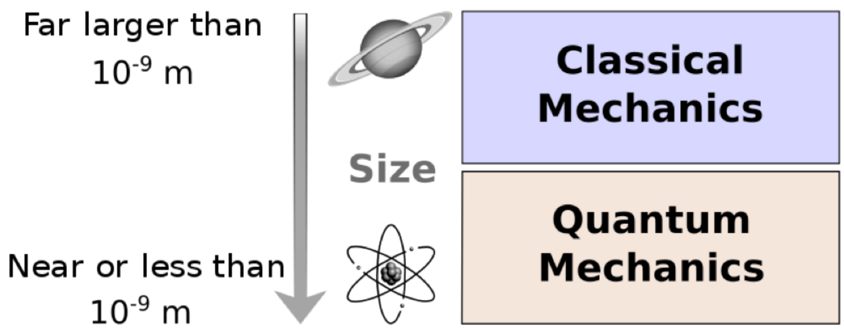
Mechanics

Background

Today, two branches of mechanics are required to explain the forces and motion within the universe: **classical mechanics** for objects larger than the atom and **quantum mechanics** for objects that are smaller than the atom. And these branches represent objects only at low speeds – the equations become more complex when relativity is introduced as objects travel at speeds closer to the speed of light. Why should the universe have a different set of laws that apply for large objects versus small objects?



Explanation

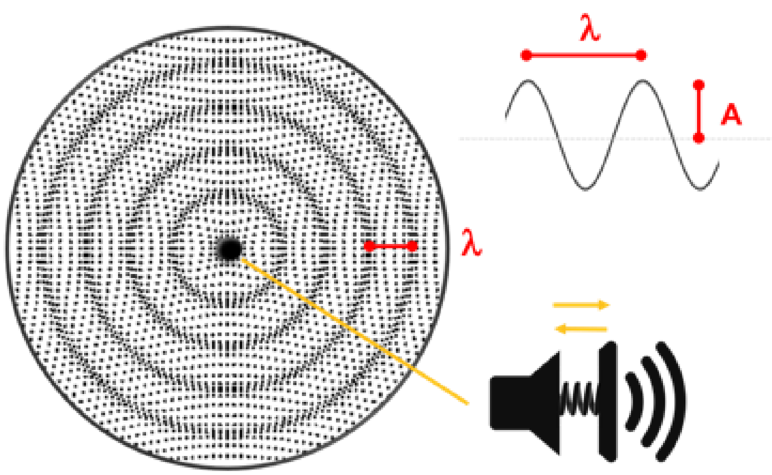
In **energy wave theory**, only one branch of mechanics is required. Classical mechanics can be used to describe the motion of the smallest components of the universe – the granules that make up the spacetime lattice itself. Classical mechanics can be used to calculate the energy of particles created by the waves of energy created from this motion. And classical mechanics can be used to calculate the formation of particles to become atoms. There is no need for a separate quantum branch. Furthermore, relativity for objects at high speeds is a natural derivation from the classical mechanics of waves.

Wave Equations vs Spring-Mass Equations

The majority of calculations on this site are performed using two different methods: 1) wave equations and 2) spring-mass equations. Both can be found in classical mechanics, but given that spring-mass equations are more traditional, it is labeled as *classical* constants and equations throughout the site.

The classical (spring-mass) equations work well for one-dimensional forces and energies based on the electron. It uses well known physics and constants and may be preferred by some. The wave equations on this site, by comparison, work well to describe all particles and motion at relativistic speeds. However, the wave constants and the use of g-factors are new and require a learning curve. Why are there two methods and why are they equal?

Imagine the vibration of air molecules, which travel as sound waves. Sound waves can be described with a wave speed, wavelength and amplitude and travels in a medium with known density. These are the constants for the wave equations and sound wave energy can be calculated using these equations. Another way to calculate the energy of sound waves is to calculate the energy input into the speaker that produces the waves, which can be modeled as a spring-mass system (the diaphragm of the speaker is the mass that vibrates on a spring). Due to the conservation of energy, the two should be equal.

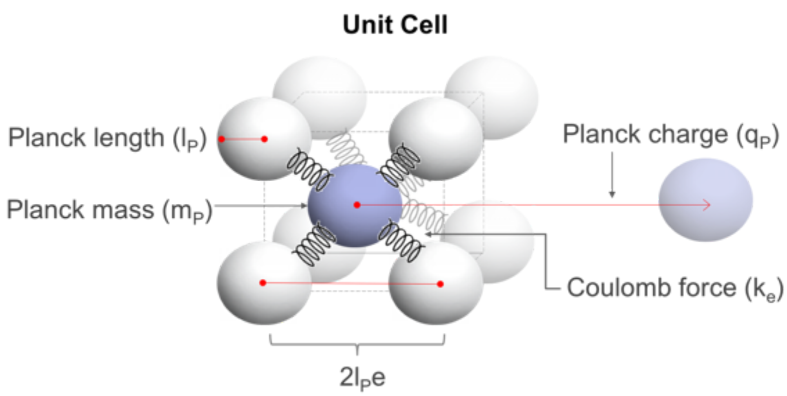


Sound waves generated by a speaker (spring-mass system)

The mechanics of the electron – calculating its energy and the force it produces on other particles – can be calculated just like the speaker that produces sound waves. Although two methods can be used (waves and spring-mass), the spring-mass example is shown on this page to illustrate the simplicity of calculating the electron in a classical manner. An example using wave constants can be found on the electron page. Other examples of equations for spring-mass systems and waves systems in one dimension and three dimensions can be found in the *Physics of Particles* paper.

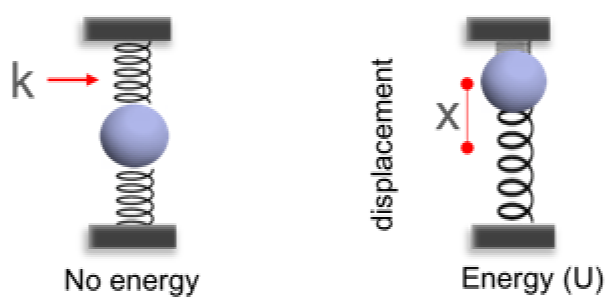
Spring-Mass System

A unit cell of the spacetime lattice from the overview page is shown again, to represent the interactions of granules. The lattice of repeating unit cells may be described as a spring-mass system and mathematically modeled with classical mechanics, even though it is not expected that spacetime literally includes *springs*. It is a representation of a unit cell with a center granule of Planck mass, with harmonic motion, affecting and displacing nearby granules in the lattice. Its harmonic motion produces a wave-like effect over time, where the distance from equilibrium over time is a sinusoidal wave and the maximum displacement becomes the wave amplitude.



Mechanics of a Single Mass

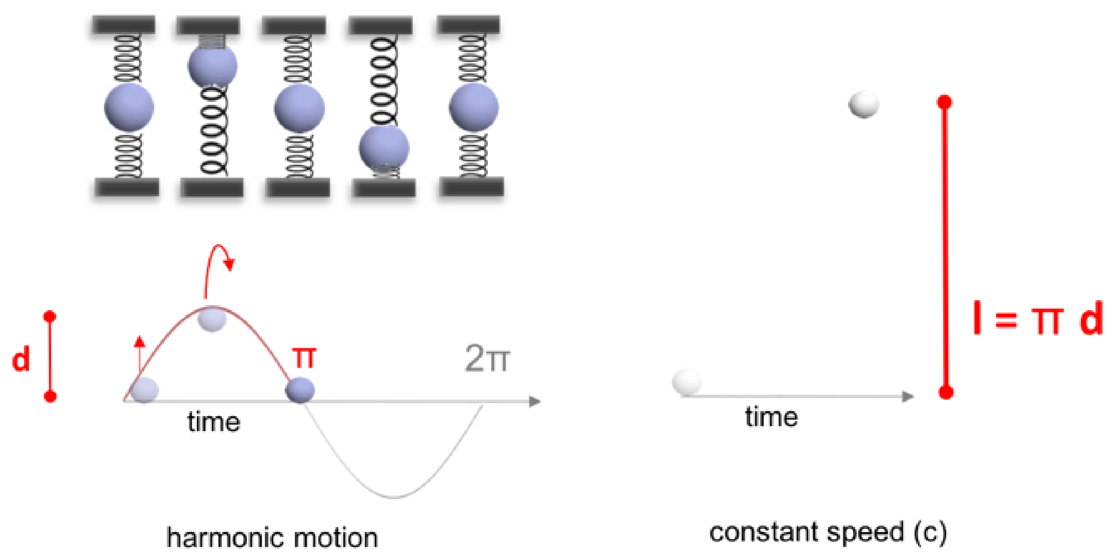
The units page described a center granule (wave center) with a *representative* mass of Planck mass. A wave center with this mass is now illustrated in the next figure. In a spring-mass system, there is no potential energy (U) for a mass at equilibrium. It is illustrated on the left as no energy, and also shows a spring constant (k). On the right of the figure, a mass is displaced from equilibrium at a distance x. Its potential energy (U) is based on the spring constant (k) and the displacement (x) as shown in the equation that follows.



$$U = \frac{1}{2}kx^2$$

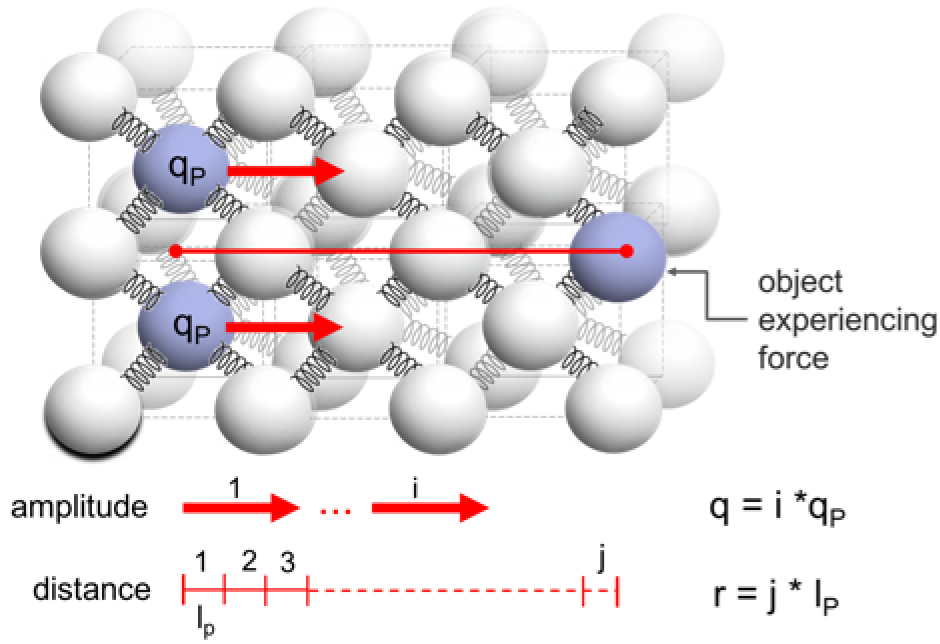
Although the Planck mass is a significant mass relative to other particles like the electron, the mechanics of a spring-mass model require displacement of the mass for it to be recognized as potential energy.

Next, the harmonic motion of a single mass in the system is illustrated. In the spring-mass model, the displacement over time is illustrated as the mass moves back-and-forth. This can be graphed as a sine wave, which is why there is the appearance of waves. In the time that it takes to reach maximum amplitude (d) and return to equilibrium at time t=π, due to harmonic motion, an object that travels at a constant speed will travel a length (l) of π*d. This is used as the cone radius and slant length in the geometry that describes the unification of forces.



Mechanics of the Lattice

When a granule is in motion, it affects the displacement and motion of other granules in the lattice as it transfers its energy. The radius of a single granule was established in the units page as Planck length (l_P). This incredibly small length sets the default value for measuring a distance. Yet, the macroscopic world in which we live sets the measuring stick for the meter to be something recognizable in size to humans (one meter is roughly the height of a human toddler). A distance (r) in the measuring stick established for the meter can be calculated using the Planck unit system by multiplying the Planck length (l_P) and the cumulative number (j) of such lengths in the distance being measured. For example, a distance of one meter is equivalent to 6.187×10^{34} Planck lengths. This relation can be expressed as $r = j * l_P$ in the next figure.



The previous figure also includes the cumulative effect of constructive wave interference on amplitude. Similar to the measuring stick for distance, the macroscopic world in which we live measures the effects of numerous particles, not a single electron. It is the effect of many granules colliding and transferring energy, producing waves and traveling through the spacetime lattice as wavelets according to Huygen's principle. The process of multiple granules in the same wave phase transferring energy can also be represented in the spring-mass system as parallel springs, where the force is additive. This amplitude is measured as the variable for charge (q), where it is a number of particles (i) that have Planck charge amplitude (q_P), related as $q = i * q_P$. These two values for total amplitude (q) and total length (r) will be shown to be the variables in energy and force equations.

Returning back to the potential energy of a spring-mass system, the energy (E) of a mass that is displaced from equilibrium (x) *and* returns to equilibrium can be described as the following:

$$E = \frac{1}{2}kx^2 + \frac{1}{2}kx^2$$

The initial displacement (x) at the center of the electron, without consideration of spin, will be shown to be the Planck charge (q_P). The spring constant (k) is related to the Coulomb force. This describes the properties of an electric universe down to the smallest levels – at the

Planck level between two granules. The following equation describes the spring constant (k) in terms of two components:

1. The constants are Coulomb's constant, which is a force (F) when units are applied correctly (charge is length). A further derivation of the magnetic constant into Planck units shows the relationship of Planck mass in the equation.
2. The variable (in parentheses) is the length that will be calculated. A spring constant is calculated as k=F/r. Thus, this is the Coulomb force (F) measured at a distance (r).

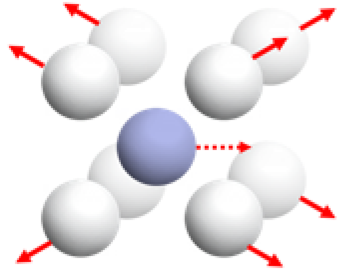
$$k = \frac{\mu_0 c^2}{4\pi}\left(\frac{1}{r}\right)$$

Two substitutions are now made to the previous spring-mass energy equation. First, the spring constant (k) equation from above is inserted into the energy equation. Second, the displacement variable (x) is replaced with the initial *one-dimensional* wave amplitude that occurs at the center of an electron. It is the Planck charge (q_P). In equation format, it is $\mathbf{x=q_P}$.

$$E_s = \frac{\mu_0 c^2}{4\pi}\left(\frac{q_P^2}{r}\right)$$

This energy equation is marked E_s as the total (strong) energy reflected. For example, within the proton, it is the strong *one-dimensional* energy of the gluon that acts at short ranges between two particles within standing wave boundaries. This is explained further in the page for the strong force.

The motion of granules at the center of a particle that spins, such as the electron, has two types of waves: longitudinal and transverse. The electric force is the effect from longitudinal wave displacement as it spreads spherically in *three-dimensions;* the magnetic force is the transverse wave as a result of spin. The details of this geometry was described on the previous page and led to the derivation of the coupling constants for forces, like the fine structure constant (α_e). A center granule (blue) is illustrated in motion in the next figure, causing particle spin. It is compared to granules (white) propagating outwards from the center. If all energy is reflected, the displacement amplitude is Planck charge. In the case of the electron and proton that require spin, the longitudinal displacement amplitude is the elementary charge.



The geometry ratio for the rectangle vs sphere+cone that leads to the derivation of the coupling constants is now applied to the previous strong energy equation. It is referred to as E_l for longitudinal energy when the fine structure constant (α_e) is appended.

$$E_l = E_s \alpha_e = \frac{\mu_0 c^2}{4\pi}\left(\frac{q_P^2}{r}\right)\alpha_e$$

The Planck charge can be replaced with the elementary charge (e_e) as it is related to the fine structure constant. This value is naturally derived in equations for the electric force because it is the initial wave amplitude for the force that affects other particles as it spreads spherically from a particle. In equation format, the known relationship of the elementary charge and Planck charge is: $\mathbf{e_e^2 = q_P^2 \alpha_e}$. It replaces the Planck charge in the previous equation to become an equation for Coulomb energy.

$$E_l = \frac{\mu_0 c^2}{4\pi}\left(\frac{e_e^2}{r}\right)$$

Coulomb energy

Energy of an Electron

An example of the Coulomb energy equation above is the calculation of the electron's rest energy (E_e). It is the energy from the center of the electron to the electron's classical radius (r_e) – the boundary of its standing waves where energy is stored. It is an example of how a derivation can start with the mechanics of granules, represented as a spring-mass system, to the Coulomb energy equation, to the exact energy of the electron.

$$E_e = \frac{\mu_0 c^2}{4\pi}\left(\frac{e_e^2}{r_e}\right) = 8.1871 \cdot 10^{-14}\left(\frac{kg\,(m^2)}{s^2}\right)$$

The electron's energy (E_e) is used as a constant throughout this web site, in particular in the sections on forces and atoms, in equations using a generic format. The electron's energy can be derived in either classical or wave constant format, but a generic form based on the electron's energy makes equations readable and gives a reader a better understanding of the equation's meaning.

The inclusion of this constant in the equations to calculate the position of electrons in atoms is of significant interest, because the ultimate derivation of the equations for atoms can be calculated with classical mechanics – without the need for quantum mechanics!

Force of an Electron

In the spacetime lattice, the energy of granules propagating spherically does not end at the boundary of a particle. The particle's boundary is simply the edge of standing waves where a particle is measured as stored energy. Beyond the boundary, this motion continues as traveling waves. In some cases, like an electron in an atom (e.g. Rydberg energy for hydrogen), it is measured as energy. In other cases, it is measured as the electric force when it causes the motion of other particles.

Force is energy at distance, represented in equation format as: **F=E/r.** Therefore, the Coulomb force (F_e) is the Coulomb energy equation with another distance in the denominator, making it r^2.

$$F_e = \frac{E_l}{r} = \frac{\mu_0 c^2}{4\pi}\left(\frac{e_e^2}{r^2}\right)$$

The previous equation is the electric force (Coulomb force) of two electrons. When multiple particles are grouped together, wave amplitude is constructive or destructive, as described earlier. In energy wave theory, the dimensionless variable Q, which is a count of particles, is appended to the electron's initial wave amplitude as a measure of wave interference.

Previous: Geometry