

Fundamental Principle of Mass

Particle	Rest Mass MeV	Measured Rest Mass m_o kg	Rest Mass-Energy $E_o = m_o c^2$ J	Absolute Density ρ_o kg/m ³	Calculated Volume V_o m ³	Calculated Radius m	Measured Radius m	Calculated Rest Mass M_o kg	Calculated Rest Mass-Energy $E_o = V_o \rho_o c^2$
<i>Photon, Neutrino, Gluon & Magnetic Monopole (Graviton)†:</i>	4.14E-21	7.37249720E-51	6.62607004E-34	2.92134721E+17	2.52366345E-68	1.81962101E-23		7.37249720E-51	6.62607004E-34 *
Electron:	0.5109989	9.10938291E-31	8.18710507E-14	2.92134721E+17	3.11821302E-48	9.06300856E-17	9.0647E-17	9.10938291E-31	8.18710507E-14
Proton:	938.27205	1.67262178E-27	1.50327748E-10	2.92134721E+17	5.72551516E-45	1.10979301E-15	1.1100E-15	1.67262178E-27	1.50327748E-10
Neutron:	939.56538	1.67492735E-27	1.50534963E-10	2.92134721E+17	5.73340731E-45	1.11030270E-15		1.67492735E-27	1.50534963E-10
Up Quark:	2.3	4.10012224E-30	3.68500610E-13	2.92134721E+17	1.40350391E-47	1.49637923E-16	Schwarzschild radius: $r_s = (2Gm)/c^2$ (Event Horizon)	4.10012224E-30	3.68500610E-13
Down Quark:	4.8	8.55677685E-30	7.69044751E-13	2.92134721E+17	2.92905164E-47	1.91225647E-16		8.55677685E-30	7.69044751E-13
Top Quark:	1.71E+05	3.05209534E-25	2.74308649E-08	2.92134721E+17	1.04475611E-42	6.29470579E-15		3.05209534E-25	2.74308649E-08
(Black Hole: $M_\odot \times 7.9424$)		1.57982278E+31	1.41987391E+48	2.92134721E+17	5.40785695E+13	2.34591458E+04	2.3459E+04	1.57982278E+31	1.41987391E+48
(Black Hole: $M_\odot \times 17 \times 10^9$)		3.38147000E+40	3.03911367E+57	2.92134721E+17	1.15750363E+23	3.02327684E+07	5.0213E+13	3.38147000E+40	3.03911367E+57

Key: [Variant m , Hypothetical] - travel at c , Elementary, Composite, Postulated[#] (min. & largest detected)

[*Demo at Planck's min. quanta of energy (h), therein, determines min. particle mass & size.]

Conclusions:

- Absolute Density $\rho_o = 3/\sqrt{\hbar}$ — Relativistically Constant
 - Particle Rest Mass $m_o = V_o \rho_o$ ($= hf/\gamma c^2$) Particle Relativistic Mass $m = V_o \gamma \rho_o$ ($= hf/c^2$)
 - Particle Rest Mass-Energy $E_o = V_o \rho_o c^2$ ($= hf/\gamma$) Particle Relativistic Mass-Energy $E = V_o \gamma \rho_o c^2$ ($= hf$)
- $h = \text{Planck constant}$
 $f = \text{Wave frequency}$
 $\gamma = \frac{1}{\sqrt{1 - (v^2/c^2)}}$
- Condensing at a limit to which energy can be concentrated, mass manifest in dense orbs of particles with distinct or relativistic variant volumes.
 - Einstein's unification of mass and energy originate from the same entity: vacuum energy - the *subquantum* scalar platform for mass-energy conservation.
 [Note: In addition to E , m and c intercorrelated by $E = mc^2$, c is potentially regulated by vacuum energy density where from experiment/observation: $v_\rho \approx 10^{26}$ kg/m³, thereby $E_\rho \approx 10^9$ J/m³ $\approx 1/c$]
 - There are NO such things as massless particles - demonstrated minimum rest mass & size. ([†]Differentiating relativistic mass & size dependent on energy carried: $V_o f \rho_o c^2 = hf$.)
 - Einstein's formulation ($E = hf$) is plainly incorrect at frequencies < 1 Hz; an inaccuracy that extends but diminishes towards 10^{10} Hz. (Rectification at lower f is: $E = h \gamma$.)
 - At higher frequencies: f and γ values converge allowing eventual infinity produced by γ to be renormalized by $\gamma = f$ (validating $E = hf$ where h is min. rest energy.)
 - Renormalization of γ establish particle velocities (v) are directly related to their frequencies: $v = c - (1/f)$; used to ascertain γ in reconciling second to above conclusion.
 [Note: Difference in v for average frequency of visible light (5.4×10^{14} Hz) travelling in a vacuum corresponds to 17.5 metres (5.84×10^{-8} seconds) less than c per light year. (c is an absolute constant.)]
 - Black holes are NOT singularities. ([#]Postulate each culminates in ultimate composite particles - accreted quark-gluon plasma at absolute density - technically quark stars.)
 - Phenomenon of the Big Bang was NOT due to a quantum fluctuation in which entire matter originated from a singularity - an infinitesimal dense volume.
 - Concept of Higgs mechanism is in disaccord with vacuum energy synthesis of mass-energy conservation. Eduction of new boson as Higgs thereby remains ambiguous.
 - Mass is the product of its major components: volume and density, fundamentally, particle mass is proportionate volume of (vacuum) energy at absolute density.