracting through a prism are attributed to a change in wavelength.[4] It is, thus, that theorists have concluded that the 'constant' c declines as light disperses through a prism (Fig. 2).

Under the rope hypothesis, the speed of the torsion along the rope remains the same irrespective of medium. What changes is the length of the links and, thus, the frequency (number of links per unit length) of light as the signal traverses different media. Refractive Index (change in the speed of light) is a mathematical artifice. Under the physical rope hypothesis, color is a function of link-length.

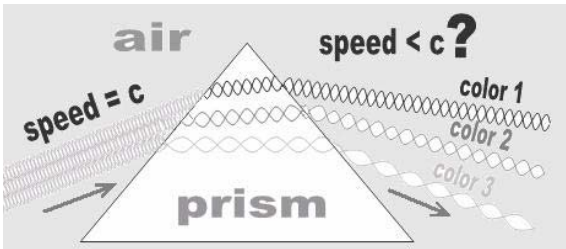

Fig. 2 Color is a function of link length

Light travels at c through any medium

C. $c = f * \lambda$

The rope is the only physical configuration that explains why frequency is inversely proportional to wavelength. We can double the number of links on a 1-meter length of rope only at the expense of making the links shorter (Fig. 3). Maxwell's equation $c = f * \lambda$ describes a rope. Wave Theory offers no physical interpretation for this observation.

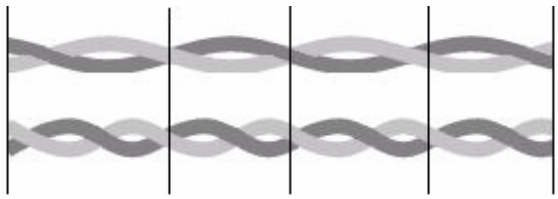

Fig. 3 Why $c = f * \lambda$

D. Orthogonality and Sinusoidality

Faraday's Law states that an oscillating magnetic 'field' generates an electric field.[5] Ampère/Maxwell's Law states that an electric 'field' induces a magnetic 'field'.[6 7] Both run perpendicular to each other and for unexplained reasons oscillate around an imaginary axis.

The taut EM rope has a magnetic strand running anti-parallel to the electric fiber. The threads run perpendicular to each other and justify why they oscillate around an imaginary axis.

A rope is also inherently wavy. The undulations are in first instance structural rather than dynamic. Of course, as the rope twirls, the torsion signals propagate in opposite directions and explain why we perceive them as sinusoidal waves.

E. Straightness and Bidirectionality

Although as just discussed, at the very fine level a wave is known to oscillate, experimentalists usually deal with 'beams' or 'rays'. If a ray of light is comprised of particles, the particles themselves may not be said to 'be' *straight*. The particles can at best 'travel' *rectilinearly*. Likewise, a series of peaks and valleys comprising an EM wave may not be said to 'be' straight. They are alleged to 'travel' rectilinearly.

At first impression, this argument may seem to be a trivial semantic issue. It is not. Where does this wave start? Where does it end? Does an EM wave begin in an atom and *extend* uninterruptedly to the next surface it touches, or does the wave *travel* from one atom to the next like a sailboat floating from one shore to another?

The issue of whether light is bent by warped space is also under siege and goes deeper than the superficial issue of language. The proponent may argue that a 'ray' or beam is *bent*. A series of discrete particles may at best be *deflected*. However, the well-established Principle of Ray Reversibility,[8 9] derived from Heron and Fermat's Principles,[10] states that whether reflecting or refracting, a beam of light retraces its path. It is difficult to believe that a

stream of discrete particles can continue to travel rectilinearly while the Earth moves at 30 km/sec around the Sun. And if this micro-scenario is not persuasive enough, perhaps a macro one is. The U.S. and Russia routinely send laser signals to retro-reflectors that have been installed on the Moon in order to measure distances to our satellite accurately.[11] The Moon is slightly over 1 light-second away and, therefore, the round trip for a photon would take a little over two seconds. A particle emitted from Earth would have trouble finding its way back after the Earth moved some 75 km from origin, especially if space is also warped, and more so if we factor that the establishment holds that "light 'travels' as a wave and departs and arrives as a particle."[12]

The rope model avoids these predicaments since every atom comprising the Moon is bound to every atom comprising the Earth via twined EM threads. The Moon can now go anywhere it wants in the Universe. No torsion signal has a chance of getting lost.

F. Reflection and Refraction

Newton postulated that light consisted of corpuscles and predicted that light should travel faster through glass than through air. Huygens' wave theory predicted the opposite. Unable to settle the matter at the time due to technological limitations, Huygens ended up winning the debate posthumously. The rope is clearly more like the EM wave than it is like a discrete particle

What is different is that the atoms comprising the mirror are already connected via twined EM threads to every atom comprising the test object we place in front of it. Whether reflecting or refracting, every atom *relays* the torsion to the next one.

G. Diffraction

Francesco Grimaldi appears to be the first observer to document that light indeed bends around corners.[13] Thomas Young would later run a more formal experiment during which he measured the wavelength.[14] His experiment and subsequent ones run by Augustine Fresnel to explain polarization would give the wave model an enormous boost in the eyes of their contemporaries. Maxwell and Hertz would put the final touches on the wave from both mathematical and experimental perspectives. The particle model was, thus, all but forgotten throughout most of the 19th Century.

A rational physical interpretation of diffraction can succeed only by assuming that light is some sort of wave. For instance, several slit experiments have been performed by groups claiming to have handled individual electrons.[15 16] In order to prevail with their theories, these researchers tacitly invoked Bohr's admittedly debunked planetary model of the atom.[17] In effect, the teams treated an electron as a discrete bead that orbits the nucleus.

The rope hypothesis, again, is at home explaining diffraction. Each atom from the source is connected via EM threads to each atom comprising the slit partition which are connected to each atom comprising the screen. When the light is turned on, the ropes torque at a higher frequency (links become shorter) and the atoms *relay* the signal from one to the other (Fig. 5 A).

The alleged bending of light by warped space is explained in like manner. The atoms comprising the Sun's corona relay EM torsion waves arriving from a star to the observer on Earth (Fig. 5B).

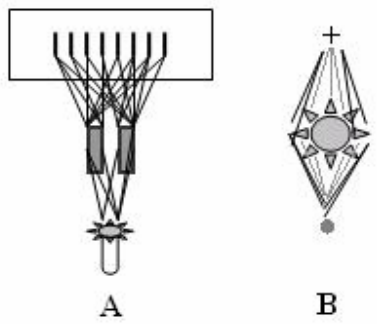

Fig. 5 A. Slit Experiment and B. Gravitational Lensing

H. Spin

Spin is a strange parameter. Most laymen imagine it as a ball going around its axis like a buggy in a carousel. However, the 'static' language used to qualify spin – orientation, direction and pointing – as well as the numbers assigned to designate spin – ½, -1, 0 – indicate that spin is a little more complex and quite unlike angular momentum.

The rope offers us a different perspective. Seen head on, we imagine seeing the ends of two strands. They either rotate clockwise (CW) or counterclockwise (CCW) (Fig. 6). An observer traveling along the rope would nevertheless see the threads twine either CW or CCW even before the rope rotates.

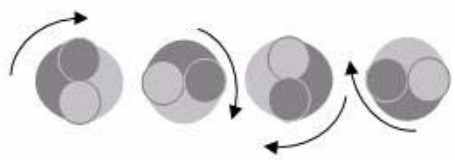

Fig. 6 EM Rope seen head on: CW spin

I. EPR

The establishment has gone out of its way to provide a physical interpretation to EPR since Einstein's group formulated it in 1936.[18] The rational thinker is compelled to choose between mystical hidden variables,[19] a manifold of many worlds,[20] or particles returning from the future.[21]

Under the rope hypothesis it is straight forward. Observer A watches the rope twirl CW. Observer B at the other end

should see the rope twirling CCW. If we reverse the spin, A now detects the rope spinning CCW and B CW.

J. Gravity

Perhaps the most important phenomenon that the rope model helps us explain is the Grand Unified Theory (GUT), the Holy Grail of Physics. Researchers have been searching for a mathematical GUT for decades. With particles and waves, that goal is ever more distant. It is not easy if at all possible to explain attraction with one-way agents.

The physical interpretations offered to the mathematical solutions have always been on the extreme side. They include scenarios where gravitons and gluons transfer 'negative momentum' to the test object or rely on particles that through contorted mechanisms end up pushing the two objects together. [22]

With the rope hypothesis, we finally have a chance to imagine a straight forward, physical mechanism that can produce attraction. If every atom in the Universe is bound to all others, it doesn't stretch the imagination to take the vision to the next step and theorize that as one object approaches another, the EM ropes fan out as a function of decreasing distance and cause the acceleration of one to the other (Fig. 7).

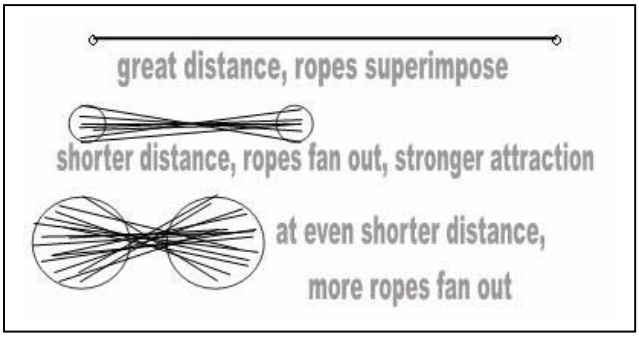

Fig. 7 Gravity mediated by EM ropes

V. CONCLUSIONS

The issue before the jury is strictly qualitative: Is there a physical medium that underlies light?

If we have already made up our minds that there is not a physical medium, we may be missing the opportunity to gain a deeper understanding of nature. We may never be able to explain phenomena that continue to elude us.

If instead the juror concludes that there is in fact an invisible entity that underlies light, we must simply go through the checklist. Does a rope have frequency, wavelength, and amplitude? Does a torsion wave travel practically instantaneously along a rope? Does the rope architecture justify Faraday, Ampere, and Maxwell Laws? Does $c = f * \lambda$ describe a rope? And so on.

There is a tendency of conservatism to reject a radical proposal outright because it fails to conform to textbook physics, threatens strongly-held traditional beliefs, or doesn't visibly answer questions about light not covered in this paper that are certain to arise. It is as a result of these potential biases that we have limited our analysis to the most obvious properties and behaviors of light that the rope hypothesis is able to justify. The purpose of this paper is not to explain all the known attributes of light, but to present the model in its most rudimentary form in order to introduce the subject to the scientific community. The jury is asked to evaluate the instant proposal objectively and strictly within the claims made herein.

We note, finally, that it is in the spirit of science to afford new theories as much latitude as possible. If the model does not succeed despite all efforts to save it, the court can take pride in its work and rest assured that there was no discretionary abuse when evaluating the proposal.

REFERENCES

[1] N. Bohr, "The Quantum postulate and the recent development of atomic theory," Nature (Supplement) 121, 1928, 580-590

[2] A. Einstein, "On a Heuristic Viewpoint Concerning the Production and Transformation of Light." Annalen der Physik 17, 1905, pp. 132-148.

[3] C. Fowler, "The solid earth: an introduction to global geophysics" (2nd ed.). Cambridge University Press., 2005.

[4] F. Arago and A. Fresnel, "Sur l'Action que les rayons de lumière polarisés exercent les uns sur les autres," Ann. Chim. et Phys. 10 (1819), 288-305.

[5] M. Faraday, "Experimental researches in electricity" (Bakerian lecture), Philos. Trans. R. Soc. London, 122, 1832, 163–177.

[6] A. Ampère, "Memoir on the Mathematical Theory of Electrodynamic Phenomena, Uniquely Deduced from Experience" 1827.

[7] J. Maxwell, "A dynamical theory of the electromagnetic field," Phil. Trans. 155, 1865, 459 – 512.

[8] Z. Knittl, "The use of the principle of reversibility in deriving known relations for a system of optical thin films," Czech. J. Phys. 7, 1957.

[9] A. Mahan, "A Mathematical Proof of Stokes' Reversibility Principle," J. Opt. Soc. Am. 33, 1943, 621-626.

[10] A. Schuster, "An Introduction to the Theory of Optics," London: Edward Arnold, 1904.

[11] J. Williams, J. Dickey, "Lunar Geophysics, Geodesy, and Dynamics," 13th International Workshop on Laser Ranging, October 7-11, 2002, Washington, D. C.

[12] R. Baierlein, "Newton to Einstein," Cambridge University Press, 2001.

[13] F. Grimaldi, "Physico mathesis de lumine, coloribus, et iride, aliisque annexis libri duo," Bologna, Italy: Vittorio Bonati, 1665, pages 1-11.

[14] T. Young, Phil. Trans. Roy. Soc. 12, London xcii, 1802, 387.

[15] P.Merli, G. Missiroli, G. Pozzi, "On the statistical aspect of electron interference phenomena," Am. J. Phys. 44, 1976a, 306-307.

[16] A. Tonomura, J. Endo, T. Matsuda, T. Kawasaki, "Demonstration of single-electron buildup of an interference pattern," Am. J. Phys. 57 (2), 1989, 117-120.

[17] M. Born, P. Jordan, „Zur Quantenmechanik," Zeitschrift für Physik 34, 1925, 858-888. [Eng. Trans. in: B. L. van der Waerden, editor, "Sources of Quantum Mechanics," Dover Publications, 1968.

[18] E. Einstein, B. Podolsky, N. Rosen, Can quantum mechanical description of physical reality be considered complete?," Physic PhysicalReview 47, 1935, 777 777-780.

[19] D. Bohm, Y. Aharonov, "Discussion of Experimental Proof for the Paradox of Einstein, Rosen and Podolski," Physical Review 108: 1957, 1070-1076.

[20] H. Everett, "'Relative State' Formulation of Quantum Mechanics," Reviews of Modern Physics 29, 1957, 454-462.

[21] J. Cramer, "An Overview of the Transactional Interpretation," Int. J. of Theo. Phys. 27, 227, 1988.

[22] H. Casimir, D. Polder, "The Influence of Retardation on the London-van der Waals Forces," Phys. Rev. 73, 360, 1948.