Momentum of

the Luminiferous Aether

Dr Michael Heffron developed these slides for presentation during Aether Round Table 56 discussion (available on the Space Audits channel of YouTube, https://www.youtube.com/live/KQsyEUXG3xQ?si=0CI_hguJohrvUZct), and hereby gives permission to freely distribute these presentation slides.

This presentation will discuss how the momentum of the luminiferous aether produces the fundamental constants of physics.

Disclaimer

Logical leaps

Too tutorial

Level of precision

My dissertation committee often complained about my tendency to “logically leap” over concepts that seemed so obvious to me that I didn’t bother to explain my thought process.

On the other hand, many journal editors rejected my paper submissions as “too tutorial.”

Certain values within this presentation may seem to have an excessive number of digits of precision.

My level of precision facilitates comparison to the stated uncertainty of measurements published by NIST,

which is an acronym for National Institute of Standards and Technology.

Those comparisons will be coming up twelve slides from now.

Secret to success

upset the right people

for the right reason

It quickly became obvious to me that there will always be people who criticize your work for some reason, so the secret to success is to upset the right people for the right reason.

My goal is for this presentation to be minimally tutorial, where I will briefly present obvious concepts solely to ensure everyone leaps with me.

If I advance to the next slide too quickly, please ask me to go back.

Momentum

$$p = mv$$

Momentum is the very simple concept of mass times velocity.

Momentum is the reason Newton's first law of motion states that every object tends to remain either at rest or in uniform motion until a collision or other external force intervenes.

Newton's first law may be better known as the Law of Inertia.

Before exploring momentum in greater detail, it is important to review some basic celestial mechanics.

Standard gravitational parameter

$$\mu = G(M + m)$$

$$\mu \cong GM \text{ for small satellites}$$

Astronomers and satellite operators use Greek letter mu to represent a body's "standard gravitational parameter."

They calculate that parameter as the universal gravitational constant times the masses of the bodies.

They often omit the insignificant mass of small satellites.

This presentation will now begin to explain why "Big G" is not universal and why the masses of the respective bodies are irrelevant.

Kepler's Third Law of planetary motion

$$T^2 = C\,r^3$$

Kepler's Third Law defines ***T*** as the period of the orbit of any given planet.

C is a constant that applies throughout the solar system, and

r is the mean radius of orbit or the semi-major axis of an elliptical orbit.

Newton's deduction

$$\frac{r^3}{T^2} = constant$$

Newton deduced that the inverse of Kepler's constant is still constant.

The next slide very slightly modifies Newton's deduction to produce the gravitational parameter for any celestial body or subatomic particle.

Gravitational parameter

$$\varkappa = \left(\frac{2\pi r}{T}\right)^2 r = v^2 r$$

Chapter 5 of my book about the scientific method advocates using the ancient Greek letter Koppa to express a body's gravitational parameter as the velocity squared times the radius of orbit for any of the body's satellites.

Note that the masses of the bodies are irrelevant for this method of finding the gravitational parameter of the orbited body.

Planets of our solar system

Planet	Mean Radius of Orbit (r, meters)	Sidereal Period of Orbit (T, seconds)	$v^2 r = \frac{4\pi^2 r^3}{T^2}$ Constant ($v^2 r$, m^3/s^2)
Mercury	5.79e10	7.60e6	**1.33e20**
Venus	1.08e11	1.9414e7	**1.32e20**
Earth	1.496e11	3.156e7	**1.327e20**
Mars	2.279e11	5.936e7	**1.326e20**
Jupiter	7.782e11	3.744e8	**1.327e20**
Saturn	1.427e12	9.297e8	**1.327e20**
Uranus	2.869e12	2.651e9	**1.327e20**
Neptune	4.497e12	5.201e9	**1.327e20**
Pluto[12]	5.91e12	7.81e9	**1.34e20**

For the planets orbiting our sun, velocity squared times radius of orbit is the sun's "constant" gravitational parameter.

Footnote 12 explains that this table only temporarily elevates Pluto back to its former planet status.

Moons of Jupiter

Moon of Jupiter	Mean Radius of Orbit (r, meters)	Sidereal Period of Orbit (T, seconds)	$v^2 r = \frac{4\pi^2 r^3}{T^2}$ Constant ($v^2 r$, m^3/s^2)
Io	4.218e8	1.528535e5	**1.268e17**
Europa	6.711e8	3.068220e5	**1.268e17**
Ganymede	1.0704e9	6.181534e5	**1.2671e17**
Callisto	1.8827e9	1.4419311e6	**1.2671e17**
Amalthea	1.814e8	4.30427e4	**1.272e17**
Himalia	1.146e10	2.164892e7	**1.268e17**
Elara	1.1740e10	2.2434e7	**1.2693e17**
Pasiphae	2.366e10	6.42e7	**1.267e17**

Velocity squared times radius of orbit for the moons of Jupiter produces a much smaller “constant” gravitational parameter for Jupiter.

Also notice that Pasiphae conforms to the gravitational parameter of Jupiter despite the fact it orbits counter to the direction of Jupiter’s rotation.

Moon and other satellites of Earth

$$\varkappa_{Earth} = 3.986004418 \times 10^{14}\ \mathrm{m}^3/\mathrm{s}^2$$

Earth has an even smaller gravitational parameter that is known to great precision due to modern spaceflight technology.

Electron velocity (v_0) at Bohr radius (a_0), gravitational parameter of proton ($\varkappa_P$)

$$v_0^2 = \frac{E_h}{m_E} \quad \therefore \quad \varkappa = v_0^2 a_0$$

The velocity squared of an electron orbiting a proton at the Bohr radius is found by dividing the Hartree energy by the mass of an electron.

Therefore, the gravitational parameter of a proton is the velocity squared of that electron times the Bohr radius at which it orbits.

Variable Big G

$$G_{sun} = \frac{\varkappa_{sun}}{m_{sun}} \quad \neq \quad G_{proton} = \frac{\varkappa_{proton}}{m_{proton}}$$

where $\boldsymbol{G_{sun}}$ = 6.6743 x 10^{-11} m^3/ kg·s^2 is Newton's gravitational constant,

$\boldsymbol{\varkappa_{sun}}$ = 1.3271244 x 10^{20} m^3/s^2 is the gravitational parameter of the sun, and

$\boldsymbol{m_{sun}}$ = 1.98841 x 10^{30} kg is the Newtonian mass of the sun.

$\boldsymbol{G_{proton}}$ = 1.51417270434688 x 10^{29} m^3/ kg·s^2 is the gravitational constant of a proton,

$\boldsymbol{\varkappa_{proton}}$ = 2.53263846154357 x 10^2 m^3/s^2 is the gravitational parameter of a proton, and

$\boldsymbol{m_{proton}}$ = 1.67262192369000 x 10^{-27} kg is the mass of a proton.

Newton's gravitational constant is the gravitational parameter of the sun divided by its alleged Newtonian mass.

That is far smaller than the gravitational constant for a proton, thereby demonstrating that Newton's gravitational constant is not universal.

Hartree energy, per NIST

E_h = 4.3597447222060(48) x 10^{-18} kg·m^2/s^2

$$E_h = \frac{G_P m_P m_E}{a_0} = \frac{2.307077552337704 \times 10^{-28}\ \mathrm{kg\ m^3/s^2}}{5.291772109013005 \times 10^{-11}\ \mathrm{m}} = 4.359744722204238 \times 10^{-18}\ \mathrm{kg\ m^2/s^2}$$

$$E_h = \frac{k\ q^2}{a_0} = \frac{2.307077552337704 \times 10^{-28}\ \mathrm{kg\ m^3/s^2}}{5.291772109013005 \times 10^{-11}\ \mathrm{m}} = 4.359744722204238 \times 10^{-18}\ \mathrm{kg\ m^2/s^2}$$

$$E_h = \frac{\varkappa_P m_E}{a_0} = \frac{2.307077552337704 \times 10^{-28}\ \mathrm{kg\ m^3/s^2}}{5.291772109013005 \times 10^{-11}\ \mathrm{m}} = 4.359744722204238 \times 10^{-18}\ \mathrm{kg\ m^2/s^2}$$

We have now reached the beginning of the promised explanation for why my data seems to be too precise.

It is possible to use the gravitational constant of a proton to calculate the Hartree energy of an orbiting electron.

It is also possible to use Coulomb's constant,

but notice it is just as easy to calculate the energy of the electron using the gravitational parameter of the proton.

The green digits represent a discrepancy between my data and NIST data that is within the bounds of NIST's stated uncertainty.

Notice that the values are all identical regardless of the "constants" used to calculate the Hartree energy.

Atomic unit of (electrostatic) force, per NIST $F_E = E_h/a_0 = 8.2387235038(13) \times 10^{-8}$ N

$$F_E = \frac{G_P m_P m_E}{a_0^2} = \frac{2.307077552337704 \times 10^{-28}\ \mathrm{kg\ m^3/s^2}}{2.800285205372795 \times 10^{-21}\ \mathrm{m^2}} = 8.238723498275127 \times 10^{-8}\ \mathrm{kg\ m/s^2}$$

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What NIST now calls the atomic unit of force was formerly called the electrostatic force acting on an electron orbiting at the Bohr radius of a hydrogen atom.

The only difference between the Hartree energy equations and electrostatic force equations is that the Bohr radius is squared to determine the force.

Put another way, the Hartree energy is divided by the Bohr radius to determine the electrostatic force.

Thus, there is an inconsistency in the data published by NIST.

The same source data can’t produce 12 digits of accuracy for the Hartree energy but only 9 digits of accuracy for the corresponding electrostatic force.

Black holes

$$\varkappa = v^2 r \quad \therefore \quad R_L = \frac{\varkappa}{c^2}$$

A consequence of the gravitational parameter applied to the orbit of an unobstructed satellite, is that a sufficiently low orbit must ultimately reach the speed of light.

That means the luminiferous radius of any given body is equal to its gravitational parameter divided by the speed of light squared.

In other words, there is a black hole at the core of all celestial bodies and all subatomic particles.

Density of black holes

$$\S = \frac{4\pi}{3}, \quad \rho = \frac{m}{\rho\S R_L^3}$$

$$\rho = 1.784488688507317 \times 10^{16} \quad \mathrm{kg/m^3}$$

The density of a spherical black hole must be its mass divided by its volume, where the section symbol represents the scalar value required to convert a radius cubed into the volume of a sphere.

Using the mass and luminiferous radius of a proton as a calibration standard, that means the density of black holes must be nearly 18 quadrillion kilograms per cubic meter.

My book about the luminiferous aether resulted from asking the question “Could that be the density of the luminiferous aether?”

The topics up to this point were primarily from my book about the scientific method. The remaining topics are primarily from my book about the luminiferous aether.

Density & pressure of the luminiferous aether

$$c = \sqrt{\frac{P}{\rho}} \quad \therefore \quad P = \rho c^2$$

$$P = 1.603818450193223 \times 10^{33}\ \mathrm{kg/m\,s^2}$$

Starting from the archaic assumption that the speed of light in aether behaves like the speed of sound in air,

refactoring the equation on the left for the speed of sound enabled me to calculate the pressure of the aether from its density times the speed of light squared.

Conveniently, NIST defines the speed of light as an exact value,

which made it easy to determine whether those were the correct values for the density and pressure of the aether.

Notice that these equations highlight the fact that everything we call constant is at best a very stable variable.

This is where my journey of discovering the luminiferous aether began!

Mass of black holes

$$\S = \frac{4\pi}{3}, \quad m = \rho \S R_L^3$$

The mass of a black hole is the density of the aether times the luminiferous volume of the black hole.

Energy of black holes

$$\S = \frac{4\pi}{3}, \quad E = P\S R_L^3$$

Similarly, the “relativistic” energy of a black hole is the pressure of the aether times the luminiferous volume of the black hole.

Einstein’s equation

$$P = \rho c^2$$

$$P(\S R_L^3) = \rho(\S R_L^3)c^2 \quad \equiv \quad E = m\,c^2$$

The top equation is the rearranged speed of sound equation used previously to determine the pressure of the aether.

Notice that multiplying both sides of the top equation by the volume of a specific black hole results in Einstein’s famous equation for converting the mass of that volume into energy.

In other words, Einstein’s “relativistic” energy is released by a mass when the aether within its volume stops whirling, thereby causing its former mass to scatter away in various directions as energy.

As of last year, the total daily energy consumption by the entire population of the world was about 2 quintillion Joules.

That’s 10^{18}.

That much energy results from applying aether pressure to a volume about the size of the smallest specks observable by optical microscopes.

Momentum of the aether

	× velocity →		
× dimension ↑	mass (kg)	momentum (kg·m/s)	energy (kg·m^2/s^2)
	linear density (kg/m)	mass flow (kg/s)	force (kg·m/s^2)
	area density (kg/m^2)	viscosity (kg/m·s)	surface tension (kg/s^2)
	density (kg/m^3)	mass flux (kg/m^2s)	pressure (kg/m·s^2)

It is easy to view the attributes in this table as different measurements, because each requires its own unique measuring device.

A more thorough examination reveals that these attributes are actually just different ways to view the momentum of aether particles.

Just as water molecules in a bucket simultaneously exhibit all of these attributes and many more, so does the aether contained within a volume.

It doesn't matter that we don't know whether the aether consists of neutrinos, quantum fluctuations, or something else.

Although we don't know the composition of the luminiferous aether, it is clear it behaves as though it is a superfluid gas composed of neutral colliding particles.

Surface tension of black holes

$$\gamma = PR_L = \rho\varkappa$$

The surface tension of any given black hole is equal to the pressure of the aether times the luminiferous radius of the black hole,

or the density of the aether times the gravitational parameter of the black hole.

That means the surface tension of a black hole represents an equilibrium between the density and pressure of the aether.

Many different surface tension equations exist, depending on the fluids and their shape.

What most of those equations seem to have in common is pressure difference; whereas the pressure on both sides of the interface for black holes is the pressure of the aether.

The unique surface tension of black holes seems to result from the equilibrium between density and pressure.

Size and gravity of black holes

$$R_L = \frac{\gamma}{P}, \quad \varkappa = \frac{\gamma}{\rho}$$

Expressed in different form, it becomes obvious that the surface tension of a black hole divided by the pressure of the aether determines the size of the black hole.

Similarly, the surface tension of a black hole divided by the density of the aether determines the gravitational parameter of the black hole.

Elementary charge, charge squared per mass

$$q \approx \frac{F}{N_A}, \quad \chi_E = \frac{q^2}{4\pi m_E} = \frac{q^2}{4\pi \rho \S R_E^3}$$

χ_E = 2.242445660046681 x 10^{-9} A^2s^2/kg

The elementary charge is the electric charge carried by a single proton.

When negative, it is the electric charge carried by a single electron.

Currently, NIST defines the elementary charge as an exact value.

Originally, the elementary charge was equal to the Faraday constant divided by the Avogadro constant.

For aether calculations, it is more convenient to deal with charge squared per mass.

Electric constant

$$\varepsilon_0 = \frac{\rho \chi_E}{\gamma_P} = \frac{\chi_E}{\varkappa_P} = \left(\frac{q^2}{4\pi}\right)\left(\frac{1}{P\S R_E^3 R_P}\right)$$

Vacuum permittivity was formerly called “the distributed capacitance of free space” or the electric constant.

Only when reduced to the simplest terms of the aether does it become obvious the electric constant derives from the pressure of the aether.

Magnetic constant

$$\mu_0 = \frac{\gamma_P}{P\chi_E} = \frac{R_P}{\chi_E} = \left(\frac{4\pi}{q^2}\right) m_E R_P = \left(\frac{4\pi}{q^2}\right) \rho \S R_E^3 R_P$$

Vacuum permeability was formerly called “the distributed inductance of free space” or the magnetic constant.

Only when reduced to the simplest terms of the aether does it become obvious the magnetic constant derives from the density of the aether.

Electric & magnetic constants

$$\varepsilon_0 = \left(\frac{q^2}{4\pi}\right)\left(\frac{1}{m_E c^2 R_P}\right), \quad \mu_0 = \left(\frac{4\pi}{q^2}\right)\left(\frac{m_E R_P}{1}\right)$$

$E_E = m_E c^2$, $c^2 R_P = \varkappa_P$

Side-by-side, the symmetry of the electric and magnetic constants is more obvious.

In this form it is also more obvious the “relativistic” energy of the electron influences electricity whereas the mass of the electron influences magnetism.

Light’s surface tension

$$\gamma_\lambda = PR_\lambda$$

$$R_\lambda = \lambda_C = \lambda_{B(m_E,c)}$$

It may come as a surprise to discover that light behaves like a black hole, with a surface tension equal to the pressure of the aether times the luminiferous radius of light.

That makes more sense when you pause to consider that aether contained between longitudinal oscillations is not very different from aether contained within a whirling volume.

The luminiferous radius of light is equal to the Compton wavelength or the de Broglie wavelength for an electron travelling at the speed of light.

Light’s gravitational parameter

$$\varkappa_\lambda = \frac{\gamma_\lambda}{\rho} = \frac{PR_\lambda}{\rho} = c^2 R_\lambda$$

As is true for all black holes, light itself has a gravitational parameter of its surface tension divided by the density of the aether.

That is equal to velocity of light squared times the radius of orbit, as is also true for all black holes.

A question worth asking is “Could light be the luminiferous equivalent of a sonic boom?”

Kinematic viscosity of light

$$\nu_\lambda = \frac{\varkappa_\lambda}{c}$$

Light waves propagating through the luminiferous aether have a kinematic viscosity equal to the gravitational parameter of light divided by the speed of light.

For anyone who may be unfamiliar with kinematic viscosity, it is a fluid's internal resistance to flow under gravitational forces.

Planck constant

$$h = m_E \nu_\lambda = \frac{m_E \varkappa_\lambda}{c} = \frac{m_E \varkappa_\lambda}{f\lambda}$$

It is interesting to note that the Planck constant is equal to the mass of an electron times the kinematic viscosity of light as it propagates through the luminiferous aether.

This equation expands that to emphasize what ***hf*** really means.

Electron energy

$$E_E = hf = \frac{m_E \varkappa_\lambda}{\lambda}$$

Multiplying both extremes of the prior equation by frequency, reveals how the luminiferous aether impacts the energy absorbed or emitted by an electron.

Force times area is constant

$$\lambda E_E = hc = m_E \varkappa_\lambda$$

The wavelength of light times the energy absorbed or emitted by an electron has the physical units of force times area.

That is a constant that is equal to the mass of an electron times the gravitational parameter of light.

Fine structure constant

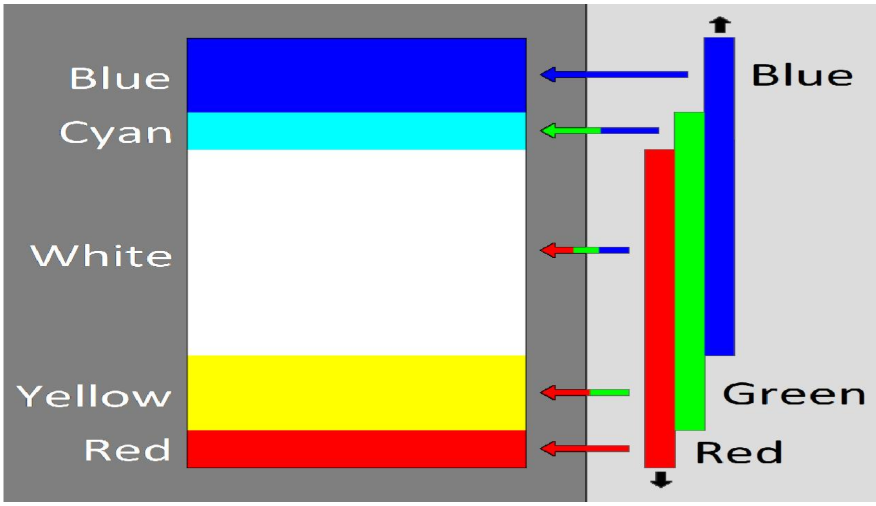
$$\alpha = \sqrt{\frac{E_h}{m_E c^2}} = \sqrt{\frac{\varkappa_P}{a_0 c^2}} = \frac{v_0}{c}$$

What many researchers call a photon actually behaves like an electron accelerated to the speed of light.

Thus, it makes sense that the fine structure constant is equal to the velocity of an electron in orbit at the Bohr radius divided by the speed of light.

The unique property of the Bohr radius of a hydrogen atom is that it is the only radius where the period of an electron's orbit exactly equals the period of the corresponding 45.56 nm wavelength of absorbed or emitted ultraviolet light.

What prisms really do



These next few slides are essential for truly understanding quantum levels.

Anyone who wishes to replicate these experimental observations can use an inexpensive acrylic prism.

Hold the prism with the apex up above your eyes and view a well-lit window surrounded by a dark or dimly lit wall or door.

You can adjust your viewing angle until you observe a blue fringe just **above** the top of the window, a cyan fringe **at** the top of the window, a yellow fringe **at** the bottom of the window, and a red fringe just **below** the bottom of the window.

Notice that the blue and yellow fringes are wider than the cyan and red fringes.

Contrary to what modern physics courses teach, prisms do not refract different colors of light at various angles.

Instead, prisms separate light into red, green, and blue panes.

A later experiment will demonstrate that all colors refract at the same angle.

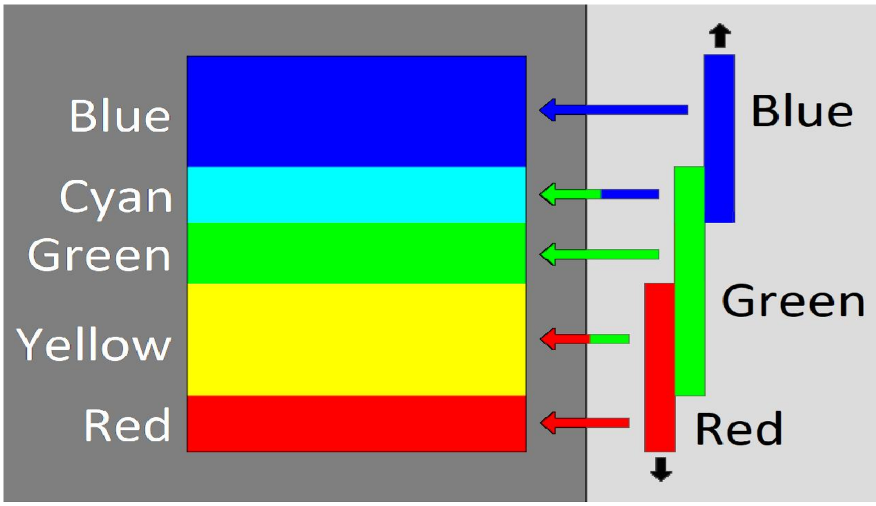
In contrast, the separation of colors is not refraction but deflection of the blue pane toward the apex, the red pane toward the base, and no deflection of the green pane.

For viewers who are artists, please note that the colors of light don’t mix like colors of pigments.

For example, yellow and blue pigments make green, while yellow and blue light make white.

The white and yellow layers of this slide demonstrate that mixing.

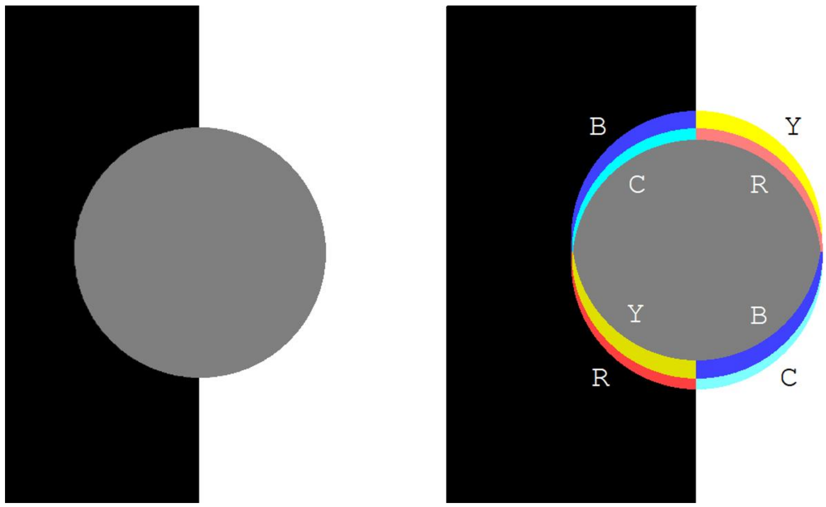
Rainbow colors



With a sufficiently narrow band of light, the color panes separate from each other to produce red, yellow, green, cyan, and blue.

A raindrop or other imperfect prism often mixes the colors to also produce orange, indigo, and violet.

Deflection rather than refraction



All colors of light refract at the same angle when they enter a prism.

If you look at the gray circle on the left with the apex of your prism pointing up, you will observe that the transition from lighter to darker or darker to lighter separates the colors, just as Johann Wolfgang von Goethe observed over three centuries ago.

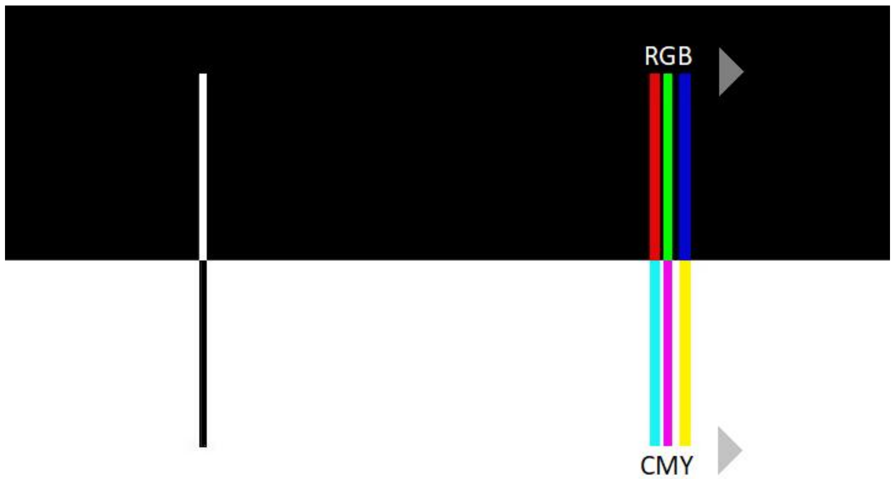
Please pay particular attention to the top of the gray circle on the right.

Notice that the blue and cyan fringes at the upper left of that circle align with the yellow and red fringes at the upper right.

Similarly, the yellow and red fringes at the lower left align with the blue and cyan fringes at the lower right.

Those fringes demonstrate that different colors do not refract at different angles.

Lines



This slide demonstrates that white light consists of only red, green, and blue.

Look at the white and black lines through your prism with its apex pointing right.

Pull the prism back far enough from the page to see the white line completely separates into only red, green, and blue.

Similarly, the black line separates into only cyan, magenta, and yellow.

Notice that blue is slightly wider and deflects slightly farther from the green line than red.

Chapter 7 of my luminiferous aether book explains this in great detail.

Now, observe directly under the green line on the black background is a magenta line on the white background.

Magenta is blue plus red.

Green is still absent from exactly where the black line was, whereas the red and blue panes deflected in opposite directions to fill the place that was a black line.

Green is only absent from the black line, where it never was.

Directly above the black line, only an undeflected green line remains where the white line once was.

The green and magenta lines are how you know green doesn't deflect at all.

Next, observe that directly under the red line on the black background is a cyan line on the white background.

Cyan is green plus blue.

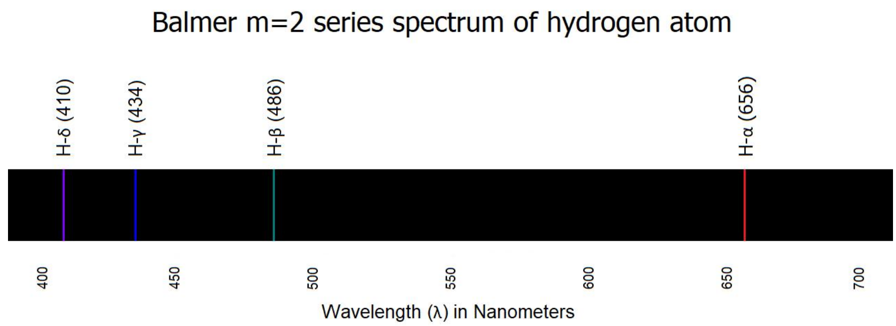
Red is still absent from where the black line was, but the entire red color pane is now shifted toward the base of the prism.

Finally, observe that directly under the blue line on the black background is a yellow line on the white background.

Yellow is green plus red.

Blue is still absent from where the black line was, but the entire blue color pane is now shifted toward the apex of the prism.

Spectral lines



Note that the behavior of white and black lines from the prior slide is critically important for understanding absorption and emission spectra.

This slide depicts the visible light portion of the Balmer m=2 series of the emission spectrum for hydrogen.

Due to spectroscopy's importance to astronomy, many prominent scientists theorized about the meaning of those spectral lines in the late 1800s.

From that work, the theory of quantum mechanics was born.

Viewers should suspect that something may be amiss with spectroscopy since many of those spectral colors result from overlapping red, green, and blue.

For example, notice how the 486 nm cyan line is between the 434 nm blue line and the 656 nm red line, yet there is no 509 nm green line.

Since cyan is a mixture of blue and green, it is important to ask “How can blue be present but green be absent?”

Quantum levels

m	n	λ (nm)	P (kg/m · s²)	Red	Green	Blue
8	**12**	**656.112**	**5.93095e27**	**255**		
8	13	586.682	6.63284e27	255	233	
8	14	541.237	7.18977e27	133	255	
8	**15**	**509.403**	**7.63907e27**		**255**	**23**
8	16	486.009	8.00681e27		239	255
8	17	468.188	8.31154e27		160	255
8	18	454.231	8.56693e27		92	255
8	**19**	**443.053**	**8.78309e27**		**27**	**255**
8	**20**	**433.936**	**8.96762e27**	**40**		**255**
8	21	426.386	9.12639e27	80		255
8	22	420.051	9.26403e27	106		255
8	23	414.674	9.38416e27	118		237
8	24	410.070	9.48953e27	126		219
Balmer		364.507	1.06757e28	($\lambda_{Balmer} = 8\lambda_{Bohr}$)		
Bohr		45.5634	8.54055e28	($P_{Bohr} = 8P_{Balmer}$)		

This slide is Table 8-1 from my luminiferous aether book.

It depicts a portion of the Balmer m=8 series spectrum of the hydrogen atom.

This table shows how red, green, and blue mix at the Bohr radius to produce the illusion of other colors and the associated illusion of quantum levels.

Since there are only three colors of visible light, all other colors are figments of our imagination.

Consequently, the theoretical quantum levels corresponding to imaginary colors can only result from mixing red, green, and blue.

Why there are only three colors

$$v_\beta = \frac{v_0}{\sqrt{8}}$$

$$\lambda_{m<n} = \frac{\varkappa_\lambda}{v_\beta^2 - \left(\frac{m\, v_\beta}{n}\right)^2}$$

$\lambda_{0,\,7.5}$ = 364.507 nm
$\lambda_{1,\,7.5}$ = 371.104 nm
$\lambda_{2,\,7.5}$ = 392.412 nm
$\lambda_{3,\,7.5}$ = 433.937 nm
$\lambda_{4,\,7.5}$ = 509.404 nm
$\lambda_{5,\,7.5}$ = 656.112 nm
$\lambda_{6,\,7.5}$ = 1012.52 nm
$\lambda_{7,\,7.5}$ = 2828.07 nm

where ***m*** and ***n*** are integers,

$\varkappa_\lambda$ = 2.18065889222682 x 10^5 m^3/s^2 is the gravitational parameter of light,

v_β = 7.73465659323441 x 10^5 m/s is the electron velocity for the base wavelength, and

$\lambda_{m,\,7.5}$ represents the color produced when ***n*** **= 7.5** and ***m*** **= 0…7**.

This refactor of the Balmer equation emphasizes how the velocity of electrons produces the various spectral lines.

Balmer's equation requires ***m*** and ***n*** to be integers and usually keeps ***m*** constant while incrementing ***n***.

Alternatively, keeping non-integer n = 7.5 constant and incrementing ***m***, Balmer's equation describes three colors of ultraviolet light, three colors of visible light, and two colors of infrared light.

Focusing on the visible light, m = 3 produces 434 nm blue light, m = 4 produces 509 nm green light, and m = 5 produces 656 nm red light.

This equation reveals that the colors of light result from constant velocity increments.

Armed with that knowledge, it is possible to use mass times velocity to explore momentum increments, mass times velocity squared to explore energy increments, or density times velocity squared to explore pressure increments.

Quantum energy levels

$$v_\beta = \frac{v_0}{\sqrt{8}}, \quad E_{m<n} = m_E\left(v_\beta^2 - \left(\frac{m\,v_\beta}{n}\right)^2\right)$$

Refactoring the prior equation provides the quantum energy levels.

As before, only when n = 7.5 are the energy levels truly quantum multiples of the mass of an electron times the velocity squared of the electron.

Questions & Answers

Q & A

Are there any questions?

Hypothesis testing errors

Null hypothesis is…	True	False
Rejected	Type I error False positive Probability = α	Correct hypothesis True positive Probability = $1-\beta$
Not rejected	Incorrect hypothesis True negative Probability = $1-\alpha$	Type II error False negative Probability = β

Backup slide, in case anyone wants to discuss false negatives/positives and/or how to determine whether a hypothesis is correct.