Nature's Reality Is De-light-full!

M. Nisa Khan and Alan D. M. Rayner

Integration Theme

Both of us co-authors are qualified and experienced natural scientists. Nonetheless we hold a more comprehensive view of what is both truly 'natural' and 'scientific' than is predominantly thought and practiced in abstract terms that objectively isolate what is observed from the observer. For us, 'science' literally means 'knowing' the true nature of reality as 'all *actual* occurrence', in all its material and immaterial aspects and in all possible ways – not as a bit of it impossibly physically isolated from the remainder. Such science hence *includes* subjective human experience, artful expression and all-round circumspection of natural phenomena as well as empirically based analytical discernment and contradiction-free reasoning. Its findings can be rigorously supported by abstract methods of computational engineering-physics and mathematics, rather than depending on the prescriptive imposition of non-existent definitive reference frames as a source of paradox and misconception.

Opening

Somewhere Beyond These Narrow Confines

Occurs a wider, deeper outlook
Unbounded by restrictive rules
And hard-edged practice
Designed to keep
One's mind in check
Incapable of wondering
In more than incremental steps
From here to there
Into circuitous exploration
All around
.
Whence all that once had seemed excluded
Is welcomed in
To grateful reconsideration
As the source
The wellspring
From which all flows
Quite naturally
As timely current
And spatial stillness
In receptive-responsive relationship

Images: ‘Double Slit’ and ‘Magnolia Hole Point’ (Photographs by Alan Rayner, Bishop’s Palace, Wells, Somerset 27th March 2025)

Modern mathematical physics is founded on a false premise that abstracts material content from space-time, ultimately as a dimensionless point mass.

Newtonian mechanics, Darwinian selection, Einsteinian relativity and Quantum mechanics all arise from this same false premise. Each in its own way is struggling to make sense of the receptive-responsive relationship between void space and energetic flux, and each is making a hash of it – which is what comes of never truly understanding natural fluid calculus within curved as well as Cartesian coordinates. And each is sustained by pride and dishonesty in not admitting what has been excluded from consideration.

Correspondingly, there is a radical difference between the meaning of ‘local’, as somewhere, sometime – and ‘omnipresent’ as everywhere and always. The latter description only applies to void space as a receptive continuum. All practical problems are therefore local and cannot realistically be extended or reduced to infinity or zero dimensionality. They are never ‘finite’ in the sense of ‘definitively discrete’, but may be treated as such temporarily for practical purposes. This is why generalised ‘one size fits all’ philosophies are so potentially misleading and damaging.

For full comprehension of the nature of reality, it is necessary to adopt a contextual as well as figural mode of perception.

Demonstration of Natural Reality with De-light-full Experiments

We human beings have been gifted with the sensory ability to distinguish between three fundamental aspects of the natural reality into which we are born. There is a tangible, material aspect, which resists prodding. There is a non-resistant, spacious aspect, which is receptive to movement. And there is an energetic aspect, which animates movement.

We have also been gifted with the philosophical ability to contemplate how these three aspects combine and relate with and to one another in all natural phenomena, of which we, ourselves, are an example. Where our contemplation is insufficiently comprehensive, it will result in biased perceptions that are prone to be self-contradictory, misleading and harmful to our selves[1] and our environment. Where it is sufficiently comprehensive it can bring a deep understanding and appreciation of the natural world and our human place within it.

Benefits of a non-contradictory and natural philosophy and the detriments of a philosophy avoiding natural principles are elaborated here: https://www.youtube.com/watch?v=a-VxKqcDenY [1]

In essence: Every tangible body is a dynamic local inclusion of intangible space somewhere, sometime within intangible space everywhere and always.

Neither one nor the other alone, but each in the other, dynamically distinct but mutually inclusive, in receptive-responsive relationship. Zero within one within infinite that can be symbolically depicted as: ~(O) ~

Neither a definitive whole nor a part in sight - except for short term practical purposes.

This is an understanding that anyone can reach, without any requirement for intellectual or technical sophistication. Compare, for example with this:

https://www.youtube.com/watch?v=BJMeKMHchwo [2]

The narrative above, concerning the fundamental evolutionary principle of 'natural inclusion', comes from Alan Rayner and M. Nisa Khan finds it compelling and valid. In order to elucidate the narrative, Khan offers her work on physics, computational engineering-physics, and mathematics, while attempting to combine all such into a working, comprehensive philosophy. This article includes contents from some conversations between Rayner and Khan which we use towards initiating and presenting this philosophy.

To Khan, philosophy is the following.

[1] "Our selves" is written as two words to perceive each of us as distinct self and not as a "together" entity.

We, humans, have received a natural gift that allows us to perceive, experience many things locally, and to also contemplate why and how all that we see and experience works and continues working. This contemplation is largely what we call 'philosophy'. While humans are at a liberty to philosophize myriad notions, no philosophy can be beneficial or sustainable in the long run if it is not contradiction-free when applied both locally and universally.

In an attempt to obtain such a comprehensive philosophy, Khan draws on her knowledge and experience in physics and mathematics and sees a strong parallel between authentic Indian ganita or mathematics as discussed in her book, "Blinding LED Headlights: The Biggest Blunder of Modern Science" [3] and "Advaita" philosophy as described by Swami Sarvapriyananda in the video referenced above [2].

Rayner describes a tangible body of material as a dynamic inclusion of intangible space that is everywhere and always. This intangible space is a void, meaning there is "no thing" in it anywhere. For a material to exist as a dynamic inclusion of space in such space that is void, there needs to be energetic properties and action associated with matter; similarly void space can only receive the matter's dynamism when some energetic field is present beyond the matter's boundary!

So how does all that happen physically?

Khan demonstrates this process later in this paper showing that at some center, regarded as the center or mass of each material body, there is a hole that is ever diminishing in size and this small, local hole is the same void as that of space that is always present everywhere. She also demonstrates that this ever diminishing or infinitesimal hole resides at the mass's center due to some energy circulation around the hole. This energetic field extends beyond the seeming boundary of the matter and therefore the boundary of matter is dynamic in actuality, although not always necessarily seen. As we note many tangible materials in our environment including "our selves", it then makes sense that some energetic field continuously exists in space and it is in fact what ether is, which pervades as an overlay in space.

Rayner eloquently describes the infinitesimal hole within a material as:

"The receptive keyhole enabling the door to this awareness to be opened is the 'hole point' of no measurable value in the core of all material form."

Rayner calls this 'The Hopening'. [4]

Khan deems it appropriate to call both matter and ethereal energy "substance", whereas space is not because space is pure void. Although modern physics has struggled to understand and describe space and ether and many contradictory descriptions exist even as accepted physics theories around them, it seems intuitive that one must acknowledge the presence of void space everywhere while matter occurs dynamically somewhere along with ether within infinite space.

While any physical entity's behavior cannot escape this reality, Khan demonstrates this reality in several realistic or practical case examples considered in the computational physics domain.

The first case is a channel optical waveguide she simulated using a finite-difference method (FDM) in her Ph.D. thesis [5] as shown in Fig. 1. She validated the waveguide modal behavior by fabricating this waveguide in compound semiconductors and measuring its light distribution profile. Fig.2 shows the actual scanning electron microscope (SEM) photograph of such fabricated waveguides. A similar case with a two coupled waveguide is simulated using FDM in Fig.3 and an actual fabricated structure is shown in Fig. 4. [5]

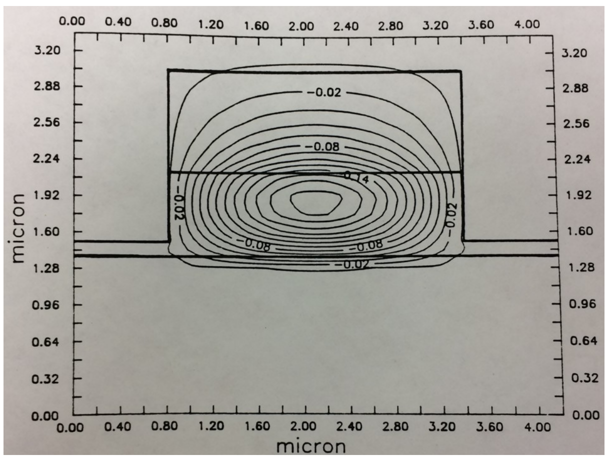


Fig. 1

Fig. 1. FDM simulation of an optical channel waveguide's EM Field. (Khan's Ph.D. Thesis, 1992, page 46.)

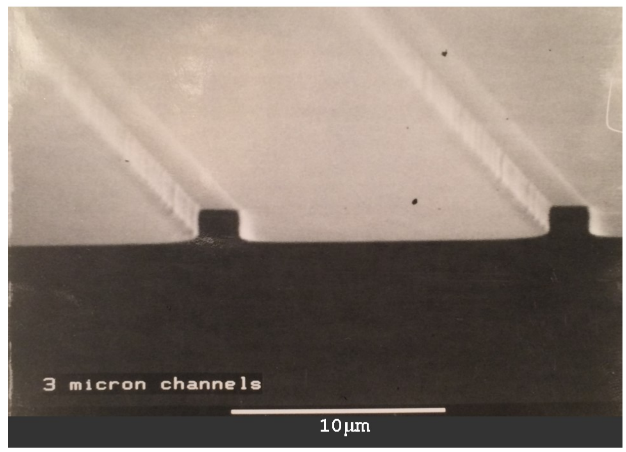


Fig. 2

Fig. 2. SEM photograph of channel waveguides. (Khan's Ph.D. (Thesis, 1992, page 103)

In Fig.1, the FDM calculated light intensities at the waveguide end-facet are shown as contours of equal intensity. In Fig.1, the rectangular waveguide cross-sectional or end-facet geometry is drawn separately as an overlay according to the dimensions used for the simulation. Each contour, which is approximately elliptical especially near the mass center, has a computed value accurate to 2 decimal places, although not all contours in the figure are marked. While the contour near the center, representing the center or weighted mass, receives a computed value, the region enclosed by this contour can never be assigned a computed value! This is true even when more and more accurate numerical simulation is performed for this material, optical waveguide. As the numerical accuracy of the center contour increases, the size of it decreases and so does the enclosed area inside the contour. Still this or any other similar numerical computation method can never generate a value for the area inside the center contour.

While any simulation such as that shown in Fig.1 is performed by abstractly cutting out a region around the waveguide, and using Cartesian coordinate-based calculations, the result obtained nevertheless shows that in the middle of circulating light energy fields inside a material waveguide – there is a void or a 'hole point' that assumes no value whatsoever!

The second case considered here also demonstrates that there is a void in each of the two channel waveguides in proximity as shown in Fig.3. Such a configuration is known as two coupled waveguides that can be used as a directional coupler to provide light switching or modulating functions in optical systems. [5] Khan demonstrated light switching and modulating functions by designing, fabricating, and testing this coupled-waveguide structure in laboratories. Fig. 4 shows an SEM photograph of the directional coupler whose microwave (RF) signal intensity simulation by means of transmission lines on the waveguides is presented in Fig. 3.

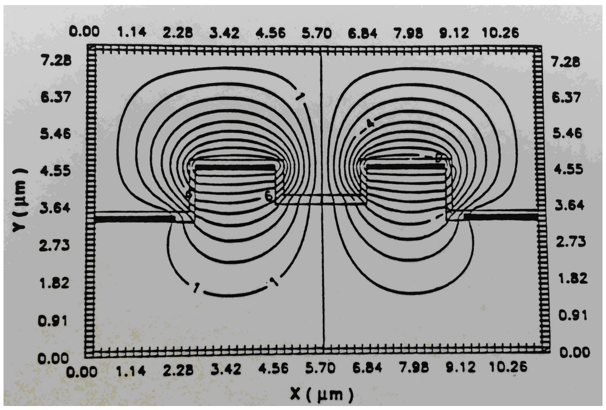


Fig. 3

Fig. 3. FDM simulation RF field of a waveguide coupler with transmission lines. (Khan, Ph.D. Thesis, 1992, page 86.)

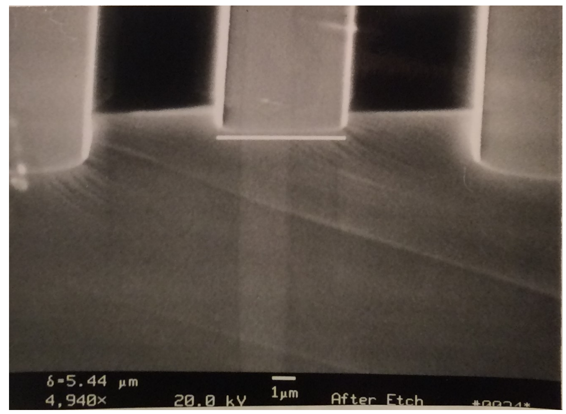


Fig. 4

Fig. 4. SEM photograph of a waveguide coupler with transmission lines. (Khan, Ph.D. Thesis, 1992, page 127.)

As discussed above, in each channel waveguide in Fig.3, we note at the mass center, there exists a 'hole point' that has a nearly elliptical boundary; but inside the boundary, the spatial region does not possess a numerical value. Furthermore, the RF intensity fields expand beyond the material waveguide boundaries in Fig. 3, and these fields are dynamic in their true nature!

Fig. 3 demonstrates several things Rayner stated decades ago about the physics of material forms in space. Firstly, matter or material ensembles in space are distinct, but not discrete. This is seen in the two distinct waveguides forming what is known as a "coupled-waveguide" structure in Fig.3. They cannot be considered discrete because they clearly share the energetic fields around them and these field contours overlap in the gap between the two waveguides.

Secondly, Rayner states that the boundary between material form and space is dynamic. This too is real because while the material boundaries may appear fixed when we view the two semiconductor material waveguides, the light or electromagnetic energies of the ensemble extend beyond the hard material boundary lines drawn in the figure. And overlap of such light energies is the very reason light exiting from each waveguide from the end facet can be modulated over time and light from one waveguide can be completely switched to the other one after the light energy travels a certain distant down these structures.

Thirdly, Rayner states that in each material form, there is a void or a hole point around which energy circulates. Certainly, this is clearly seen in the two cases considered here.

While Rayner's descriptions are demonstrated in two cases here that involve light or electromagnetic energies within and without (or outside) material structures, could one argue that such are not true for a chunk of solid wood, for example? Khan would argue that Rayner's descriptions are always appropriate and accurate for all material existing locally in space. Simply because space or spatial void exists everywhere extending to infinity; some energetic field or ether pervades this spatial domain and the energetic properties are within and without every material form. If there are many such material forms residing locally in space, they can be distinct from one another; but never discrete as they share dynamic boundaries among "them selves" and with their local spatial regions or neighborhood.

The FDM method applied to obtain the results depicted in Figs. 1 and 3 was developed into a software program by Khan and her colleague J. P. G. Bristow [6] and consequently Khan is profoundly familiar with the algorithm used in such a finite numerical software tool. Here she elaborates more on just how a simulation in Figs. 1 and 3 are obtained from the start in order to demonstrate that space is always, locally and everywhere, a void.

The step-by-step process of calculating the electromagnetic field distribution for the optical waveguide in Fig. 1 is the following. At the very beginning, the finite rectangular space window is defined as depicted in Fig. 5, with an appropriately scaled width and depth to fully include the waveguide cross-section of a certain rectangular geometry. For analyzing the case of Fig. 1, the space window size is 4.20 micron by 3.36 micron. This space is void of any material or energetic properties; but still has its own receptive properties in the form of permittivity (ε_0) and permeability (μ_0). This is equivalent to acknowledging that for any material to be included in a domain, a domain of continuous, receptive void must first exist on its own.

In the next step, a grid is overlaid on the space window with enough x and y nodes so that the distance between two adjacent x and y nodes, i.e., the Δx and Δy granular units are structured finely enough to assign properties of matter elements and certain energetic domain within the space window. The case simulated in Fig.1 is a waveguide that sits on a semiconductor substrate in open air and therefore matter elements are that of the waveguide and the energetic domain is the open air around the waveguide. Accordingly, for each (x_i, y_i) node, the corresponding values permittivity (ε) and permeability (μ) are assigned depending on whether a node belongs to the waveguide or open air as seen in Fig. 5. The permittivity property of matter or energy fields is equivalent to the ability of matter or electromagnetic field to respond in a given situation that maybe viewed as some occurrence we refer to as 'occurrity'. Similarly, the permeability property of matter or energy fields is equivalent to the ability of matter or EM field to receive the response for the same occurrence. These properties can be thought of as inherent properties of matter and EM energy locally.

A governing equation derived from Maxwell's Equations is then solved for the entire window with specified (ε_i, μ_i) for each node 'i' while satisfying certain boundary conditions along those boundaries that separate materials from other distinct materials or EM energetic field. This governing equation is equivalent to what is known as the EM wave equation, which is a second-order differential equation. [5]

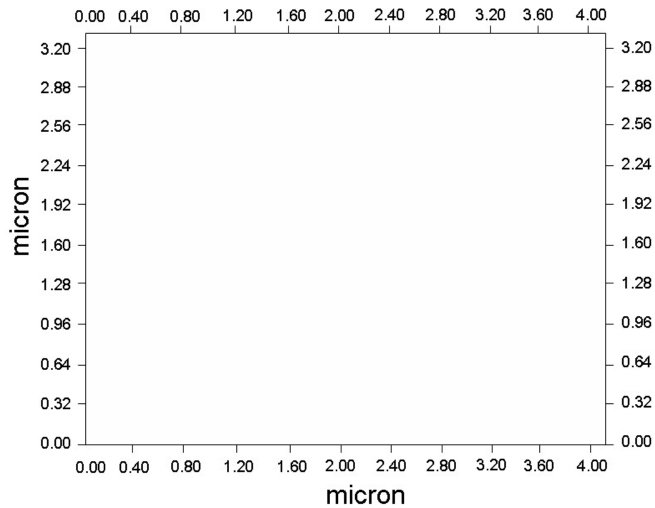


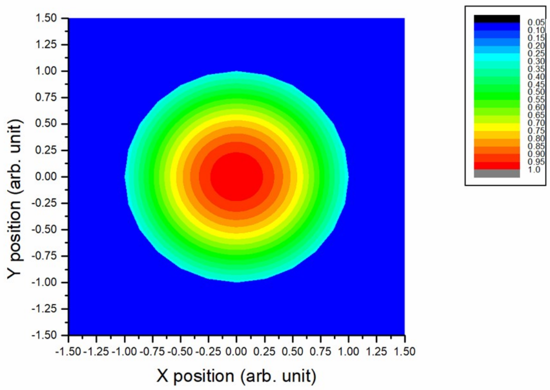
Fig. 5

Fig.5. Finite simulations start with first creating a space window containing nothing as shown here with the finite window size of 3.36 micron X 4.20 micron. Then the space window is divided with a grid of suitable Δx and Δy and ε_0 and μ_0 are then assigned to the grid nodes as the receptive and responsive properties of void. Then each grid node 'i' is overwritten with different ε_i and μ_i according to the waveguide geometry and what resides outside it, which in our case is air. Therefore all grid nodes then get specified by either the waveguide's (ε_w , μ_w) or that of the air, i.e., (ε_{air} , μ_{air}). The waveguide is placed on the gridded region with its mass center being closest to the center of the entire rectangular space window.

Similar finite-difference and finite-element software tools have since become commercial and graphics can now be generated with colors representing contour's regional values. Still, all such numerical simulation software programs use the same basic concepts of using grids in a space window to assign matter and energetic field's responsive and receptive properties.

A typical semiconductor LED is also an optical waveguide structure that enables light propagation through the material layers inorganically grown on a substrate and that light exits from the chip surface. In contrast, in channel waveguides, as seen in Figs. 2 and 4, light exits out of the channel facet that is invariably part of a side edge of the chip as seen in Fig.2.

While commercial FDM software tools are now available that can simulate LED outputs that resemble that shown in Fig. 1, Khan was the first to derive an analytic equation for LED light intensity distribution generated on the LED surface and in the immediate 3D space (i.e., near field) where the LED light is cast in open air medium. [7] She validated her derived equation by calculating the surface light intensity profile of a Philips LED. In Fig. 6, the light output calculated for the Philips LED is plotted on the surface of the LED with intensity or EM field distribution using a contour map. In Fig. 7, the same calculation of light intensity is plotted differently. This plot, although not a surface contour plot, is nevertheless a surface plot where contours of higher light intensity is now plotted with increasing heights.



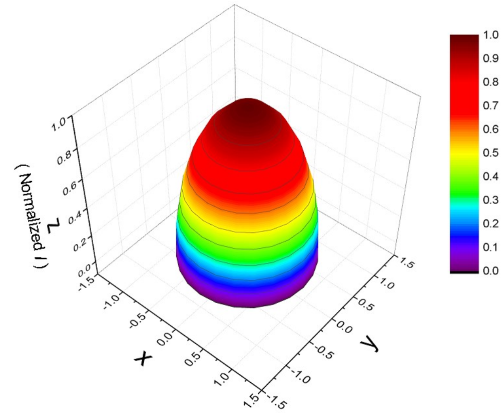
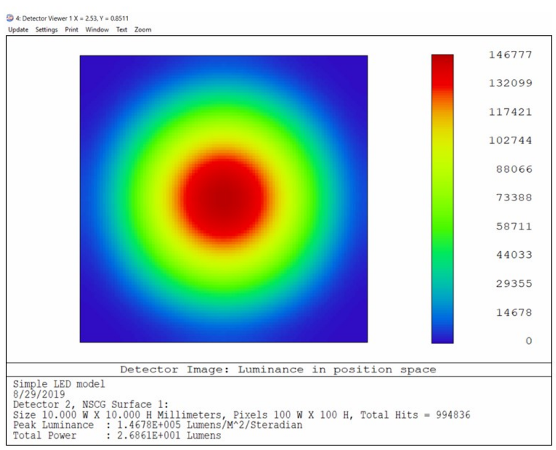


Fig. 6
Fig. 6. The normalized light intensity calculation of an LED Khan's closed form equation. (Fig. 13 in Ref. [7])

Fig. 7
Fig. 7. The normalized light intensity on an LED surface using Khan's closed form equation. (Fig.11 in Ref. [7])

In Fig. 8, the light output measured from a Philips LED is plotted on the surface of the LED as luminance distribution using a contour map. In Fig. 9, the calculated and measured luminance are plotted together over one transverse axis only to show the very good agreement between Khan's calculation using her novel derived closed-form, analytic formula and the measured data from the Philips LED. [7]

In both Figs. 6 and 7, the center of the plot actually does not contain a computed value even when an analytic closed form equation is used for intensity calculation. Why? Because, in reality, the closed form equation still needs an inherent value at the center for response and receive properties of the LED, which cannot be measured or simulated. Rather, in the plots, the nearest closed contour's value is just artificially extended to the middle that represents the mass center.



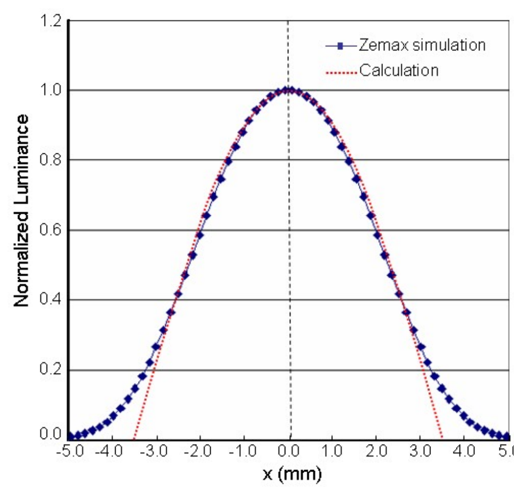


Fig. 8
Fig. 8. The luminance data, equivalent to surface light intensity, of a Philips LED. (Fig. 12 in Ref. [7])

Fig. 9
Fig. 9. Comparison between Khan's calculation and data from a Philips LED in one transverse direction. (Fig. 14 [7])

It is impossible to measure any substance at this mass center juncture in an isolated fashion. Instead an average value (for example, average brightness or luminance) is measured over a finite aperture and this value cannot correspond to the ever-decreasing infinitesimal concept that is the same as the 'hole-point', which is an actual void. This void is the attractor of both matter or radiation that binds them to space that exists everywhere and always - only as void.

While the mass center does not hold a value or cannot be assigned a value corresponding to any substance in reality or even via computation, it does, in the case of an LED or laser, approach some real luminance value. So what real value does the middle approach in Figs. 6 and 7 – but actually never gets there? Because the mass center never gains this approached value, it actually always remains as a true void! In the case of an LED, the mass center or the hole point, approaches a real value that can be calculated using Equation [9] in Khan's 2019 paper. [7]

This mass center of any material form remains a void without assuming a physical value while it asymptotically approaches some real value. This physical and real value can be described as some quantified material mass or radiation energy. The concept of asymptote is therefore important and must not be treated only as some nonrepresentational mathematical concept!

The concept of asymptote describes something real and can be contemplated rather than measured. Physical substance in 3D space evolving over time can have physical properties that asymptotically approach some real value or zero or infinity or finite or whole numbers. Whole numbers are also known as natural numbers or integers and definite portions of them are known as rational numbers.

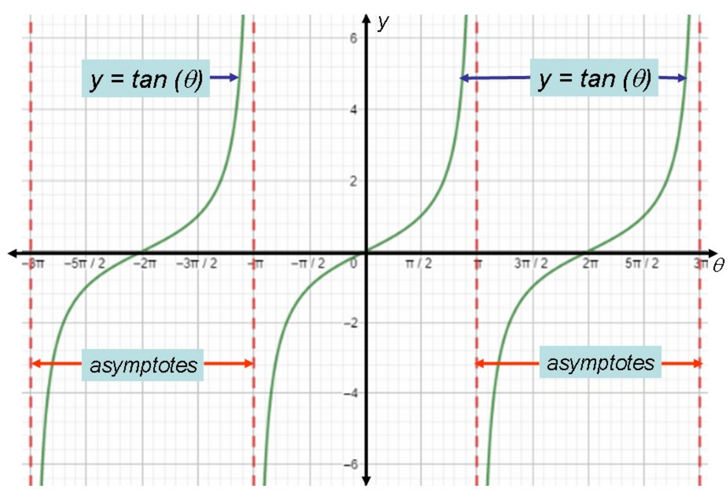


Fig. 10

Fig.10. The tangent function is graphed on an abstract 2D Cartesian coordinate system showing the functional values in green and asymptotes with dotted read vertical lines.

It is best to describe asymptotes using abstract graphs. While asymptotes are intangible, it turns out that it can be depicted in an abstract manner using tangent curves drawn in 2D Cartesian coordinates. It is important to note that no real physical phenomenon can be entirely or accurately described in 2D Cartesian coordinates. In Fig. 10, repeated tangent curves are drawn along horizontal axis representing angles increasing from zero to higher values and vertical axis representing the tangent of those angles. The asymptotes are the vertical lines at certain angles where the tangent values cannot be defined.

Just as physical materials interact with and possess properties of EM radiation in the optical, microwave, and radio spectra, they can interact with EM radiation in the thermal or infra-red spectra as well as in the audible spectra. The simulations and calculations presented above are analogously used or could be used for thermal and sound systems. Finite difference methods are also utilized to obtain thermal analysis of LEDs and examples of such are shown in Fig. 11 and 12. Details of how these simulations are performed are explained by Khan in "Understanding LED Illumination" (CRC Press, 2013). [8]

Figs. 11 and 12 are contour plots generated using the commercial software Sauna V4.500. They show similar thermal energy distribution behaviors on an LED surface as those shown in the LED's light energy distribution in Fig.6. While Fig.11 shows the thermal energy distribution for an LED with a large heat sink attached to it via a ceramic plate, Fig. 12 only shows an enlarged portion of the ensemble in order for us to note the distinct temperature contour lines. Unfortunately the entire LED chip, shown as a square in light red, shows the same finite temperature value because the grid used for the LED chip region was not fine enough. If it were, similar elliptical contour lines would appear where no real value would be computed at the exact center location of the LED chip. For thermal simulations, the physical properties that engage in receptive and responsive occurrences within energy flow movement are translated with thermal conductance and resistance parameters instead of ε and μ used for light energy distribution calculations.

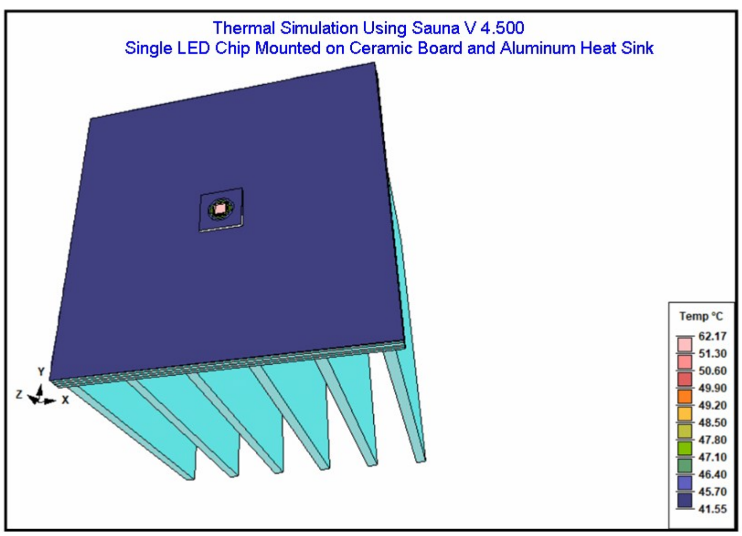


Fig. 11

Fig.11. Thermal Simulation of an LED mounted on an aluminum heat sink. Calculated temperatures are shown using false colors. Lightest blue corresponds to the coolest temperature in the aluminum fins; light pink is the hottest temperature inside the LED.

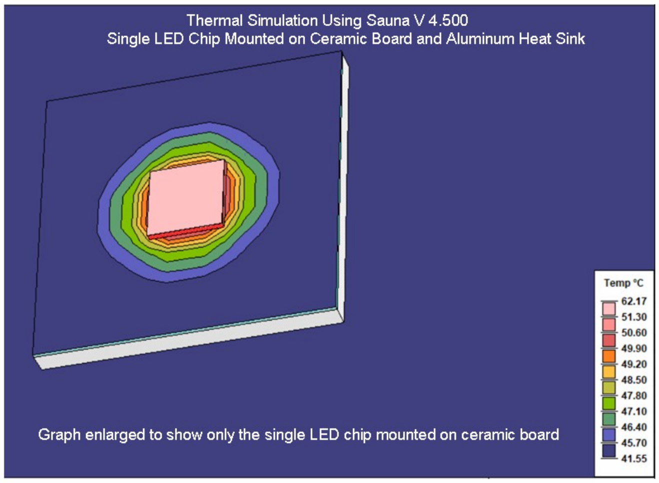


Fig. 12

Fig.12. An enlarged region from Fig. 11 simulation showing distinct contours on the LED substrate. The LED chip is shown as a square on top of the substrate. Similar contour temperature gradients on the LED are not calculated here only because the grid on the LED was not sufficiently fine and such as approximation is usually acceptable for LEDs' thermal analyses.

The simulations for predicting weather activities including temperature in certain geographic regions are essentially similar to the thermal simulations seen in Figs. 11 and 12. But weather prediction modeling and simulations are performed at much larger scale where state-of-the-art supercomputers are required to obtain reasonably reliable predictions.

Fig. 13 shows a modeled temperature contour plot of surface temperature in the US from 2017.

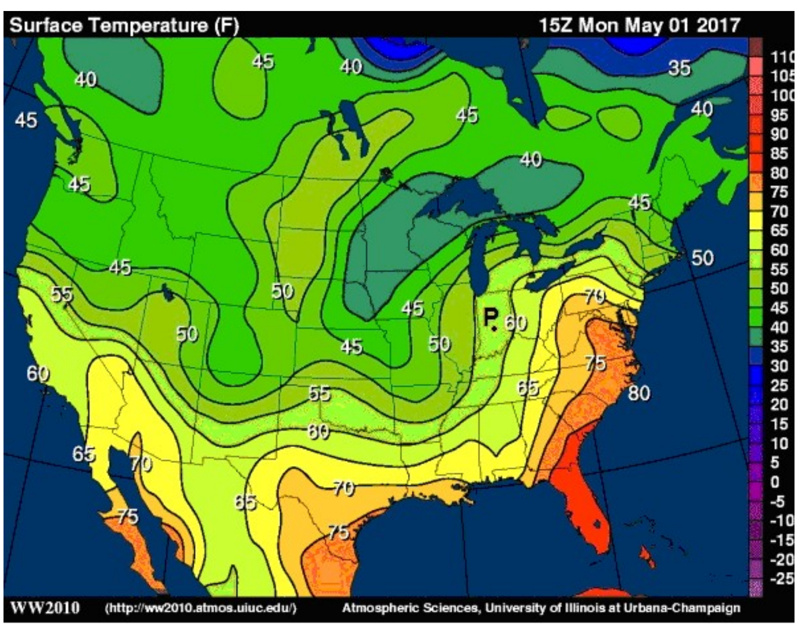


Fig. 13

Fig.13. An example of a weather prediction simulation for the US from May, 2017. False colors are used to distinguish temperature variations in regions using isothermal contours. (Ref. [9])

The authors generating Fig.13 have stated the following: “If we wanted to pick a specific point, "P," on the map, near Indianapolis, Indiana, and estimate a specific temperature, we could do that, too. Point "P" is approximately half-way between the 55 and 60 degree Fahrenheit isotherms, so the temperature at "P" is about half-way between 55 and 60 degrees Fahrenheit. We'll call it 57 or 58 degrees Fahrenheit, knowing that we're just making our best estimate based on the isotherms. I should also point out that sometimes you won't even see isotherms plotted, and instead, a temperature map will just be shaded. In reality, every boundary where colors change is an isotherm (even if it's not drawn or labeled), and sometimes very small contour intervals are used.” [9]

We have now seen numerous cases where scientific calculations use rigorous mathematics and computation engineering methods to solve practical problems involving matter and EM radiation confluence. In all such analyses, the mass center of any substance, be it matter or EM radiation, is a void or ‘hole point’ that cannot be assigned a value representing some physical property; nor can it be measured in an isolated fashion. This hole point is an attractor around which EM radiation energies circulate in 3D space and evolve over time. We have also seen that any boundary distinguishing matter or radiation in space is dynamic and intangible, meaning they do not have rational or discrete values. Most notably, matter and EM radiation substance are receptively included in space that is simply a void containing “no thing” whatsoever.

These descriptions have been clearly stated by Rayner in many publications since 2000 [10]. Rayner has also stated, “The void within matter is continuous with that which is present throughout everywhere, including throughout 'ether' as an immaterial combination of natural space and energy in mutually inclusive receptive-responsive relationship - distinct but not separate. (Einstein seemed to get confused about this!).” Rayner further stated, “The spatial void throughout everywhere can be felt by a human entirely in one instant!” This is what Fourier Transform is all about and Khan hopes to elaborate on this in a future publication as she does not think Fourier was aware of what Fourier Transforms physically mean in Nature. [3]

There appears to be an important synergy between what has been said here by Rayner, with the support from Khan’s work on physics and computational engineering, and authentic Indian ganita or mathematics [3]. Such ganita itself is the confluence of all of Nature without any contradiction. Ganita used to be held with the highest respect in the Vedic culture and it is essentially physics or the fundamentals of all science. Science has been the cornerstone of Vedic civilization. Hence it is ‘big knowledge’ in other words Vedic science that cannot be altered with misguided or abstract notions. “Advaita” philosophy as described in [2] is also synergistic with Rayner’s description of Nature and Ganita - in that the infinite spatial void is at the core of every person (i.e., the person’s awareness) which itself is the same void. Such a philosophy is non-contradictory, harmonious, and hence De-light-full!

Anything else other than such philosophy and general practice is abstract and will lead to contradiction sooner or later. Abstraction can be useful so long as we know that we are being practical in the short term. It is equivalent to Louie Gardiner saying that even the name 'Louie' is an abstraction because the larger 'LOUIE' is not 'Louie' – the name!

Acknowledgement: The authors would like to acknowledge the following companions who have engaged in conversations with them and offered their unique and yet synergistic take on spatial void and the 'hole point' residing at the heart of all distinct substance that exists locally in space:

Louie Gardiner, Roy Reynolds, David Peleshok, Christian Taylor, Kristi Strazzullo, Fabienne Vailes, and Eva Vass.

References

1. https://www.youtube.com/watch?v=a-VxKqcDenY
2. https://www.youtube.com/watch?v=BJMeKMHchwo
3. Khan, M. Nisa, "Blinding LED Headlights: The Biggest Blunder of Modern Science", self-published by KDP Publishing, December 2024.
4. Rayner, A. D. M., "The Hopening", https://ia600200.us.archive.org/31/items/natural-inclusions-paintings-vol-4/Natural%20inclusions%20Paintings%20vol4.pdf
5. Khan, M. Nisa, "Ph.D. Thesis", University of Minnesota, Department of Electrical Engineering, 1992.
6. M. N. Khan, A. Gopinath, J. P. G. Bristow and J. P. Donnelly, "Technique for velocity-matched traveling-wave electrooptic modulator in AlGaAs/GaAs," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 41, no. 2, pp. 244-249, Feb. 1993, doi: 10.1109/22.216463.
7. Khan, M. Nisa, *IEEE Photonics Journal*, Vol. 11, No. 6, December 2019.
8. Khan, M. Nisa, "Understanding LED Illumination", (CRC Press, 2013, Boca Raton, FL, USA)
9. https://www.e-education.psu.edu/meteo3/l1_p10.html
10. Rayner, A. "The Origin of Life Patterns in the Natural Inclusion of Space in Flux" (Springer, 2017, Berlin/Heidelberg)