MECH'S PHYSICS I

Rewrite the Maxwell's Equations

SAMPLE

Introductory Sections Only

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Asked if he
"stood on the shoulders of Newton,"
Einstein replied,
"No, I stood on the shoulders of Maxwell." [1]

He must have started from under the ground beneath Maxwell's feet.
In this book, we start our exploration from there.

CONTENTS

PREFACE

Call me “Mech.” This is the title and the nickname I coined for myself. (Because I do not have a doctorate.) This means an earnest, greasy mechanic. I have long been craving such a life, fiddling around with machines of my own inventions alone wordlessly.

But more seriously, I have been desiring to understand how our world works mechanically, not only mathematically. So, I defined “Mech,” a title for a “Mechanism Seeker.”

My hero Kukai, who led Japanese Buddhism in the 7th century, is said to have entitled himself as a “Samana” when he was young. In those days, the word Samana was a title for a person without official monk status who sought religious truth through ascetic life. Only one qualification to be a Samana was declaring so to himself.

Like young Kukai, I declare myself a Mech. I hope you will accept my declaration with a generous, warm heart.

If you want to call yourself a “Mech” after reading this book, please do so. You can use this title only for declaring to yourself.

Before and after my retirement in June 2013, I have always sought mechanisms of general relativity, gravity, momentum, the origin of mass, blackholes, cosmology, quantum mechanics, light, and the unified field theory. And now, in the year of the 10th anniversary of

my retirement, I am convinced that the time has matured for publication.

My *Mech's Physics* series books will cover all the above topics with one coherent original hypothesis. All I present hereafter are far from orthodox ones. So, my books are intended for self-sustaining explorers with curiosity and guts of voyagers who enjoy judging what to accept on one's own responsibility rather than for disciplined learners.

You could categorize what I present here as one of the fringe theories. Indeed, I cannot guarantee the legitimacy of my theories. It is up to you to judge. But, at least, I guarantee that I will offer many fresh points of view, thought experiments, and ideas of original experiments you have never encountered.

You need to know the basics of vector calculus and *Special Relativity* as prerequisites. But only with them, without abstruse mathematics, will you find consistency and comprehensiveness in my theories, both of which the "*Standard Model*" fails to satisfy as a whole. As you know, quantum theory is incompatible with relativity. All attempts to harmonize them seem like crying for the moon.

This book on rewriting constitutive equations of electromagnetism is the starting point that serves as the foundation of all my following books, which accommodates the whole system of physics theories from the beginning.

As cited on the front page, Albert Einstein, the most crucial founder of modern physics, said that his theories were built on the shoulder of Maxwell. But I believe he must have started from under the ground beneath Maxwell's feet.

In this book, we start our exploration from there.

1. A HISTORY OF ELECTROMAGNETICS AND AETHER

In modern physics, electromagnetism is described purely mathematically, apart from mechanical rationalization.

The mechanism of how a ray of light propagates has been one of the most vital concerns of physicists. In the process of studying the history of electromagnetics, I found all-stars of historical physicists and mathematicians.

Search for some popular rankings of the greatest physicists and the greatest mathematicians. You will find many of the same names on both rankings, many of which left significant achievements in the study of light or electromagnetism.

You must not be familiar with the term “Aether” because few books today treat it seriously. But until the age of Einstein, aether was the most serious concern in physics society. As far as I know, most of the greatest physicists have tried to explain the mechanism of light with various kinds of aether at least once. You might not know that even Newton and Albert Einstein, both famous anti-aether theorists, were once one of them.

I believe the ultimate purpose of the pro-aether theorist’s struggle was to attribute the energy of light to the potential energy and the kinetic energy. If the space holds these energies in its way, there must be some substance to keep them. Most physicists just before the age of Einstein called the substance the aether.

In today's electromagnetics, the energy of electromagnetic waves is attributed to electric energy and magnetic energy. Most physicists today seem to believe that all questions on electromagnetics have settled, and it is no longer an area to look into.

But it is settled only mathematically in an abstract way. The mechanism pro-aether theorists sought keenly was left unanswered. What corresponds to potential energy, and what corresponds to kinetic energy?

Until now, all pro-aether theorists' trials seemed to have failed and forgotten. I present here what their aether was like before I revive it as the "*Yasui's aether*."

1.1 Modern Formulation

$$\Box \boldsymbol{A} = -\mu_0 \boldsymbol{j}. \tag{1.1}$$

This is the most elegant equation in all physics equations, in my opinion. This is the ultimate figure of the mathematical crystallization of Maxwell's equations, in which $\boldsymbol{A}$ is the electromagnetic four-potential, μ_0 is the vacuum permeability, and $\boldsymbol{j}$ is the four-current.

But I do not elaborate on this here because this is NOT the direction we go in my books. This equation is beautiful but tells us nothing about the mechanism of electromagnetism.

Instead, we go the other way around. Decompose, digest, reason the mechanism, and reconstruct a new set of equations that does not contradict the conventional one but adds additional ideas, as special relativity did over Newton's dynamics.

1.2 Age of Ancient Greece

In ancient Greece, "aether" (also spelled as "ether") was the

personification of the bright upper sky. The term "aether" was also used by philosophers such as Plato and Aristotle to describe the fifth element, which was believed to fill the celestial realm beyond the Earth. The concept of aether was primarily associated with their cosmological theories.

1.3 Age of Scientific Renaissance

In the 17th century, as a part of the Scientific Renaissance, the mechanism of light began to be looked into scientifically for the first time. The term "luminiferous aether" began to be used as a medium for transmitting light.

PHOTO 1-1 Christiaen Huygens II (1629-1695),
by Caspar Netscher,
PD, available on Wikimedia Commons.

Christiaan Huygens was a great mechanism seeker. He explored what light is and how it behaves, and proposed wavelet theory known as the “Huygens–Fresnel principle” in his “Treatise on Light,” [2] drafted in 1678.

He described how each point on a wavefront acts as a source of secondary spherical waves that form the next wavefront. Although his theory had some faults, his wavelet concept is still used to design phased array radars today.

He conceived of light as a wave that proceeds through the aether. I believe this is the first significant scientific study on the mechanism of light.

PHOTO 1-2 Sir Isaac Newton (1643-1727),
by Godfrey Kneller,
PD, available on Wikimedia Commons.

Sir Isaac Newton was a great mechanism seeker, too. Aside from his splendid works on differential and integral calculus and dynamics, he was engaged in research on light around the same age as Huygens.

At first, Newton showed favor for the hypothesis of aether. In his manuscript [3] in 1675, answering the aether hypothesis offered by Robert Hooke, who is known for "Hooke's law" of an elastic body, Newton partly supported Hooke's aether hypothesis.

But, five days after submitting that manuscript, on December 14th, 1675, Newton wrote a letter [4] to the editor to suspend that manuscript. In the letter, he wrote:

"*My conceit of trapanning* (* supporting) *the common Ether, as he* (* Robert Boyle known for "Boyle's law") *was pleased to express it, makes me begin to have the better thoughts on that he was pleased to entertain it with a smile. I am apt to think that when he has a set of experiments to try in his air pump, he will make that one to see how the compression or relaxation of a muscle will shrink or swell,*

soften or harden, lengthen or shorten it.
As for Registering the two discourses you may do it, only I desire you would suspend till my next letter, in which I intend to set down something to be altered & something to be added in the Hypothesis (* of Ether)*, being in the mean while.*"

Newton called the aether "the common Ether" at the beginning part of this letter. This shows that the concept of aether was already common at his age.

Newton had already favored the light-as-a-particle theory then, but after this incident, such a tendency against the light-as-a-wave theory seemed to be strengthened.

In *Opticks* [5]*,* published in 1704, 29 years after the above-cited letter, he mentioned aether 12 times. Aether seemed to have been a significant concern for Newton for a long time.

His writing is lofty and elegant but a little devious. Here, I translate what he wrote in *Opticks* down to simple and crude expressions of my understanding:

"*Some say light is a wave. If so, there must be something ponderous to vibrate. You can call it aether. But if such a thing exists, the trajectories of planets or anything must be susceptible to its resistance. Obviously, they are not. So, light cannot be a wave but extremely subtle particles I call corpuscles*."

I agree with Newton on one point:
"If the light is a wave, there must be something to vibrate."

Any waves carry energy from the radiation source to some receivers. It takes time to deliver the energy. Then, something must hold the energy when the waves are flying in the middle.

I guess the motivations of the light-as-a-wave theorists postulating aether were their desire to rationalize the mechanism of light and to explain the energy of light waves with potential energy and kinetic energy like the energy of waves in a common elastic body.

This challenge is precisely what historical physicists tried to do and what we will do in this book.

If we do not accept the existence of any media for light, we must accept the light-as-a-particle theory. I think today's concept of the "photon" resembles Newton's corpuscle. I want to discuss the concept of the "photon" later.

By the way, Newton was a super-giant in the academic society at the time and notorious for disgracing and ruining Hooke, who supported the light-as-a-wave theory. No one could raise their voice against Newton. Consequently, Newton's corpuscle theory dominated the study of light for a long time. This left Hooke and Huygens' light-as-a-wave theory forgotten for over a century.

I suppose Newton was a man of justice. He could not tolerate those who supported the hypothesis that Newton believed wrong. He must have wanted to guide those heresiologists back onto the "right path," he believed.

You can easily imagine that if you were in the age of Newton's dominance and asserted your wave theory, you must have been thrown out of the physics society easily.

This kind of thing happened everywhere in history. In the Roman Inquisition held in 1615, the Catholic Church and the best astronomers at the time guided Galileo Galilei, who insisted that the earth is circling the sun, onto the "right path," they believed.

Galilei spent his later life under house arrest.

Upon the news of this Roman Inquisition, René Descartes postponed publishing his "*Treatise on the World"* based on the heliocentric view like Galilei.

Position as a scientist is vulnerable. If you have a family to support, you are not free to argue against dominant power. You must be obedient to survive.

Is this kind of threat weakened today? I do not think so. Only a FIRE (Financial Independence, Retire Early) person like me can dare to propose a drastic new theory safely.

1.4 Age of Wave Science

In the 19th century, many physicists began to study the mechanism of light as a wave again. Many types of aether were proposed as the medium for light to explain the mechanism of reflection, refraction, dispersion, and interference in this age.

PHOTO 1-3 Portrait of Thomas Young (1773-1829),
by Henry Perronet Briggs,
CC BY-SA 4.0, available on Wikimedia Commons.

Thomas Young was a versatile person who left monumental works in various fields.

As a Mech, I am familiar with the “Young's modulus,” denoted as E. Young's modulus is a mechanical property of linear elastic solid that relates lengthwise stress (force per unit area) with strain (deformation ratio).

With the familiar “Young's modulus,” I believed he was a man of mechanical science. But he also had significant achievements on the study of light.

In the age when Newton’s century-old light-as-a-particle theory held rule over the study of light, he brought back the honor of Huygens, who argued that light is a wave.

Young put forth several mechanical reasons supporting the wave theory of light. He demonstrated interference experiments in the context of light-as-a-wave theory.

PHOTO 1-4 Augustin-Jean Fresnel (1788-1827),
PD, available on Wikimedia Commons.

Augustin-Jean Fresnel, known as the inventor of the Fresnel lens, made one major discovery on light. He was the first to understand that light is a “transverse wave,“ inspired by the interference experiment of light by Thomas Young mentioned above.

Fresnel established the “Fresnel equations” from experimental results showing the difference in reflection coefficient depending on the angle between the reflecting surface and the polarization angle of the incident ray of light.

At his time, no one knows that light is an electromagnetic wave. But Fresnel found at least something vibrating perpendicular to its direction of propagation.

He also found that any plane wave of light can be resolved into a combination of two orthogonal linear polarizations. So, he used two sets of “Fresnel coefficients” in his equations, one for normal and the other for parallel polarization to the reflecting surface.

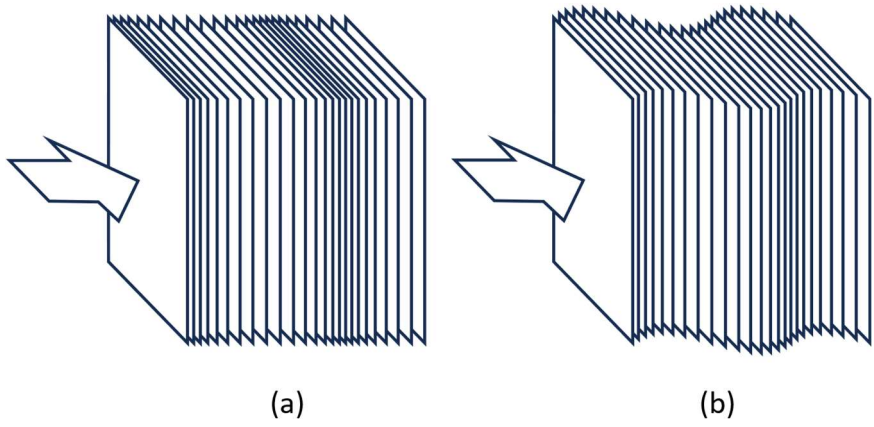

FIG. 1-1 (a) Longitudinal Waves, (b) Transverse Waves

There are two kinds of waves in the dynamics of a homogeneous elastic continuum. Namely, (a) longitudinal and (b) transverse waves, as shown in FIG. 1-1.

In seismology, they are called P-waves and S-waves, respectively. P stands for pressure, and S stands for shear. P and S also stand for Primary and Secondary, respectively, because the seismic pressure waves always reach earlier than the shear waves.

Longitudinal waves like acoustic sound propagate in compressible materials. Those materials can be both fluid and solid. Such material is compressed in some regions and expanded in others as those waves travel.

In FIG. 1-1 (a), when the left surface of some material is pushed

abruptly from the left, the left-end material in the planate region perpendicular to the push axis is compressed.

Because the propagation speed of a wave is limited, just the right-side plane of the left-end region stays still for a moment. Consequently, the material in the planate part is compressed, and the pressure there rises depending on its *modulus of elasticity in volume*. This rise of pressure accelerates the material in the adjoining region. This movement causes another push for the next part. The longitudinal waves propagate to the right with this chain reaction.

Therefore, there can be no angular-symmetry break around the propagation axis. In other words, longitudinal waves cannot have polarization. So, if light has polarization, it cannot be a longitudinal wave.

Transverse waves propagate in both compressible and incompressible materials. Those materials must be solid or fluid with such a high viscosity that they can be assumed to be solid. Such material is distorted as transverse waves travel.

In FIG. 1-1 (b), when the left-end surface of the material is dragged sideways abruptly, the left-end material is pulled in the direction the dragging displacement applied.

Because the propagation speed of a wave is limited, just the right-side plane of the left-end region stays still. Consequently, the material in the part is distorted, and the shearing force is generated depending on its *modulus of elasticity in torsion*. This shearing force accelerates the material in the adjoining region sideways. This movement causes another drag for the next part. The transverse waves propagate to the right with this chain reaction. The direction of the motion is called the polarization angle. The transverse waves have polarization.

Because fluids without very high viscosity cannot support shearing force, transverse elastic waves can propagate only in solid material.

"Fresnel equations" were constructed assuming the light waves

were transverse elastic waves like seismic S-waves with vibrations perpendicular to the ray's direction. So, the Aether-as-an-Elastic-Solid concept began to be studied by physicists after Fresnel.

Today, we know that the light waves were transverse, and no longitudinal wave light is known. This means that if the aether is an elastic solid, its *modulus of elasticity in volume* must be infinite or at least extremely high so that the speed of the longitudinal light wave is high enough not to be detected so far.

The aether must be incompressible.

Many physicists delved into their specific aether to explain the behavior of light in this age.

Sir George Gabriel Stokes, known for "Stokes' theorem" in fluid dynamics, thought the aether may behave both as a solid and a liquid. [6]

Stokes' aether behaved like a solid for very rapid vibrations of light to be compatible with transverse wave theory. Still, it acted like fluid for slower-moving objects to allow "aether dragging" to be consistent with the Michelson–Morley experiment mentioned later.

Augustine-Louis Carchy and Franz Neumann were supporters of the Aether-as-an-Elastic-Solid concept. They thought the difference in the refraction index of materials was due to the difference in the rigidity of the aether. [6]

George Green, known for "Green's theorem" and "Green's function" in mathematics, thought that the reflection and the refraction on the boundary face of different materials are due to the different densities of aether within them. [6]

James MacCullagh devised a rotationally elastic aether. His aether consisted of an array of incompressible rotatable spheric elements, as shown in FIG. 1-2. Guessing from the structure, MacCullagh seemed to intend to attribute kinetic energy to the angular momentum and potential energy to the rotational elastic distortion

of each element. The problem with his aether is that such a structure is hard to imagine.

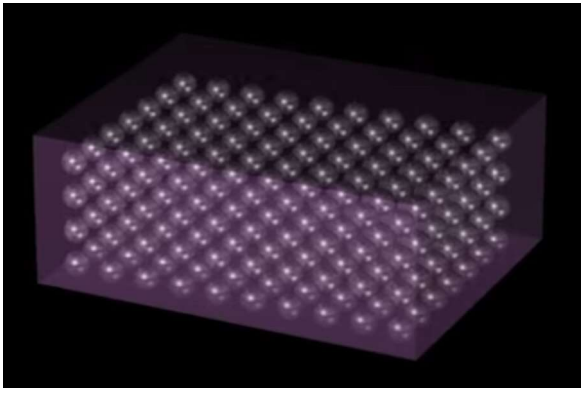

FIG. 1-2 MacCullagh's Aether
Source: See the Pattern
https://www.youtube.com/watch?v=W5UEGyqSqZg

Lord Kelvin, who left his name as the unit of absolute temperatures "kelvin," devised his version of aether to solve the problem of MacCullagh's aether. He figured out a mechanical structure of each element of MacCullagh's aether, as shown in FIG. 1-3.

The structure of Kelvin's aether element is;
"*formed of spheres, each sphere being in the centre of the tetrahedron formed by its four nearest neighbours. Let each sphere be joined to these four neighbours by rigid bars, which have spherical caps at their ends so as to slide freely on the spheres. Such a structure would, for small deformations, behave like an incompressible perfect fluid. Now attach to each bar a pair of gyroscopically-mounted flywheels, rotating with equal and opposite angular velocities, and having their axes in the line of the bar: a bar thus equipped will require a couple to hold it at rest in any position inclined to its original position, and the structure as a whole will possess that kind of quasi-elasticity which was first imagined by MacCullagh*" [6]

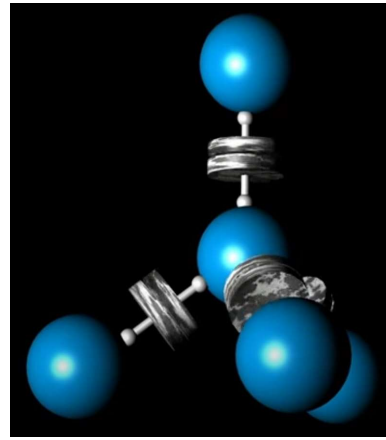

FIG. 1-3 Kelvin's Aether Element
Source: See the Pattern
https://www.youtube.com/watch?v=W5UEGyqSqZg

I do not think MacCullagh and Kelvin's models work well. But I can understand their desire to construct models to explain the mechanism of light with potential energy and kinetic energy stored in the structure of their aether.

All other challenges for a mechanical model of light in this age fell short of consistency.

1.5 Age of Electromagnetism

In the 19th century, just around the demise of Fresnel, electricity and magnetism began to be studied scientifically.

PHOTO 1-5 Michael Faraday (1791-1867),
by Thomas Phillips,
PD, available on Wikimedia Commons.

Michael Faraday opened the door to electromagnetism. He started his career as a chore boy because he was from a lower-class background and had not received a satisfactory education. Despite this handicap, he educated himself and made many epoch-making discoveries in chemistry, electricity, and magnetism.

Admitting that he could not express his discoveries mathematically due to lack of education, he devised many experiments and made many discoveries, such as electromagnetic induction. This paved the way for the heart of Maxwell's Equations. His graphical analysis of the force field, the "line of force" he called, influenced Maxwell strongly.

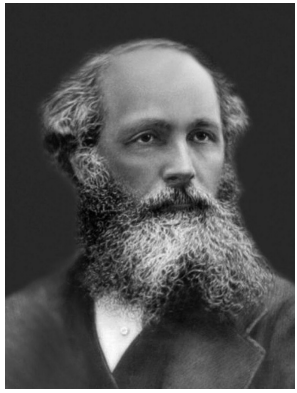

PHOTO 1-6 James Clerk Maxwell (1831-1879),
by an unknown author,
PD, available on Wikimedia Commons.

James Clerk Maxwell put together the laws of electromagnetism discovered by Faraday, Gauss, Ampère, and others, with the language of mathematics to construct a set of comprehensive equations of electromagnetism called “Maxwell’s Equations.”

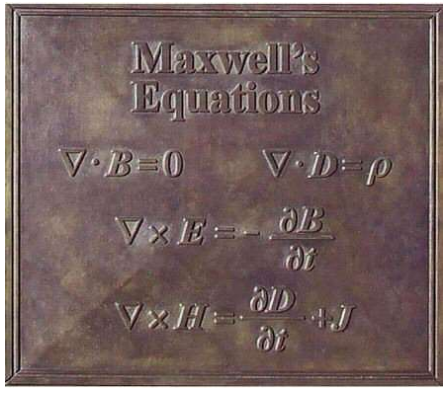

PHOTO 1-7 Plaque showing Maxwell's Equation in differential
form at the Edinburgh statue, by FF-UK,
CC BY-SA 4.0, available on Wikimedia Commons.

PHOTO 1-7 is the Plaque at the “Statue of James Clerk Maxwell” on George Street in Edinburgh, Scotland, showing Maxwell’s Equations in the commonly known form.

This plaque reads;

$$\nabla \cdot \boldsymbol{B} = 0, \tag{1.2}$$

$$\nabla \cdot \boldsymbol{D} = \rho, \tag{1.3}$$

$$\nabla \times \boldsymbol{E} = -\frac{\partial \boldsymbol{B}}{\partial t}, \tag{1.4}$$

$$\nabla \times \boldsymbol{H} = \frac{\partial \boldsymbol{D}}{\partial t} + \boldsymbol{J}, \tag{1.5}$$

where, in modern notation,
$\boldsymbol{B}$ is the magnetic field,
$\boldsymbol{D}$ is the displacement field,
ρ is the charge density,
$\boldsymbol{E}$ is the electric field,
$\boldsymbol{H}$ is the magnetizing field,
$\boldsymbol{J}$ is the current density.

Symbols written with bold Italic letters are three-dimensional field vectors. The only symbol with plain Italic letters ρ represents the scalar field.

Here, we have the following constitutive relations:

$$\boldsymbol{D} = \epsilon_0 \boldsymbol{E}, \tag{1. 6}$$

$$\boldsymbol{H} = \frac{1}{\mu_0} \boldsymbol{B}, \tag{1. 7}$$

where,
ε_0 is the vacuum permittivity,
μ_0 is the vacuum permeability.

Thus, the independent field vectors are reduced to three: ($\boldsymbol{E}$ or $\boldsymbol{D}$), ($\boldsymbol{B}$ or $\boldsymbol{H}$), and $\boldsymbol{J}$.

If $\boldsymbol{J} = 0$ and $\rho = 0$, these equations represent equations of motion of electromagnetic waves in a vacuum.

Though this set of equations is commonly called “Maxwell’s Equations” today, these equations should be called “Maxwell–Heaviside equations” because Oliver Heaviside constructed this formulation of equations.

Heaviside was a developer of vector calculus. With freshly developed his mathematical tools, he rewrote Maxwell’s original equations to today’s commonly known formulation on the plaque shown above.

Maxwell’s original equations are detailed later.

PHOTO 1-8 Heinrich Rudolf Hertz (1831-1879),
by Robert Krewaldt,
PD, available on Wikimedia Commons.

Heinrich Rudolf Hertz carried out the first radio transmitter experiments in 1887. This invention had a huge impact on the technology world as a communication tool. This gave the importance of Maxwell’s Equations a sharp rise.

A series of experiments observing the waves Maxwell’s Equations predicted were done by Hertz between 1886 and 1889. With these experiments, Hertz proved that the speed of these waves was equal to the speed of light. He also measured Maxwell's waves' electric field intensity, polarization, and reflection. With these experiments,

Hertz proved that light and these waves were both electromagnetic radiations obeying Maxwell's equations.

1.6 Age of Special Relativity

The "Special Theory of Relativity" (SR) was derived by applying laws of electromagnetics to moving objects. As cited on the front page, Albert Einstein's SR stood on Maxwell's shoulder.

Hendrik Antoon Lorentz and Albert Einstein represent this age. Because the main feature of the "Special Theory of Relativity" (SR) presented by Einstein is the "Lorentz Transformation," I believed that the arguments of these two physicists must have been identical. But in fact, they were very different in concepts.

PHOTO 1-9 Hendrik Antoon Lorentz (1853-1928),
by an unknown author,
PD, available on Wikimedia Commons.

Hendrik Antoon Lorentz derived the "Lorentz Transformation" and the "Lorentz Force," which describes the combined electric and magnetic forces acting on a charged particle in an electromagnetic field.

In all his works, he assumed his version of aether (or "ether" as he

wrote) as the medium which transmits electromagnetic waves. His aether was revised several times. Jules Henri Poincaré, famous for many mathematical achievements, played an essential role in studying aether and developing the Lorentz transformation.

One of Lorentz's aether models shown in FIG. 1-4 consists of an array of spherical "molecules" like MacCullagh's array of "elements" shown in FIG. 1-2. Each molecule confines a tiny electric and magnetic moment within it. When an electric field or magnetic field is applied on his aether, electric or magnetic moments in the molecules arise to make electric or magnetic lines of force like molecules of dielectric substance polarize under an electric field.

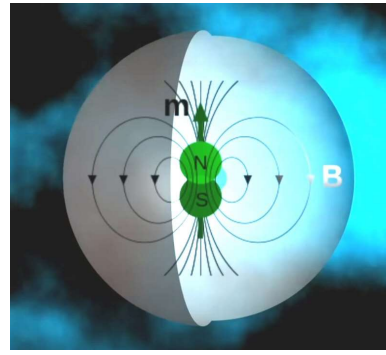

FIG. 1-4 Lorentz's Molecule of the Aether,
Source: See the Pattern,
https://www.youtube.com/watch?v=W5UEGyqSqZg

In the late 19th century, supporting the aether concept was the major side in physics society. But, in 1887, a seemingly fatal impact struck the aether concept. Albert A. Michelson and Edward W. Morley carried out a historical experiment called the "Michelson–Morley experiment."

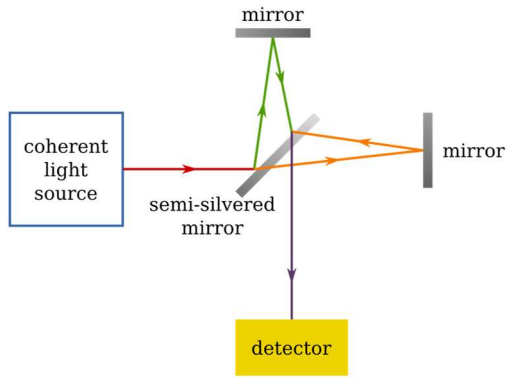

FIG. 1-5 A diagram of the Michelson–Morley experiment.
by Bdesham in Inkscape
PD, available on Wikimedia Commons.
Apparatus for detecting the difference of speed of light
depending on the direction of up-down and right-left.

This experiment utilized an interferometer to detect the difference in the speed of light depending on the direction. Because the earth is circling the sun, if the light is a wave propagating in the aether, the speed of light must be affected by the wind of the aether.

The result was negative. This experiment proved that the speed of light is the same in all directions. Thus, the experiment's conclusion was “there must not be the aether.”

This logic of denying the existence of the aether is still frequently found in scientific articles today. I am afraid that many people could believe that the aether was utterly disproved. This is not correct.

It is true that the Michelson–Morley experiment indeed disproved the existence of the aether at that time. But you must keep in mind that all interpretations of any experiments are susceptible to the uncertainty of the premises on which experiments were done and interpreted.

You cannot confirm the perfectness of the premises in any

experiment. Eliminating all implicit wrong premises is impossible in principle.

Michelson and Morley had no chance to realize that they had relied on the wrong implicit premises that time dilation and length contraction would never happen.

When incompleteness of any premises is inevitable, building up some new theories relying on authorized conclusions unthinkingly is always dangerous. Many fundamental premises in quantum mechanics are pretty dubious despite the number of Nobel Prizes it earned.

Here, I declare that I will present new interpretations for all fundamental quantum mechanics experiments in relation to General Relativity and Cosmology in the coming *Mech's Physics* series books.

Coming books include new dissenting interpretations of;

- Wave Length versus Photoelectric Effect,
- Wave Length of Black-Body Radiation,
- Energy-Frequency Relationship,
- Quantum of Energy,
- Four Fundamental Forces,
- Gauge Theory,
- Shape of Elementary Particles,
- Origin of Mass,
- Stern-Gerlach Experiment and Bell Inequality,
- Entanglement,
- Quantum Leap,
- Compton Effect,
- Collapse of the Wave Function,
- Renormalization,
- Double-Slit Experiment of Electron Beam,
- de Broglie Wave,
- Aharonov–Bohm Effect,
- Superconductivity,
- Bose–Einstein Condensation and Superfluidity,
- Concept of Photon and Photon Number Resolving,

- Photons in Optical Apparatuses,
- Three-Polarizer Puzzle,
- Origin of Gravity,
- Origin of Mass,
- Dark Matter and Dark Energy,
- Inflation Hypothesis,
- Flatness Problem of the Universe,
- Flatness Problem of the Galaxy Rotation Curve,
- Event Horizon and Singularity of a Blackhole.

I know all these titles listed here look precisely like fringe theories. But this is why I must struggle for ten years before publishing this first book. I believe today's quantum mechanics and general relativity will never be harmonized unless we construct integrated theories from the beginning.

I hope you will find all my ideas, including general relativity and cosmology, in the following books related to each other to prove the legitimacy of my theories as a whole.

I cannot guarantee the correctness of my theories, of course. As said before, it is up to you to judge. But regardless of the correctness, I believe appreciating different angles of view must be inspiring. At least, raison d'etre of the *Mech's Physics* exists here. If you deny tasting itself, you are like the church of the medieval age.

Lorentz introduced the hypothesis of "Time Dilation" and "Length Contraction" and constructed "Lorentz Transformation" to justify the existence of his "Ether" under the condition of the Michelson–Morley experiment.

The result of the Michelson–Morley experiment is well explained with the Lorentz Transformation. There is no known experiment to verify the existence or no existence of the aether or absolute frame of reference if you accept Lorentz Transformation.

Today, his theory is often called “Lorentz Ether Theory” (LET). In LET, the skeleton of the aether (ether) is immobile and at rest in the absolute space of Isaac Newton. With LET, it was considered that all motions should be argued on the reference of absolute rest frame of aether. This means his LET has the “Preferred Frame of Reference,” a countervailing idea against Einstein’s “Relativity” concept, which insists that there is no “Preferred Frame of Reference.”

There are some physicists who support the absolute frame of reference today. Their theories are called “neo-Lorentzian” interpretations of SR.

Though LET became compatible with the Michelson–Morley experiment by introducing Lorentz Transformation, Lorentz faced criticism that his theory was ad hoc.

I think this criticism holds good. He seemed to have introduced Lorentz Transformation mathematically just to fit in with the results of experiments without mechanical rationalization. I point out that the most critical flaw of his length contraction theory is about the contraction of an electron as it flies near the speed of light.

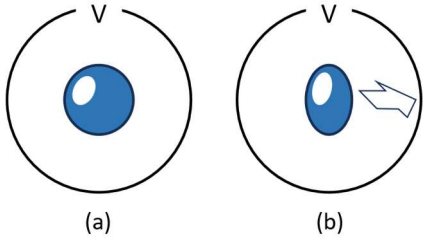

FIG. 1-6 Length Contraction of an Electron.
(a) Stationary Electron in volume V of the aether.
(b) Moving Electron in volume V of the aether.

As shown in FIG. 1-6, if an electron is contracted, the surrounding

aether in volume V must expand to fill the deficit. Thus, aether must be compressible, and a compressible medium transmits longitudinal waves. This contradicts Fresnel's discovery described above.

Yasui's aether was devised to overcome this seemingly fatal problem and to reason the mechanism of Lorentz transformation.

In modern physics, elementary particles are treated as point particles without volume. If true, the volume deficit problem mentioned above has been settled from the beginning. However, I'm afraid I have to disagree with the concept of a zero-volume particle. This will be discussed in another book of my *Mech's Physics* series.

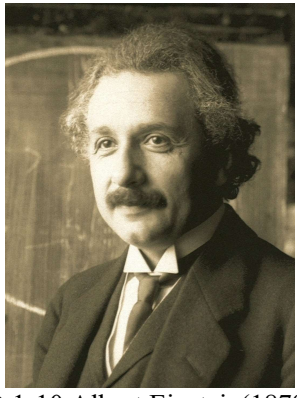

PHOTO 1-10 Albert Einstein(1879-1955),
by Ferdinand Schmutzer,
PD, available on Wikimedia Commons.

Albert Einstein is the greatest physicist and mathematician in many popular rankings. His works were mathematical but based on physical insight. His theories were developed through many thought experiments he devised. Thus, I call him the greatest mechanism seeker in the history of physics.

In 1905, he published a paper titled "*On the Electrodynamics of Moving Bodies*" [7], which is taken as the paper of "*Special Relativity*" (SR).

He assumed two premises for this paper.

One is that "*if the Maxwell-Hertz equations* (* Maxwell's Equations) *for empty space hold good in system K, they also hold good in system k,*" [7] where K and k represent different inertial frames of reference. He called this premise "*The Principle of Relativity*" in the paper. This means the laws of physics must be identical in all inertial frames of reference.

The other is that "*light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body.*" [7] This means that the speed of light is the same for all observers who fly at any velocity relative to each other, thanks to the time dilation and length contraction. This is called "*The Principle of Invariant Light Speed*."

With these two premises, he carried out a famous thought experiment called the "Light Clock Experiment" and derived the most famous equation in physics:

$$E = mc^2. \qquad (1.8)$$

In 1908, three years after this Einstein's paper, Hermann Minkowski established an elegant way to describe three spatial dimensions and one temporal dimension together as "Spacetime" of the "Minkowski Space." This became the mathematical foundation of the SR taught today.

Although the two premises mentioned above look reasonable, there are no reasons for their legitimacy. The term "Principle" is a proposition that could not be explained. I believe all principles should graduate the principle status and be reasoned by lower class principles until the lowest class principles are defined.

Yasui's aether explains why those two premises hold good later in this book.

1.7 Age of Quantum Mechanics

In 1905, the same year when Einstein published the paper of SR called "*annus mirabilis*" (miracle year), Einstein published a paper on the photoelectric effect titled "*Über einen die Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspun*" (*Concerning an Heuristic Point of View toward the Emission and Transformation of Light*). [8] This paper opened the door to quantum mechanics.

On the photoelectric effect, I have an utterly different view. My interpretations of this effect will be detailed in another Mech's Physics series book.

By the way, Einstein spent a miserable life in the last phase of his academic life. In those days (and till now), physics society was dominated by Copenhagen schoolers.

Though Copenhagen interpretations are the foundation of today's quantum physics, they have many weird postulations. Einstein could not accept the weirdness and tried to find a reasonable explanation.

Particularly, he did not like the fundamental randomness introduced by the Copenhagen interpretation. He left famous words, "God does not play dice." I empathize with him deeply.

Einstein desperately fought against the Copenhagen schoolers and proposed the "EPR paper." [9] But it was the worst paper. It only gave Copenhagen schoolers momentum, and finally, he was routed.

When Japanese hero Nobel laureate Hideki Yukawa visited Einstein at Princeton University in 1939, he was already a good-natured old man with gentle eyes. Although he is known as the most outstanding scientist today, he had been outcasted and isolated from the mainstream of Copenhagen schoolers by that time.

One physicist at Princeton at that time said that he had never talked with Einstein because it could risk him being outcasted from the mainstream like Einstein. I was not surprised by this story. All societies tend to become exclusive against mavericks.

In 1964, John Stewart Bell published a paper on "*Bell's inequalities*" disproving the EPR paper. This paper is recognized as the conclusion of the EPR problems today.

But I have utterly different interpretations of EPR problems. This will be detailed in another book of the *Mech's Physics* series. I believe I can save Einstein from the abyss of dishonor.

PHOTO 1-11 Niels Bohr (1885-1962),
Source: Niels Bohr's Nobel Prize biography,
PD, available on Wikimedia Commons.

Niels Henrik David Bohr was one of the leaders of the Copenhagen school. He contributed to the foundations of understanding atomic structure and quantum theory, but he and the Copenhagen school held mechanisms in disregard.

At first, he respected Einstein and praised his quantum theory. But later, Bohr found what Einstein sought was different from his way. While Einstein sought a mechanism, Bohr described the experimental results mathematically as they were, disregarding its

mechanism. He and his school seemed to have abandoned seeking the mechanism of our world and believed mathematical description was sufficient for human physicists.

Bohr was a courteous and reliable person. Because many scientists relied on him, he could establish influence in physics society. Bohr was gracious but adamant. He could not tolerate those who supported the hypothesis that he believed wrong.

There is a famous episode of his adamance. When Schrödinger, who stuck to the mechanism, became sick after a hard debate with Bohr and went to bed, Bohr remained by his bedside and insisted on further discussion despite a high fever of Schrödinger.

He must have wanted to guide Schrödinger and Einstein back onto the "right path," he believed.

Since this age, physics society seems to be dominated by descendants of Copenhagen schoolers. Today, if you do not support some kind of String Theories, getting any academic post in physics society must be very tough.

Challenging the very foundation of the solid hierarchy of physics is way too risky for professional scientists, considering even Einstein was thrown out of society. They might have their family to support. I believe it is my mission to present an alternative branch riding on the advantage of being a retired.

I hope your mind is broad enough to tolerate my dare and independent enough to try tasting my unorthodox ideas.

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