The New Foundation Model of Physics

Illuminating science — www.illuminating.science

How it works

Physical constants are made of fundamental Planck units. These natural quantities of length, mass, and time are the building blocks of the universe.

$$G = \frac{l_P}{m_P}\,c\,c = \frac{l_P\,l_P\,l_P}{m_P\,t_P\,t_P}$$

$$\hbar = l_P\,m_P\,c = \frac{l_P\,l_P\,m_P}{t_P}$$

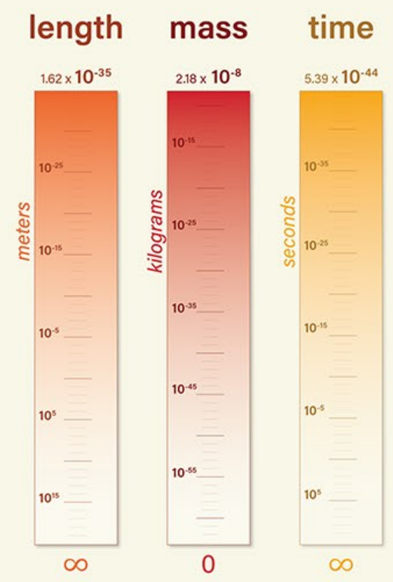
Fundamental Units

Length, mass, and time are fundamental unit dimensions. Length and mass describe the spatial attributes of particles and fields, and time quantifies their rates of change.

l_P PLANCK LENGTH — m_P PLANCK MASS — t_P PLANCK TIME

Potentials

Each Planck unit is a *maximum potential* in one of the unit dimensions. All three potentials coincide at the Planck scale.



Dimensions

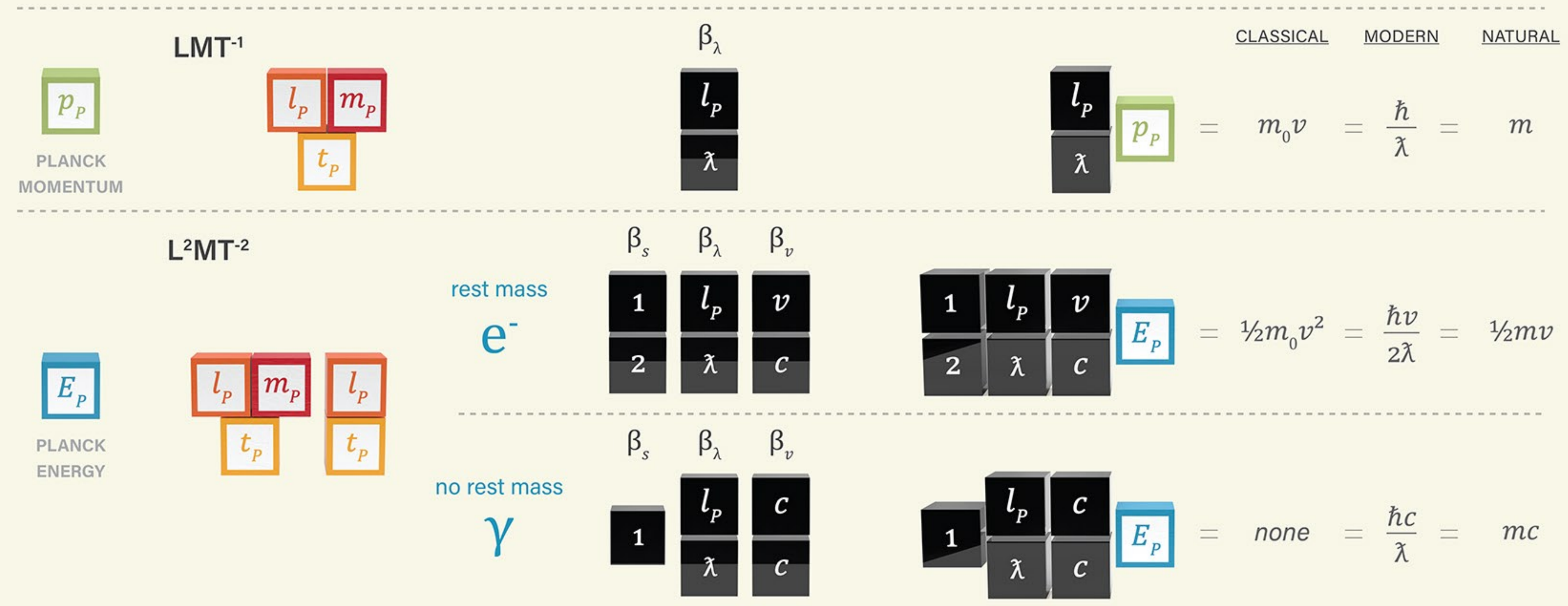
Physical dynamics are defined by ratios of the three unit dimensions. Each elementary particle of the standard model conserves the maximum potential of these unit dimensions.

Operators

Elementary particles redistribute the conserved Planck potential over space and time. A particle's *spatial* and *temporal* distributions are quantified by dimensionless proportionality operators.

Formulas

Natural formulas consist of one or more proportionality operators acting on a maximum potential in the given unit dimensions.



Momentum

Momentum was contrived in unit dimensions **LMT-1** to match the observation that kinetic energy is proportional to velocity squared. Not until Louis de Broglie explained the wave nature of matter was it possible to show that momentum is a purely spatial attribute and *not* a measure of displacement. Velocity gives the correct proportion but in the *wrong* unit dimensions.

A particle's energy potential is naturally quantitied in unit dimensions of mass and is proportional to the inverse wavelength of all standard model particles. Replacing p in unit dimensions **LMT-1** with inertial mass m in unit dimension **M** is mathematically consistent with traditional formulas and accurately describes the physical attributes of photons *and* electrons. Inertial mass and rest mass are related by:

$$m = m_0\left(\frac{v}{c}\right)$$

Confusion over the physical meaning of momentum arises from the following equality between wavelength and velocity

$$\frac{\lambda_C}{\lambda} = \frac{v}{c}$$

Rest mass and velocity are mathematical instruments for finding a particle's wavelength. Rest mass quantifies the Compton wavelength, while velocity quantifies the change from Compton to de Broglie wavelength. However, it introduces the unnecessary unit dimensions **LT-1**. The energy potential of every particle is simply the inverse of its wavelength in unit dimensions of mass.

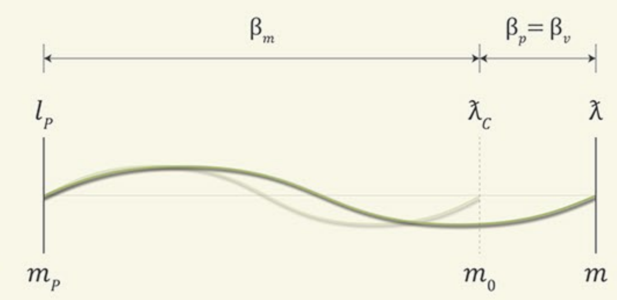
2-part energy mechanism

Kinetic energy is determined by a simple 2-part energy mechanism in a particle's wavelength and velocity. The ratio of each part to its maximum potential produces the kinetic energy of all standard model particles, with the inclusion of a ½ spin factor for particles with rest mass.

Part I: $\frac{l_P}{\lambda}$ — Part II: $\frac{v}{c}$

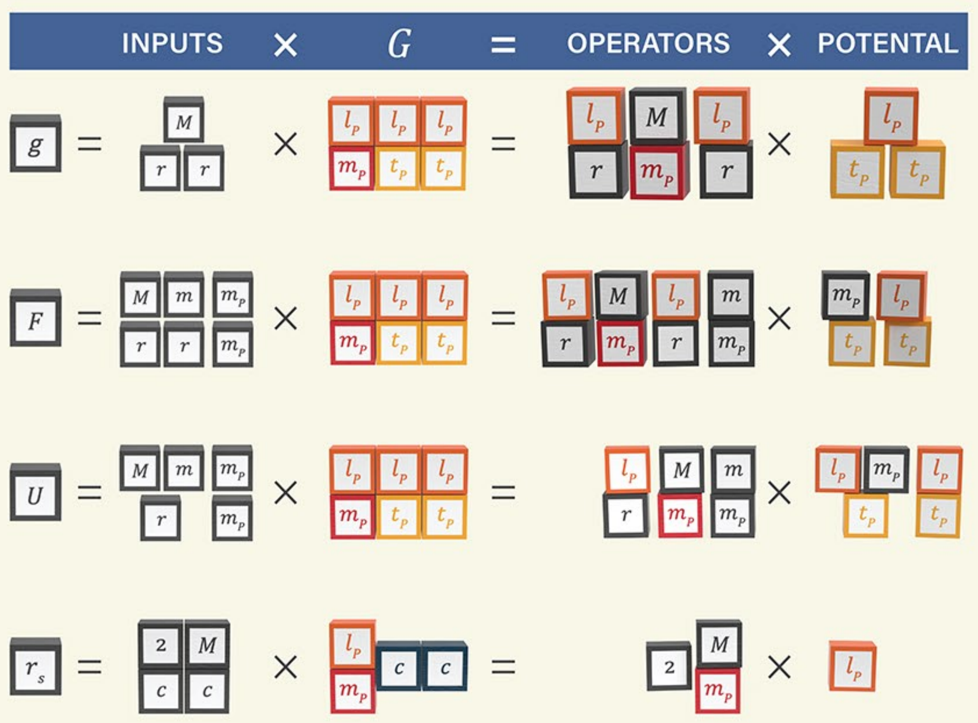
Rest mass partitions a particle's energy evenly between both parts of the mechanism, creating equal ratios in the change of wavelength and velocity.

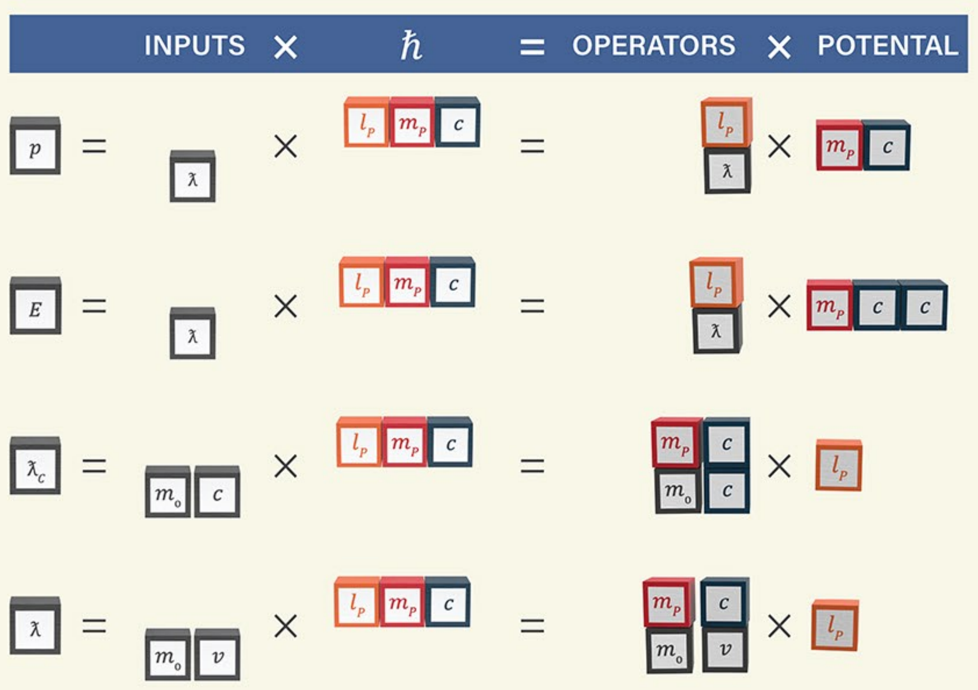
The following illustration shows the ratio of a particle's wavelength at velocity v to the Compton wavelength at the particle's maximum velocity potential c. As the wavelength increases, the particle's velocity decreases proportionally.



Composite constants and natural formulas

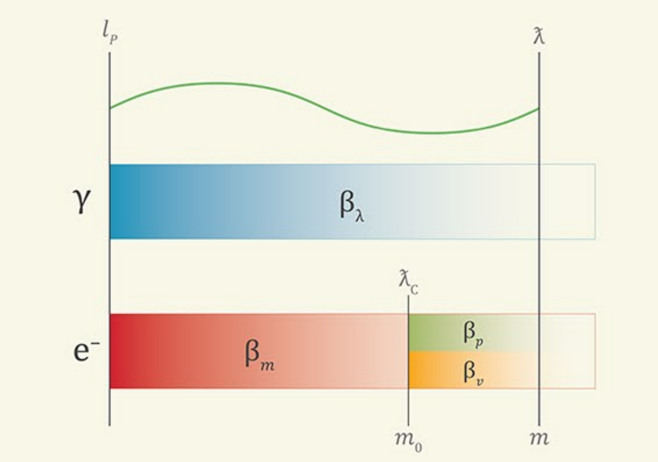
Replacing Planck's constant and the gravitational constant with fundamental Planck units reveals hidden insights. The Planck units embedded in historical constants combine with formula inputs to create dimensionless proportionality operators and potentials.

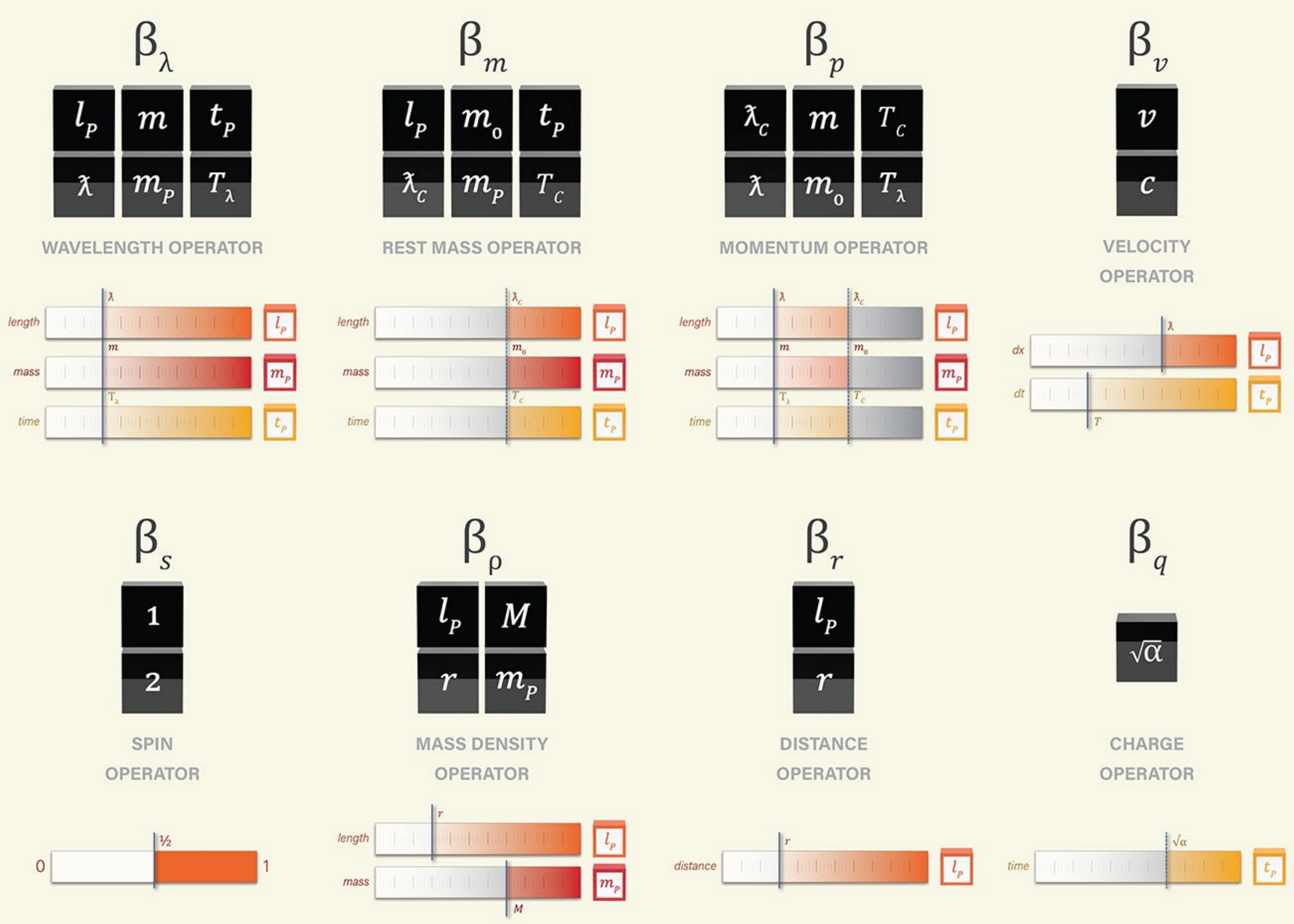




Operators

Proportionality operators describe the distribution of elementary particles and field potentials. Maximum potentials are transformed by dimensionless ratios of particle and field attributes to the maximum unit potentials.





Important relationships between mechanical operators are shown above. The wavelength operator is equal to the combined rest mass and momentum operators. The momentum and velocity operators are equal.

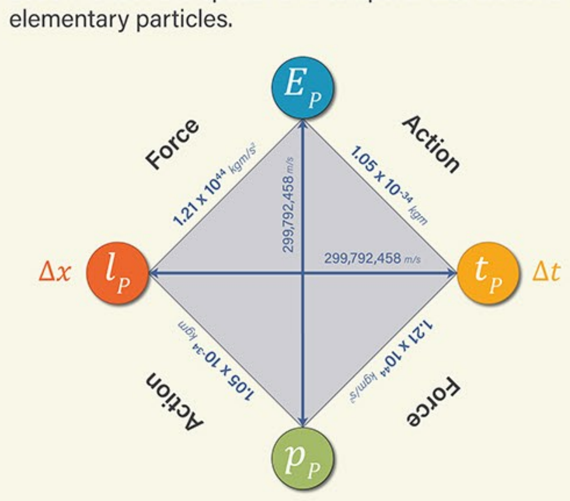
Symmetries

Conserved potentials are correlated across unit dimensions giving rise to natural symmetries. The conservation of length, mass, time, momentum, energy, and action reflect the spatial and temporal distributions of elementary particles.

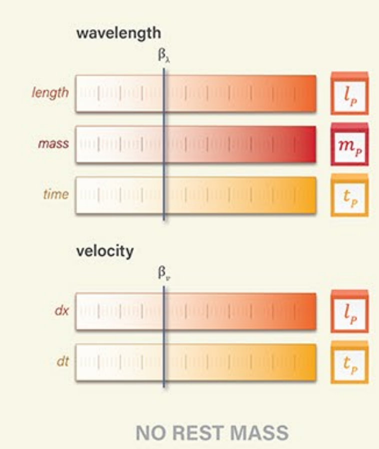
symmetry	formula	potential	invariant	conserved
length-mass	$\lambda m = l_P m_P$	$l_P\,m_P$	$\lambda\,m$	3.52 x 10-43 kgm
mass-momentum	$\lambda m = p\,T_\lambda$	$l_P\,m_P$	$\lambda\,m$	3.52 x 10-43 kgm
		$p_P\,t_P$	$p\,T_\lambda$	3.52 x 10-43 kgm
momentum-energy	$\lambda p = TE_k$	$l_P\,p_P$	$\lambda\,p$	1.05 x 10-34 kgm²s-1
	$(\lambda p = 2TE_k)$	$t_P\,E_P$	$T\,E_K$	1.05 x 10-34 kgm²s-1

Length-mass symmetry is the inverse relationship between wavelength and mass. Mass-momentum symmetry is an alternate expression of length-mass symmetry using traditional units of momentum. Momentum-energy symmetry is the conserved relationships between wavelength-momentum and oscillation period-energy. The kinetic energy of particles with and without rest mass can be calculated simply from the oscillation period.

NO REST MASS: $\frac{t_P}{T}E_P$ — REST MASS: $\frac{1}{2}\frac{t_P}{T}E_P$

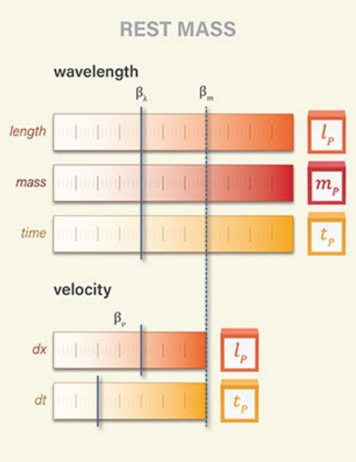


Momentum-energy symmetry conserves Planck's constant, $l_P p_P$ and $t_P E_P$. The constrained relationships between wavelength, momentum, time, and energy produce predictable quantities of action and force.



Particles without rest mass have correlated attributes in the unit dimensions of energy. Each particle's conserved Planck energy potential is distributed over the particle's wavelength and velocity.

Particles with rest mass have correlated attributes in the unit dimensions of energy. Changes in inertial mass/momentum are equal to changes in velocity. Each particle's conserved Planck energy potential is distributed over the particle's wavelength and velocity.



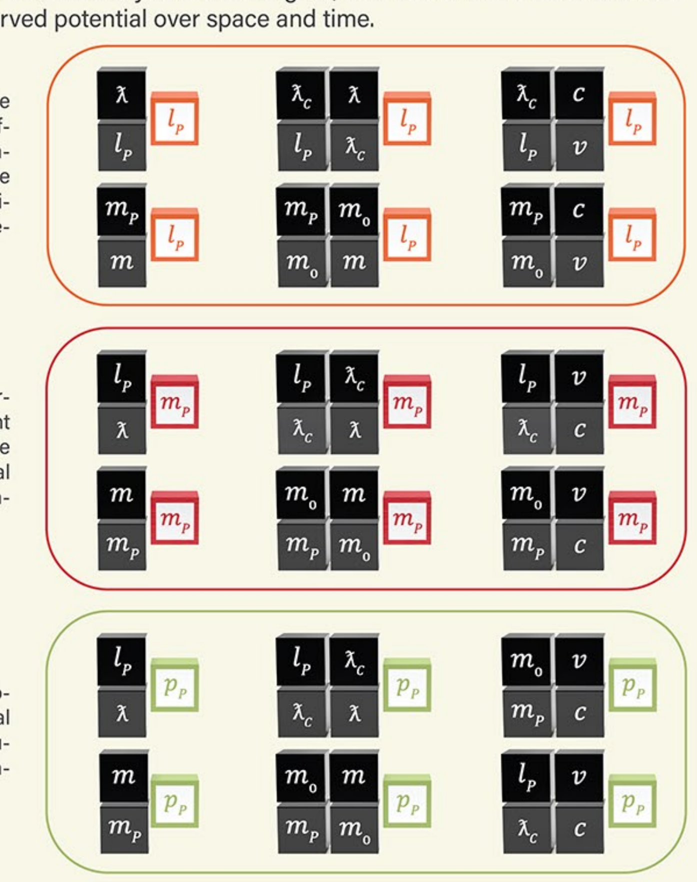
Natural formulas

Natural formulas describe the spatial and temporal distributions of elementary particles and systems. A formula consists of the maximum potential of the unit dimensions you are solving for, and one or more dimensionless proportionality operators that dilute the conserved potential over space and time.

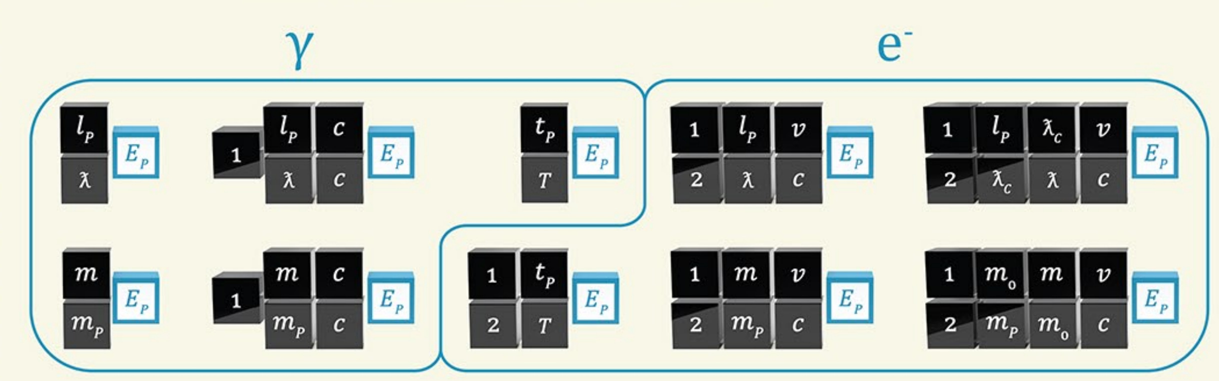
WAVELENGTH — Six equivalent forms of the wavelength formula using different combinations of operators. The formula produces the de Broglie wavelength at velocity v, and the Compton wavelength at velocity c.

MASS — Six equivalent forms of the inertial mass formula using different combinations of operators. The formulas produce the inertial mass of particles with and without rest mass.

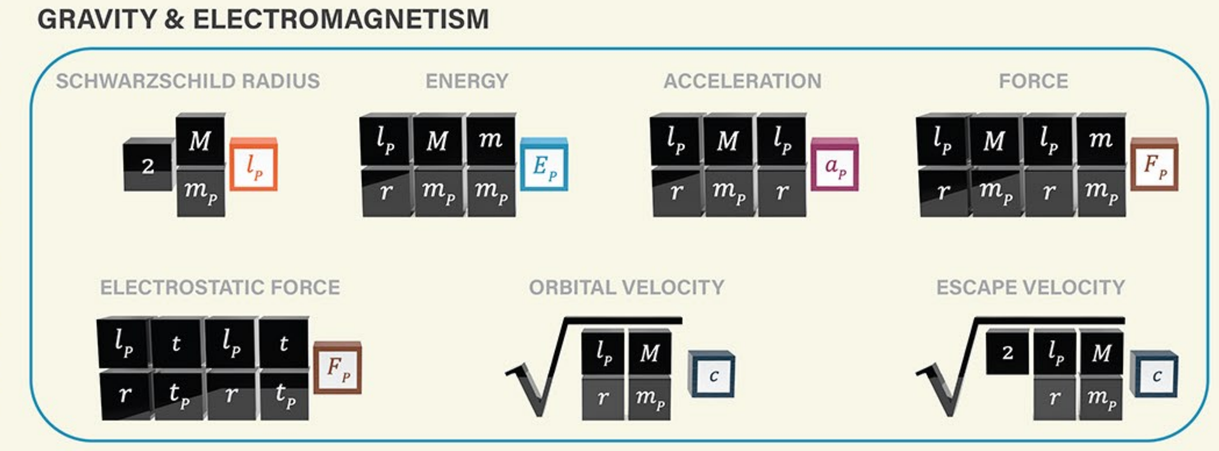
MOMENTUM — Six equivalent forms of the momentum formula in traditional units of momentum. The formula quantifies the energy potential of a particle's wavelength.



ENERGY — Equivalent forms of the kinetic energy formula for particles with and without rest mass. Kinetic energy requires the spin, wavelength, and velocity operators. For particles with rest mass, the wavelength operator can also be split into rest mass and momentum operators.



GRAVITY & ELECTROMAGNETISM



Electromagnetism

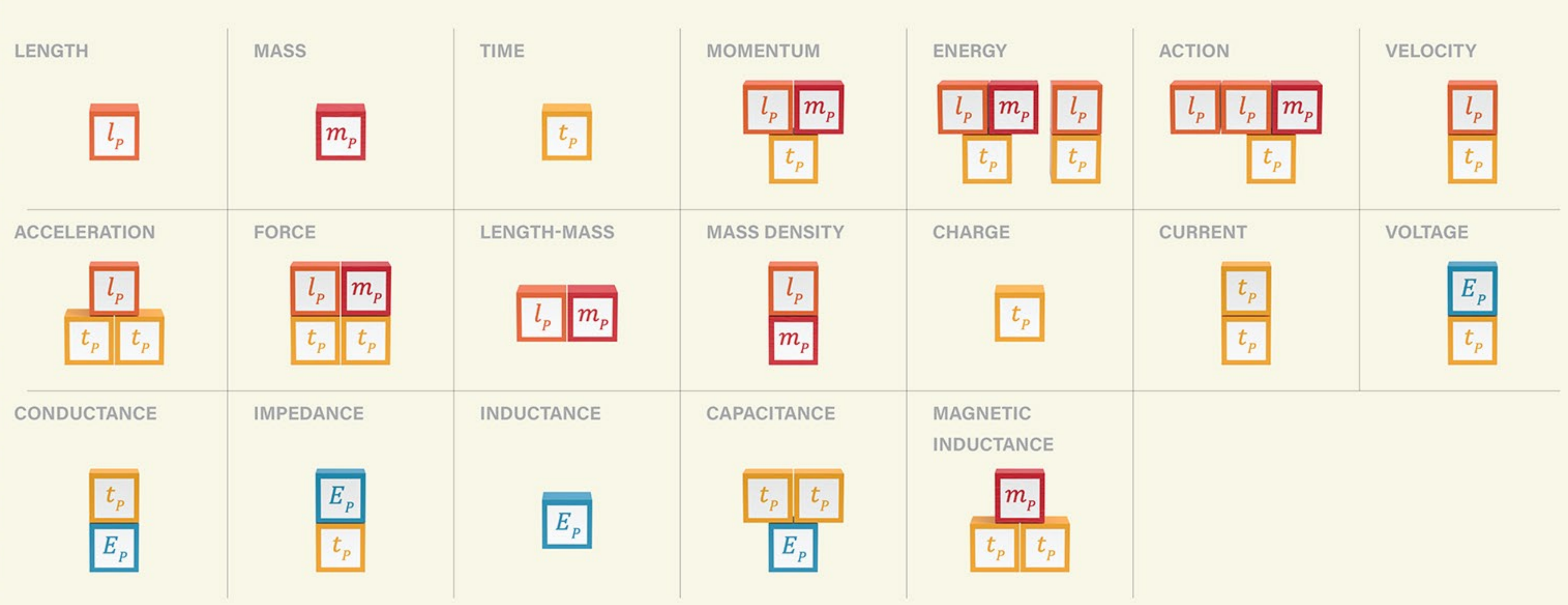
The electromagnetic interaction works in the same unit dimensions as mechanical and gravitational physics; electromagnetism is naturally quantified in units of length, mass, and time.

Time is the unit dimension quantifying mechanical changes in momentum (force) and velocity (acceleration). So it should come as no surprise that the maximum electric charge is equal to the Planck time. Substituting Planck time for Planck charge gives the correct magnitudes and dimensions of electromagnetic phenomena in unit dimensions of length, mass, and time.

Unit	Conversion	Dimensions
coulomb	2.874 495 x 10-26	s
ampere	2.874 495 x 10-26	dimensionless
volt	3.478 872 x 1025	kgm²s-3
tesla	3.478 872 x 1025	kgs-2
weber	3.478 872 x 1025	kgm²s-2
ohm	1.210 255 x 1051	kgm²s-3
henry	1.210 255 x 1051	kgm²s-2
farad	8.262 723 x 10-52	s⁴kg-1m-2
siemen	8.262 723 x 10-52	s³kg-1m-2

Potentials

Each unit dimension and combination of unit dimensions has a maximum potential defined by the Planck units. These units represent extreme limits of a quantized universe. See **Electromagnetism** for conversion between charge and time.



Historical constants

Historical constants are combinations of natural units and proportionality operators. The New Foundation Model replaces historical constants with dimensionless proportionality operators and maximum unit potentials. See **Electromagnetism** for conversion between charge and time.