THE WORLD BEYOND

BLACK HOLES

Wim Vegt

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Light contains the key to open the doors to Heaven.
Unfortunately, the same key fits on the doors to Hell

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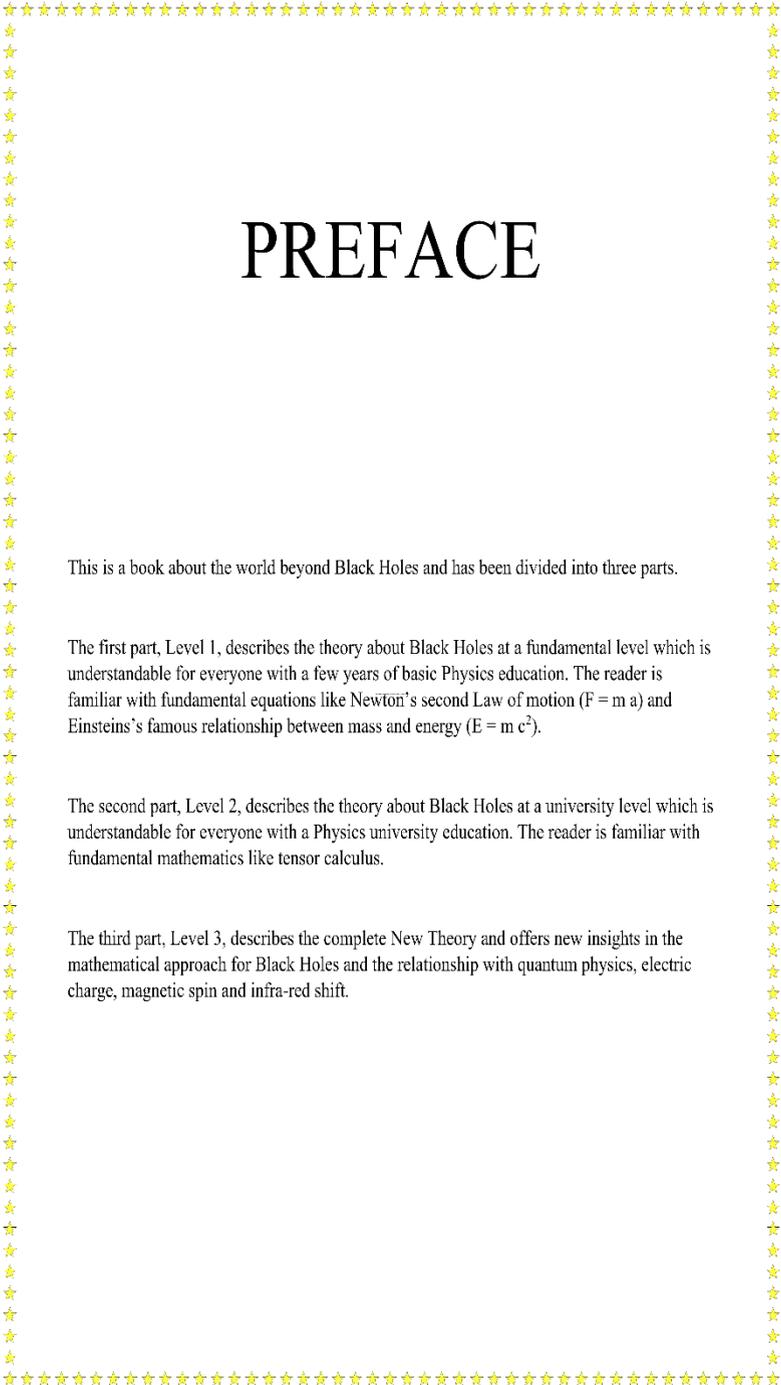
PREFACE

This is a book about the world beyond Black Holes and has been divided into three parts.

The first part, Level 1, describes the theory about Black Holes at a fundamental level which is understandable for everyone with a few years of basic Physics education. The reader is familiar with fundamental equations like Newton's second Law of motion ($F = m\,a$) and Einsteins's famous relationship between mass and energy ($E = m\,c^2$).

The second part, Level 2, describes the theory about Black Holes at a university level which is understandable for everyone with a Physics university education. The reader is familiar with fundamental mathematics like tensor calculus.

The third part, Level 3, describes the complete New Theory and offers new insights in the mathematical approach for Black Holes and the relationship with quantum physics, electric charge, magnetic spin and infra-red shift.

Classical Theory

Newton

NEWTON in 3 dimensions

$$\overline{F} = m\ \overline{a}$$

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \rightarrow \begin{pmatrix} F_z \\ F_y \\ F_x \end{pmatrix} = m \begin{pmatrix} a_z \\ a_y \\ a_x \end{pmatrix}$$

Maxwell (James Clerk Maxwell)

$$\nabla \cdot \overline{E} = \frac{\rho}{\varepsilon}$$

$$\nabla \times \overline{E} = -\mu\ \frac{\partial \overline{H}}{\partial t}$$

$$\nabla \cdot \overline{H} = 0$$

$$\nabla \times \overline{H} = \varepsilon\ \frac{\partial \overline{E}}{\partial t}$$

Dirac/ Schrödinger (Newton 4th Dimension)

Energy-Time Domain (x-4)

$$\nabla \cdot (\overline{E} \times \overline{H}) = -\frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\overline{E} \cdot \overline{E} \right) + \mu_0 \left(\overline{H} \cdot \overline{H} \right) \right)}{\partial t}$$

$$\overline{\phi} = \frac{1}{\sqrt{2\mu}} \left(\overline{B} + i\ \frac{\overline{E}}{c} \right) \qquad \overline{\phi}^* = \frac{1}{\sqrt{2\mu}} \left(\overline{B} - i\ \frac{\overline{E}}{c} \right)$$

$$\overline{\phi} \cdot \overline{\phi}^* = \frac{1}{2\mu} \left(\overline{B} + i\ \frac{\overline{E}}{c} \right) \cdot \left(\overline{B} - i\ \frac{\overline{E}}{c} \right) = \frac{1}{2} \mu H^2 + \frac{1}{2} \varepsilon E^2 = w$$

$$\overline{\phi} \times \overline{\phi}^* = \frac{1}{2\mu} \left(\overline{B} + i\ \frac{\overline{E}}{c} \right) \times \left(\overline{B} - i\ \frac{\overline{E}}{c} \right) = i\sqrt{\varepsilon\mu}\ \overline{E} \times \overline{H} = i\sqrt{\varepsilon\mu}\ \overline{S}$$

$$-\frac{i}{\sqrt{\varepsilon_0\ \mu_0}} \nabla \cdot (\overline{\phi} \times \overline{\phi}) = -\frac{\partial \overline{\phi} \cdot \overline{\phi}^*}{\partial t}$$

$$\overline{\alpha} = \begin{bmatrix} 0 & \sigma \\ \sigma & 0 \end{bmatrix} \quad \text{and} \quad \overline{\beta} = \begin{bmatrix} \delta_{ik} & 0 \\ 0 & -\delta_{ik} \end{bmatrix}$$

$$\left(\frac{imc}{h} \overline{\beta} + \overline{\alpha} \cdot \nabla \right) \psi = -\frac{1}{c} \frac{\partial \psi}{\partial t}$$

Quantum Gravity (Newton 4th Dimension)

Energy-Time Domain (x-4)

$$\nabla \cdot (\overline{E} \times \overline{H}) + \frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\overline{E} \cdot \overline{E} \right) + \mu_0 \left(\overline{H} \cdot \overline{H} \right) \right)}{\partial t} + \frac{\sqrt{\varepsilon\mu}}{2} \left(\varepsilon \left(\overline{E} \cdot \overline{E} \right) + \mu \left(\overline{H} \cdot \overline{H} \right) \right) \overline{g}$$

$$\overline{\phi} \cdot \overline{\phi}^* = \frac{1}{2\mu} \left(\overline{B} + i\ \frac{\overline{E}}{c} \right) \cdot \left(\overline{B} - i\ \frac{\overline{E}}{c} \right) = \frac{1}{2} \mu H^2 + \frac{1}{2} \varepsilon E^2 = w$$

$$\overline{\phi} \times \overline{\phi}^* = \frac{1}{2\mu} \left(\overline{B} + i\ \frac{\overline{E}}{c} \right) \times \left(\overline{B} - i\ \frac{\overline{E}}{c} \right) = i\sqrt{\varepsilon\mu}\ \overline{E} \times \overline{H} = i\sqrt{\varepsilon\mu}\ \overline{S}$$

$$-\frac{i}{\sqrt{\varepsilon_0\ \mu_0}} \nabla \cdot (\overline{\phi} \times \overline{\phi}) = -\frac{\partial \overline{\phi} \cdot \overline{\phi}^*}{\partial t}$$

$$\overline{\alpha} = \begin{bmatrix} 0 & \sigma \\ \sigma & 0 \end{bmatrix} \quad \text{and} \quad \overline{\beta} = \begin{bmatrix} \delta_{ik} & 0 \\ 0 & -\delta_{ik} \end{bmatrix}$$

$$\left(\frac{imc}{h} \overline{\beta} + \overline{\alpha} \cdot \nabla \right) \psi = -\frac{1}{c} \frac{\partial \psi}{\partial t} - \frac{g}{c^2} \psi$$

New Theory

Newton

NEWTON in 4 dimensions

$$\overline{F}^4 = m\ \overline{a}^{-4}$$

$$\begin{pmatrix} x_4 \\ x_3 \\ x_2 \\ x_1 \end{pmatrix} \rightarrow \begin{pmatrix} F_t \\ F_z \\ F_y \\ F_x \end{pmatrix} = m \begin{pmatrix} a_t \\ a_z \\ a_y \\ a_x \end{pmatrix}$$

Maxwell (Newton in 3 Dimensions)

NEWTON: $\rightarrow \overline{F}_{TOTAL} = m\ \overline{a}\ [N] \rightarrow \overline{f}_{TOTAL} = \rho\ \overline{a}\ [N/m^3]$

$-\rho\ \overline{a} + \overline{f}_{TOTAL} = \overline{0}\ [N/m^3]$

$-\rho\ \overline{a} + \overline{f}_{ELECTRIC} + \overline{f}_{MAGNETIC} = \overline{0}\ [N/m^3]$

$-\rho\ \overline{a} + \overline{f}_{COULOMB} + \overline{f}_{LORENTZ} + \overline{f}_{COULOMB} + \overline{f}_{LORENTZ} = \overline{0}\ [N/m^3]$

$-\frac{1}{c^2} \frac{\partial (\overline{E} \times \overline{H})}{\partial t} + \varepsilon_0 \overline{E}(\nabla \cdot \overline{E}) - \varepsilon_0 \overline{E} \times (\nabla \times \overline{E}) + \mu_0 \overline{H}(\nabla \cdot \overline{H}) - \mu_0 \overline{H} \times (\nabla \times \overline{H}) = 0\ [N/m^3]$

Dirac/ Schrödinger (Newton 4th Dimension)

Energy-Time Domain (x-4)

B-6   B-7

$$(x_4) \qquad \nabla \cdot (\overline{E} \times \overline{H}) = -\frac{1}{2} \frac{\partial \left(\varepsilon_0 \left(\overline{E} \cdot \overline{E} \right) + \mu_0 \left(\overline{H} \cdot \overline{H} \right) \right)}{\partial t}$$

3-Dimensional Space Domain

B-1   B-2   B-3

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \quad -\frac{1}{c^2} \frac{\partial (\overline{E} \times \overline{H})}{\partial t} + \varepsilon_0 \overline{E}(\nabla \cdot \overline{E}) - \varepsilon_0 \overline{E} \times (\nabla \times \overline{E}) +$$

B-4   B-5

$$+\mu_0 \overline{H}(\nabla \cdot \overline{H}) - \mu_0 \overline{H} \times (\nabla \times \overline{H}) = \overline{0}$$

Quantum Gravity (Newton 4th Dimension)

Energy-Time Domain

Inner Energy   Potential Energy

B-7   B-8

$$(x_4) \qquad \nabla \cdot \overline{S} + \frac{\partial w}{\partial t} + \rho\ \overline{g} \frac{\Delta x}{\Delta t} = 0$$

3-Dimensional Space Domain

B-1   B-2   B-3

$$\begin{pmatrix} x_3 \\ x_2 \\ x_1 \end{pmatrix} \quad -\frac{1}{c^2} \frac{\partial (\overline{E} \times \overline{H})}{\partial t} + \varepsilon_0 \overline{E}(\nabla \cdot \overline{E}) - \varepsilon_0 \overline{E} \times (\nabla \times \overline{E}) +$$

B-4   B-5   B-6

$$+\mu_0 \overline{H}(\nabla \cdot \overline{H}) - \mu_0 \overline{H} \times (\nabla \times \overline{H}) + \frac{1}{2} \left(\varepsilon^2 \mu \left(\overline{E} \cdot \overline{E} \right) + \varepsilon \mu^2 \left(\overline{H} \cdot \overline{H} \right) \right) \overline{g} = \overline{0}$$

1.0 Black Holes Level 1

THE WORLD BEYOND
BLACK HOLES
LEVEL 1

Light contains the key to open the doors to Heaven.
Unfortunately, the same key fits on the doors to Hell

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1. Black Holes (level 1)

1.1 Introduction

To understand the physics of Black Holes, it is important to understand the first law in Physics which controls our entire universe. This is the law of "Perfect Equilibrium". Within the entire universe there is always a prefect equilibrium between all the physical forces like gravity, forces of inertia, radiation pressure and Electro-Magnetic Interaction forces at any time, in any direction and at any space coordinate. This is the fundamental law in physics on which also the existence of a Black Hole has been grounded.

This new theory will explain the forces within a beam of light interacting with gravity while the beam of light propagates within the gravitational field generated by a black hole.

When we look at modern Physics, we can only be impressed by an enormous amount of knowledge and a complete New World of technical applications. We now live in the century of the impressive victory of the new science and the new technology over the old-fashioned world and the old-fashioned way of thinking.

Great shifts in the way of thinking and the technological achievements are mostly characterized by an important scientific publication in a century that changes everything in that century. We can recognize the century of Isaac Newton who triggered in 1687 the seismic shift in thinking with his famous publication "Philisophiae Naturalis Principia Mathematica" (Mathematical Principles of Natural Philosophy).

We recognize the century of James Clerk Maxwell who triggered in 1865 the large shift in thinking with his famous publication "A Dynamical Theory of the Electromagnetic Field".

We recognize the century of Albert Einstein who triggered in 1905 the large changings in thinking with his famous theory of Special Relativity represented in his publication "On the Electrodynamics of Moving Bodies". Manifesting a "New Theory" and a "New Way of

Thinking" with important contributions of Hendrik Lorentz, Henri Poincaré and Hermann Minkowski.

It is recognizable that with the sudden change in thinking in a new period, a new kind of mutual common sense and a general agreement by many scientists of the the new theory and the new way of thinking arises. The New Theory will be protected by common sense and mutual agreement. This new way of thinking settles down in the scientific society and become immovable. Other options disappear and simply do not exist anymore.

Different from the alpha and the gamma sciences, the beta sciences are being developed by a kind of a LEGO system. Building blocks built one after another and built on top of each other. Like we build with the LEGO system houses and castles using the same LEGO building block over and over again, we build in the beta sciences grand theories, using basic the same basic equations over and over again. A large shift in the beta sciences happens when a new mathematical building block has been developed. Like the equations of Newton or the equations of Maxwell or the Schrödinger and the Dirac equations. These fundamental equations form the mathematical LEGO system of our modern scientific world.

Because these mathematical building blocks are being used over and over and again in numerous applications over a period of of more than 100 years, a general scientific common sense rises around these mathematical building blocks. This scientific common sense protects these mathematical building blocks like a high wall around a medieval town.

A fundamental problem rises, when one of these building blocks is not correct or turns out not to be correct under certain conditions. Like the famous Law of Newton for the relationship between acceleration (a), mass (m) and force (F): "F = m a" turns out not to be valid at velocities near the speed of light because at these velocities the mass is changing. It took a long time before Albert Einstein's theory of general relativity had been accepted, because his theory of general relativity was in contradiction with the famous well-known mathematical building blocks which had already been used and being protected for hundreds

of years. But nowadays Einstein's famous theory of general relativity has been accepted world-wide.

This book describes a comparable conflict in the modern beta sciences and brings the well-known and generally accepted Modern Physics of the last 150 years in question. Because when a fundamental mathematical building block, which has been introduced 150 years ago and has been used to develop the Modern Physics during the last 150 years, turns out to be wrong (or not complete), a fundamental problems rises in Modern Physics, developed during the last 150 years.

This situation happens in relation with the well-known Maxwell Equations, presented 150 years ago in the famous publication: "*A Dynamical Theory of the Electromagnetic Field" in 1865*. which has been used as a fundamental mathematical building block in many modern physical theories.

In Maxwell's time there were no optical LASERS (**L**ight **A**mplification by **S**timulated **E**mission of **R**adiation) and the outcome of his theory was in his time completely in correspondence with what could be measured at that time. The value for the speed of light, calculated from the Maxwell Equations, corresponded almost exactly with the value for the speed of light measured in 1862 by Léon Foucault by a system of rotating mirrors and measured in 1877 by Albert Michelson (300.140 [km/s]).

But nowadays there arises several problems with Maxwell's theory for the electromagnetic field. Since the existence of the LASERS it became clear that the speed of light is not always the same in every direction. When a beam of light, generated by a LASER, propagates with the well-known speed of light "$c = 299.792$ [km/s]" in the z-direction, the speed of light equals zero in the x-direction and the y-direction (in a orthogonal x,y,z frame).

This new phenomenon cannot be explained by Maxwell's Theory. In Maxwell's Theory the speed of light has to be exactly the same in every direction. This is clearly not the fact for a LASER beam. And also for the projection of a slide on a screen, it is clearly that the speed of light within the plane of the screen equals zero. Because the slide we observe does not move. While the projection beam itself moves towards the

screen with the speed of light "c", the beam clearly remains focused and does not move within the plane, perpendicular to the direction of propagation.

Another effect which cannot be explained by Maxwell's Theory about electromagnetism has been demonstrated within the IBM research group. A new, until 1995 unknown, experiment has been conducted by: O. Gunawan, Y Virgus and K. Fai Tai to demonstrate a subtle hidden feature in electromagnetism - a previously unknown field confinement effect that they named the "camelback effect" (Ref. 1) in a system of two lines of transverse dipoles.

In electromagnetism, the elementary source of electric field and magnetic field can be respectively modeled as a point charge - a hypothetical charge located at a single point in space - and a dipole, a pair of equal and oppositely charged or magnetized poles separated by a distance. Imagine we line up two rows of magnetic dipoles and we try to measure the strength of the magnetic field along the center axis. The magnetic field is certainly stronger at the center and diminishes away from it. However, if the length of the dipole line exceeds certain critical length, a surprising effect occurs: the field gets slightly stronger near the edges and produces a field confinement profile that looks like a camel's back—hence the name of the effect. The IBM team has reported this discovery with detailed experimental and theoretical studies in two recent publications and patents.

This surprising discovery is exciting for a few reasons. First, it represents a new elementary one-dimensional confinement potential in physics, joining the list of well-known potentials such as Coulomb, parabolic, and square well. Second, this effect becomes the key feature that enables this system to serve as a new class of natural magnetic trap (Ref. 2) called parallel dipole line (PDL) trap with many possible exciting applications. This camelback effect and the related PDL magnetic trap can be realized using special cylindrical magnets whose poles are on the curved side and a graphite rod as the trapped object.

This new, until 1995 unknown, effect can only be explained by electromagnetic interaction, described in the New Theory (Ref. 3).

A recent experiment[5] in 2019 at the Yale University in New Haven C.T. USA published in Nature with the title: "*To catch and and reverse a quantum jump mid-flight*" conflicts a fundamental aspect of the Copenhagen Interpretation related to "Fundamental Uncertainty" (Probability) represented within the "Standard Model" in Quantum Physics (Ref. 4).

In quantum physics, measurements can fundamentally yield discrete and random results. Emblematic of this feature is Bohr's 1913 proposal of quantum jumps between two discrete energy levels of an atom. Experimentally, quantum jumps were first observed in an atomic ion driven by a weak deterministic force while under strong continuous energy measurement.

The times at which the discontinuous jump transitions occur are reputed to be fundamentally unpredictable. Despite the non-deterministic character of quantum physics, is it possible to know if a quantum jump is about to occur? Here we answer this question affirmatively: we experimentally demonstrate that the jump from the ground state to an excited state of a superconducting artificial three-level atom can be tracked as it follows a predictable 'flight', by monitoring the population of an auxiliary energy level coupled to the ground state. The experimental results demonstrate that the evolution of each completed jump is continuous, coherent and deterministic.

The only explanation for this deterministic effect has been described within the new theory in equation (5.7, Page 152) which originated form the deterministic electromagnetic field.

There is no other conclusion than the conclusion that the Maxwell Equations are "wrong" or at least "not complete". The right equation(s) have to describe both possibilities. The possibility that the light moves in every direction with the exactly the same speed of light "c" like the light being emitted by the sun. And the possibility that the light moves only in one direction and equals zero in the directions perpendicular to the plane of propagation like the propagation of a LASER beam.

A second conclusion can only be that fundamental quantum mechanical relations like the Schrödinger wave equation and the relativistic Dirac equation both originate from a deterministic field like an

electromagnetic field which has been demonstrated in the new theory in equation .

To find these new equation(s) we observe that the Maxwell equations are not in unification with Newton's theory of equilibrium of forces. The Maxwell Equations are not in unification with Newtons 3rd law "action = - reaction". Maxwell has not included the force densities with an electromagnetic field at all. To find this new equation, we have to introduce the force densities within an electromagnetic field.

1.2 Inertia, the Interaction between Confined Electromagnetic Energy and Gravity

Black Holes are a challenge in modern Physics. The greatest challenge for the "Reader" of this book will be to "Let it Go", to "Let it Pass Away", to "Forget what you have learned". To become simple and humble again and most of all: be "Be Not Impressed" of what Modern Physics has achieved the last 300 years. Because in Modern Physics we did not get too far. We got far in technology and we got far in applications of technology, but in the understanding of Physics we did not get much further than Isaac Newton 300 years ago. Since Isaac Newton, not much has changed in our physical concept of the Universe. The knowledge of Isaac Newton already contains the "Philosopher's Stone", the "Key of Wisdom". The key to open the gates to the hidden world of knowledge.

The "Philosopher's Stone" refers to the hidden and deep understanding of. "Light". As it was written in the holy books. Like it has been written in the Jewish "Torah-Pentateuch-Bereishit-Genesis 1:1-5" and in the Christian Bible in Genesis 1:1-5.

In the beginning God created the heavens and the earth. ² Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters. ³ And God said, "Let there be light," and there was light. ⁴ God saw that the light was good, and he separated the light from the darkness. ⁵ God called the light "day," and the darkness he called "night." And there was evening, and there was morning—the first day.

Described in a different version in the Muslim Religion in "The Verse of Light" in the 35th verse of the 24th Sura of the Quran.

Our first knowledge starts with the knowledge of Light. And the "Black Hole" is like the "Anti-God". The great "Absorber of the Holy Light". The unholiest place in the universe from which no Holy Light can escape. An "Eternal Prison for Light". A kind of Hell in the Spiritual world becomes a place of Eternal Darkness in this world in our universe.

How would Isaac Newton have looked at the phenomenon of a "Black Hole"?

In Newton's time it was impossible to speak about a phenomenon like a Black Hole. A place in the Universe in which all the light disappears. Because in Newton's time Light was symbolic for "God". And a Black Hole eating and destroying Light would be like the Devil eating and destroying God. Newton immediately would been accused of evil witchcraft and worshipping the Devil. And Newton would have been burnt alive on the stakes because in his time it was still usual to burn witches and other heretics on the medieval stakes.

This fact makes it very interesting, because maybe Newton knew about the possibility of Black Holes in the Universe. Because it is well-known that Newton kept many of his secret writings hidden for the scientific world. And the fact that Newtons famous equation of motion turns out to be a theoretical and mathematical foundation for the existence of Black Holes in the universe.

Newton published his famous second law of motion in 1705 in "Philosophiae Naturalis Principia Mathematica" which will turn out to be the foundation for the possible existence of Black Holes in the Universe, when Newton's second law of motion will be applied to a beam of light within a gravitational field.

1.3 Inertia and the change in the relative radiation pressure

To understand this mathematical approach in physics, it is necessary to understand the concept of "inertia". The property of inertia for "matter" as well the property of inertia for "light".

Figure 1 The comparison of a waterjet emitted by a shower head and a laser beam emitted by a laser.

To understand the property of "inertia" for a beam light, we start with an imaginary model of a beam of light, presented by a jet of water leaving a shower head.

Imagine you hold your right hand in the water jet, emitted by a shower head. Then you will feel the radiation pressure of the water jet, comparable with the radiation pressure of a beam of light emitted by a laser.

Figure 2 The shower head emits a waterjet towards to the right and the laser emits a laser beam towards to the right.

When you move your right hand towards to the **left** (in the opposite direction of the water jet), you will feel that the radiation pressure of the water jet **increases**. When you move your hand towards to the **right** (in the direction of the water jet) you will feel that the radiation pressure of the water jet **decreases**.
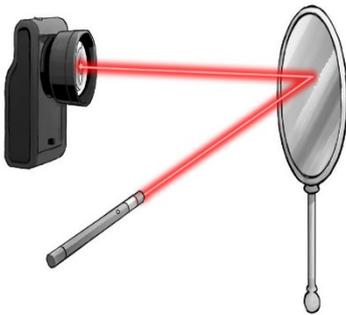
Figure 3. A laser beam has been reflected by the mirror (placed at the right from the laser) and acts with an electromagnetic radiation pressure on the mirror directed towards to the right.

In a comparable way the radiation pressure of a laser beam emitted by a laser acting on the mirror, will **increase** when we move the mirror towards to the **left** (towards the laser, in the opposite direction of propagation of the laser beam). The radiation pressure on the mirror will **decrease** when we move the mirror towards to the **right** (away from the laser, in the direction of propagation of the laser beam).

Of course, the radiation pressure of the beam of laser light will be much smaller compared to the radiation pressure of the water jet. But with very sensitive equipment the radiation pressure of the beam of laser light can be measured. As an example, the radiation pressure on earth of the light emitted by the sun, equals about 10 [μN/ m^2]. Which equals a total radiation pressure of the sunlight acting on the surface of the whole earth of about 1.25 10^9 [N].
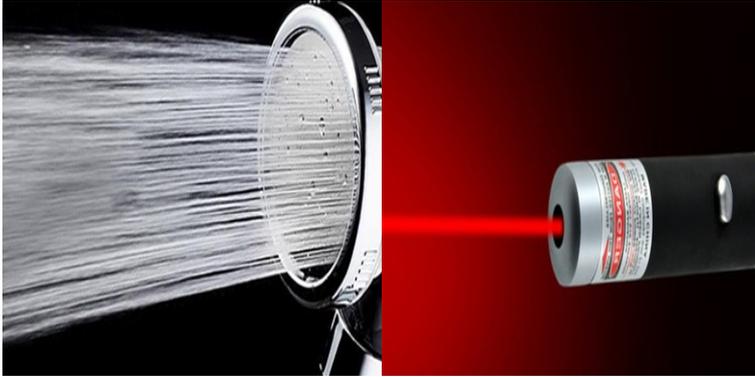

Figure 4. The shower head emits a waterjet towards to the left and the laser emits a laser beam towards to the left.

Now we choose a shower head and a laser emitting towards the left. When you move your left hand towards to the **left** (in the direction of the water jet), you will feel that the radiation pressure of the water jet **decreases**. When you move your left hand towards to the **right** (in the opposite direction of the water jet) you will feel that the radiation pressure of the water jet **increases**.
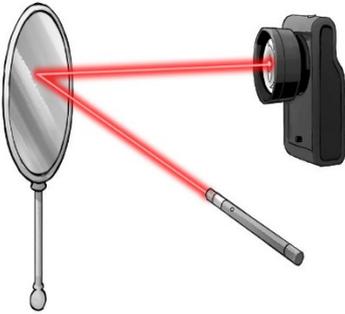
Figure 5. A laser beam has been reflected by the mirror (placed at the left from the laser) and acts with an electromagnetic radiation pressure on the mirror directed towards to the left.

In a comparable way the radiation pressure of a laser beam emitted by a laser acting on the mirror, will **decrease** when we move the mirror towards to the **left** (away from the laser, in the direction of propagation of the laser beam). The radiation pressure on the mirror will **increase** when we move the mirror towards to the **right** (in the opposite direction of the laser beam).

1.4 Inertia and the relative change of the radiation pressures of confined water jets

To demonstrate the property of inertia, we place the right hand in the water jet, emitted towards to the right by the first shower head. The the left hand has been placed in the water jet, emitted towards to the left by the second shower head.
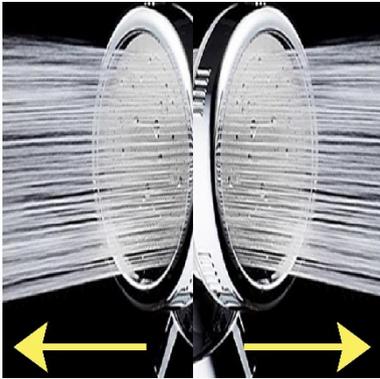
Figure 6. Two shower heads, pointing in opposite directions, emit two waterjets pointing in opposite directions. The left hand has been placed in the waterjet emitted towards to the left and the right hand has been placed in the waterjet emitted towards to the right.

The radiation pressure of the water jet acting on the left hand equals the radiation pressure acting on the right hand but has been directed oppositely. Both radiation pressures neutralize each-other and the resulting force acting on the system of both hands equals zero.
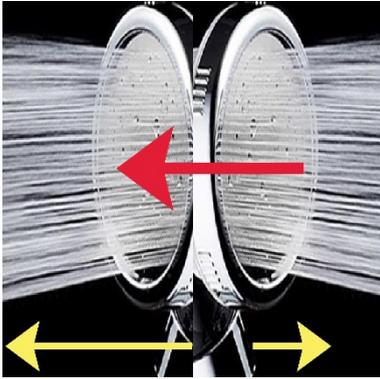
Figure 7. The left hand has been placed in the waterjet emitted towards to the left and the right hand has been placed in the waterjet emitted towards to the right. The resulting force has been oriented towards to the Left.

To demonstrate the property of inertia of the confined water jets between both hands, we move both hands simultaneously towards to the right. The radiation pressure of the waterjet acting on the left hand will increase. The radiation pressure of the waterjet acting on the right hand will decrease. The total resulting radiation pressures of both waterjets will not neutralize each-other anymore. The total resulting radiation pressure of both waterjets will be directed towards to the left, opposite in the direction of moving. In figure 7 this has been represented by the red arrow pointing towards to the left. We experience the effect of inertia. Both waterjets resist the starting movement of our both hands towards to the right, when we consider both hands together as one mechanical system.

We replace both hands by one (plastic) box, placed over both waterjets. When we move the box towards to the right, we will experience the (extra) inertia of the box, caused by the resulting force of both waterjets directed towards to the left. This is the resulting inertia force, represented by the red arrow in figure 7. Moving the box towards to the right results in an inertia force in the opposite direction represented by the red arrow in figure 7.
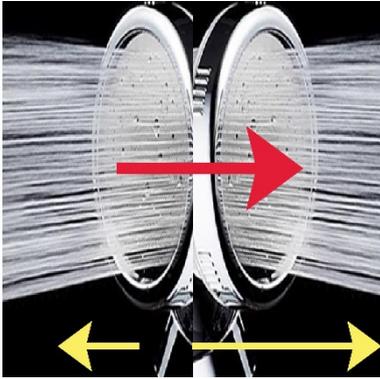
Figure 8. The left hand has been placed in the waterjet emitted towards to the left and the right hand has been placed in the waterjet emitted towards to the right. The resulting force has been oriented towards to the Right.

To demonstrate the property of inertia of the confined water jets between both hands, we move both hands simultaneously towards to the left. The radiation pressure of the waterjet acting on the left hand will decrease. The radiation pressure of the waterjet acting on the right hand will decrease. The total resulting radiation pressures of both waterjets will not neutralize each-other anymore. The total resulting radiation pressure of both waterjets will be directed towards to the left, opposite in the direction of moving. In figure 7 this has been represented by the red arrow pointing towards to the left. We experience the effect of inertia. Both waterjets resist the starting movement of our both hands towards to the left, when we consider both hands together as one mechanical system.

We replace both hands by one (plastic) box, placed over both waterjets. When we move the box towards to the right, we will experience the (extra) inertia of the box, caused by the resulting force of both waterjets directed towards to the left. This is the resulting inertia force, represented by the red arrow in figure 8. Moving the box towards to the left results in an inertia force in the opposite direction represented by the red arrow in figure 8.

1.5 Inertia and the relative change of the radiation pressures of confined laser beams

To demonstrate the property of inertia of the electromagnetic radiation (laser beam), confined between both mirrors, we place the right mirror in the laser beam, emitted towards to the right by the first laser. The left mirror has been placed in the laser beam, emitted towards to the left by the second laser.
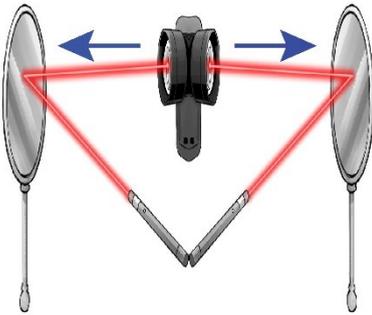

Figure 9. Two lasers, pointing in opposite directions, emit two laser beams pointing in opposite directions. The left mirror has been placed in the laser beam emitted towards to the left and the right mirror been placed in the laser beam towards to the right

The radiation pressure of the laser beam acting on the left mirror equals the radiation pressure acting on the right mirror but has been directed oppositely. Both radiation pressures neutralize each other, and the resulting force acting on the system of both mirrors equals zero.
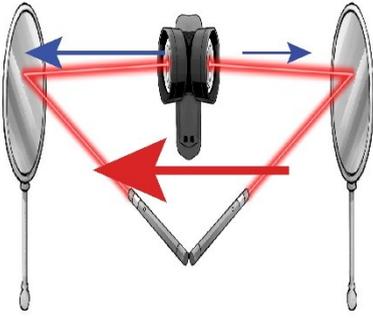
Figure 10. The left mirror has been placed in the laser beam emitted towards to the left and the right mirror been placed in the laser beam towards to the right. The resulting force has been directed towards tot the Left.

To demonstrate the property of inertia of the confined laser beams between between both mirrors, we move both mirrors simultaneously towards to the right. The radiation pressure of the laser beam acting on the left mirror will increase. The radiation pressure of the laser beam acting on the right mirror will decrease. The total resulting radiation pressures of both laser beams will not neutralize each-other anymore. The total resulting radiation pressure of both laser beams will be directed towards to the left, opposite in the direction of moving. In figure 10 this has been represented by the red arrow pointing towards to the left. We experience the effect of inertia. Both laser beams resist the starting movement of our both mirrors, when we consider both mirrors together as one mechanical system.

We replace both mirrors by a box with at the inside 100 % reflecting mirrors. The confined electromagnetic radiation (laser beam) between both mirrors will act on both mirrors with an oppositely directed radiation pressure.

When we start to move the box towards to the right, the resulting total radiation pressure will be oriented towards tot the left. This is the inertia force of the confined electromagnetic radiation. Albert Einstein demonstrated the proportionality between mass (inertia) and energy (intensity of electromagnetic radiation of the confined laser beam) by his famous equation: $E = m\,c^2$.
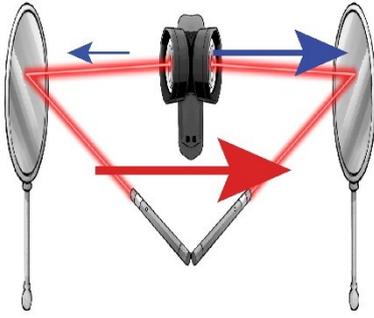
Figure 11. The left mirror has been placed in the laser beam emitted towards to the left and the right mirror been placed in the laser beam towards to the right. The resulting force has been directed towards tot the Right.

To demonstrate the property of inertia of the confined laser beams between between both mirrors, we move both mirrors simultaneously towards to the left. The radiation pressure of the laser beam acting on the left mirror will decrease. The radiation pressure of the laser beam acting on the right mirror will increase. The total resulting radiation pressures of both laser beams will not neutralize each-other anymore. The total resulting radiation pressure of both laser beams will be directed towards to the right, opposite in the direction of moving. In figure 11 this has been represented by the red arrow pointing towards to the right. We experience the effect of inertia. Both laser beams resist the starting movement of our both mirrors, when we consider both mirrors together as one mechanical system.

We replace both mirrors by a box with at the inside 100 % reflecting mirrors. The confined electromagnetic radiation (laser beam) between both mirrors will act on both mirrors with an oppositely directed radiation pressure.

When we start to move the box towards to the left, the resulting total radiation pressure will be oriented towards tot the right. This is the inertia force of the confined electromagnetic radiation. Albert Einstein demonstrated the proportionality between mass (inertia) and energy (intensity of electromagnetic radiation of the confined laser beam) by his famous equation: $E = m\, c^2$.

We replace in a "thought experiment" the box with at the inside 100 % reflecting mirrors by a sphere with a 100 % reflecting inside. The hollow sphere contains confined electromagnetic radiation. Proportional to the total confined electromagnetic energy inside the sphere, the sphere will demonstrate the property of "inertia" in any direction according Newton's second law of motion: $F = m \cdot a$.

Now we replace the hollow sphere with confined electromagnetic radiation by a "Gravitational-Electromagnetic Confinement" of electromagnetic radiation. In a comparable way the electromagnetic confinement will demonstrate the property of "inertia", represented by Newton's second law of motion: $F = m \cdot a$.