Particle Mass Differences
Earth/matriX: Science Today

In decades gone by, the CODATA often presented the characteristics of the particles as of their alphabetical order which disguised any particular pattern, other than the randomness of the letters in the alphabet itself. This practice of randomly presenting the elements in alphabetical order remains.

The Traditional Alphabetical order of particles.

Alpha p.	***Deuteron***	***Electron***	***Helion***	***Muon***	***Neutron***	***Proton***	***Tau***	***Triton***

In this study of the particle mass differences, the order of the data is presented as of the incremental progressive order of the numerical values of the particle masses.

The Order of Selected Particles by Incremental Mass Values

Electron	**Muon**	**Proton**	**Neutron**	**Tau**	**Deuteron**	**Helion**	**Triton**	**Alpha p.**

The Order of All Particles by Incremental Mass Values

Electron	**Muon**	**Atomic Mass c.**	**Proton**	**Neutron**	**Tau**	**Deuteron**	**Helion**	**Triton**	**Alpha p.**	**Planck**

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The Constants of Mass of the Recommended Values of the Fundamental Physical Constants Presented by CODATA 2010 Follow the Order Below.
No criterion of incremental/decremental mass is apparent in the order.

Electron	*Muon*	*Tau*	*Proton*	*Neutron*	*Deuteron*	*Triton*	*Helion*	*Alpha p.*
$-9.10938291E^{-31}$	$1.883531475E^{-28}$	$3.16747E^{-27}$	$1.672621777E^{-27}$	$1.674927351E^{-27}$	$3.34358348E^{-27}$	$5.00735630E^{-27}$	$5.00641234E^{-27}$	$6.64465675E^{-27}$

Values rounded off to four digits

$-9.1094E^{-31}$	$1.8835E^{-28}$	$3.1674E^{-27}$	$1.6726E^{-27}$	$1.6749E^{-27}$	$3.3436E^{-27}$	$5.0073E^{-27}$	$5.0064E^{-27}$	$6.6446E^{-27}$

The CODATA for 2010 presents the recommended physical constants in an order that interrupts the incremental tendency of mass values as may be observed above.

Were the **Planck constant for mass** to be included, it would be the final term on the table as shown. However, since its mass is much larger than the other particles, it does not register a significant difference on my pocket calculator.

All numerical values are fractal expressions in this study unless otherwise indicated.

Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.	Planck

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New Order of Particles by Incremental Mass Values

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-								
Muon		-							
Proton			-						
Neutron				-					
Tau					-				
Deuteron						-			
Helion							-		
Triton								-	
Alpha p.									-

In this study, the order of the particle masses is presented according to their incremental/decremental numerical values for their respective mass values.

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Earth/matriX Proposed Order for the Mass of the Particles

The Constants of Mass of the Recommended Values of the Fundamental Physical Constants, CODATA 2010,

Constants Presented in Incremental Order Horizontally to the Right and Vertically Down

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	$9.10938291E^{-31}$	$1.883531475E^{-28}$	$1.672621777E^{-27}$	$1.674927351E^{-27}$	$3.16747E^{-27}$	$3.34358348E^{-27}$	$5.00641234E^{-27}$	$5.00735630E^{-27}$	$6.64465675E^{-27}$
Muon	$1.883531475E^{-28}$	-							
Proton	$1.672621777E^{-27}$		-						
Neutron	$1.674927351E^{-27}$			-					
Tau	$3.16747E^{-27}$				-				
Deuteron	$3.34358348E^{-27}$					-			
Helion	$5.00641234E^{-27}$						-		
Triton	$5.00735630E^{-27}$							-	
Alpha p.	$6.64465675E^{-27}$								-

Incremental progression of particle mass values.

Incremental Progression of mass

Constants whose order has been rearranged so as to produce the incremental progression pattern.

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Neutron-proton Mass Difference $2.30557392 \times 10^{-30}$

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-								
Muon		-							
Proton			-						
Neutron			**2.30557392**	-					
Tau					-				
Deuteron						-			
Helion							-		
Triton								-	
Alpha p.									-

The 2.30557392 is the smallest mass difference of all particle mass differences between two particles.

CODATA for 2010 presents for the first time the difference between the neutron-proton masses. Although only the neutron-proton mass difference is offered, numerous theoretical particle mass differences exist. ***Fractal numerical values.***

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Particle Mass Differences Derived as of the Recommended Values of the Fundamental Physical Constants, CODATA 2010

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-								
Muon	1.874422	-							
Proton	1.671710	1.484268	-						
Neutron	1.674016	1.486574	2.30557392	-					
Tau	3.166559	2.979116	1.4948482	1.4925426	-				
Deuteron	3.343572	3.155230	1.670961	1.668656	1.761134	-			
Helion	5.005501	4.818059	3.333790	3.331484989	1.838942	1.66282886	-		
Triton	5.006445	4.819003	3.334734	3.332428947	1.839886	5.0073563	5.006412	-	
Alpha p.	6.6436456	6.4563036	4.9720349	4.9697293	3.4771867	3.3010732	1.6382444	1.6373004	-

The particles are placed according to their progressive incremental tendency of mass. All numerical values of mass differences are $x10^{-27}$, except $1.874422\ x10^{-28}$ and $2.305574\ x10^{-30}$.

In my mind, if one offers the theoretical mass difference between the neutron and proton, then all possible differences of particle masses should be theoretically presented.

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	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-								
Muon	1.874422	-							
Proton	1.671710	1.484268	-						
Neutron	1.674016	1.486574	2.30557392	-					
Tau	3.166559	2.979116	1.4948482	1.4925426	-				
Deuteron	3.343572	3.155230	1.670961	1.668656	1.761134	-			
Helion	5.005501	4.818059	3.333790	3.331484989	1.838942	1.66282886	-		
Triton	5.006445	4.819003	3.334734	3.332428947	1.839886	5.0073563	5.006412	-	
Alpha p.	6.6436456	6.4563036	4.9720349	4.9697293	3.4771867	3.3010732	1.6382444	1.6373004	-

Note the incremental/decremental tendencies in the fractal numerical values of the particle mass differences.

Incremental tendency

Decremental tendency

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Fractal Overall and Columnar Means of the Particle Mass Differences Derived as of the Recommended Values of the Fundamental Physical Constants, CODATA 2010

	3.787349714	3.599793286	2.96127362	2.9858968368	6.309258675	3.323752787	3.3223282 mean by column
	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion
Muon	1.874422						
Proton	1.671710	1.484268					
Neutron	1.674016	1.486574	2.30557392				
Tau	3.166559	2.979116	1.4948482	1.4925426			
Deuteron	3.343572	3.155230	1.670961	1.668656	1.761134		
Helion	5.005501	4.818059	3.333790	3.331484989	1.838942	1.66282886	
Triton	5.006445	4.819003	3.334734	3.332428947	1.839886	5.0073563	5.006412
Alpha p.	6.6436456	6.4563036	4.9720349	4.9697293	3.4771867	3.3010732	1.6382444

3.234796019 fractal overall mean difference

Triton 1.6373004

Given the fact that the Planck mass is so large, it cannot be illustrated easily with the other particles.

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Particle Mass Differences Including the Atomic Mass Constant Derived as of the Recommended Values of the Fundamental Physical Constants, CODATA 2010

	Electron	Muon	Atomic Mass c.	Proton	Neutron	Tau	Deuteron	Helion	Triton	*Alpha p.*
Electron	-									
Muon	1.874422	-								
Atomic Mass c.	1.6596279	1.4721857	-		-					
Proton	1.671710	1.484268	1.208285	-						
Neutron	1.674016	1.486574	1.438843	2.30557392	-					
Tau	3.166559	2.979116	1.506931	1.4948482	1.4925426	-				
Deuteron	3.343572	3.155230	1.683044	1.670961	1.668656	1.761134	-			
Helion	5.005501	4.818059	3.345873	3.333790	3.331484989	1.838942	1.66282886	-		
Triton	5.006445	4.819003	3.346817	3.334734	3.332428947	1.839886	5.0073563	5.006412	-	
Alpha p.	6.6436456	6.4563036	4.984117	4.9720349	4.9697293	3.4771867	3.3010732	1.6382444	1.6373004	-

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Particle Mass Differences and Their Reciprocals Derived as of the Recommended Values of the Fundamental Physical Constants, CODATA 2010

Reciprocals

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-	.533497792	.598189877	.597365855	.31580021	.299081341	.199780201	.199742531	.150519768
Muon	1.874422	-	.673732776	.672687669	.335670044	.316934106	.20755246	.207511802	.154887387
Proton	1.671710	1.484268	-	.433731485	.668964246	.598458013	.299958905	.299873992	.201124895
Neutron	1.674016	1.486574	2.30557392	-	.6699961	.599284693	.300166443	.300081416	.201218203
Tau	3.166559	2.979116	1.4948482	1.4925426	-	.567815964	.54379094	.543511935	.287588814
Deuteron	3.343572	3.155230	1.670961	1.668656	1.761134	-	.601384799	1.997061803	.302931785
Helion	5					86	-	.199743848	.610409533
Triton	5					53	5.006412	-	.61076147
Alpha p.	6.					32	1.6382444	1.6373004	-

Likewise, in order to comprehend the nature of the numerical expressions, one should also present the fractal reciprocals of the mass difference values.

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Particle Mass Differences and Their Reciprocals Derived as of the Recommended Values of the Fundamental Physical Constants, CODATA 2010

Reciprocals

	Electron	Muon	Proton	Neutron	Tau	Deuteron	Helion	Triton	Alpha p.
Electron	-	.533497792	.598189877	.597365855	.31580021	.299081341	.199780201	.199742531	.150519768
Muon	1.874422	-	.673732776	.672687669	.335670044	.316934106	.20755246	.207511802	.154887387
Proton	1.671710	1.484268	-	.433731485	.668964246	.598458013	.299958905	.299873992	.201124895
Neutron	1.674016	1.486574	2.30557392	-	.6699961	.599284693	.300166443	.300081416	.201218203
Tau	3.166559	2.979116	1.4948482	1.4925426	-	.567815964	.54379094	.543511935	.287588814
Deuteron	3.343572	3.155230	1.670961	1.668656	1.761134	-	.601384799	1.997061803	.302931785
Helion	5.005501	4.818059	3.333790	3.331484989	1.838942	1.66282886	-	.199743848	.610409533
Triton	5.006445	4.819003	3.334734	3.332428947	1.839886	5.0073563	5.006412	-	.61076147
Alpha p.	6.6436456	6.4563036	4.9720349	4.9697293	3.4771867	3.3010732	1.6382444	1.6373004	-

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