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GLOBAL VAN-CONG EFFECTIVE KINETIC, GRAVITATIONAL POTENTIAL, AND TOTAL ENERGIES, OBTAINED IN THE PLANET-SUN INTERACTION SYSTEMS, AND ENHANCED BY OUR EMPIRICAL GLOBAL EFFECTIVE KINETIC PLANET MASS, EXPRESSED AS A FUNCTION OF ANY SPEED (OR ANY RELATIVITY) (43)

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ABSTRACT

In this work, we present the new expressions of global effective kinetic, gravitational potential and total energies, obtained in the planet-sun interaction systems, as those given in Equations (4, 5, 6), and enhanced by a new global effective kinetic mass of the planet, as that given in Eq. (1). Some concluding remarks are given as follows. At the low speed v (<< c), c being the light speed, given in the non-relativistic case, they are found to be correct. At v=c, given in the relativistic case, the kinetic energy is found to be equal to: $m \times c^2 \times \left[\frac{2+p}{4}\right]$, $p > 0$, and, in particular, for p=2, to: $m \times c^2$, in good agreement with that proposed by Einstein in 1905[2], m being the rest mass of the planet, as those shown in Tables 2-10 and 11-21 in Appendix 1, for various planet-sun interaction systems.

KEYWORDS: Global effective kinetic-potential-total energies, global effective kinetic mass, light speed, relativity, non-relativity (3^{rd} Newton′s Law).

First of all, the numerical results of the planetary parameters such as: the rest planet mass, m, the distance from the planet to the sun at **Perihelion (Aphelion)**, r_P, the planet speed average values $v_{P,Aver.}$ [1], and corresponding Newton ones $v_{P,NL}$, being obtained by a 3^{rd} Newton′s Law, the sun mass M, universal gravitational constant G, and light speed c, are found to be given in Tables 1 and 11 in Appendix 1, respectively.

Then, at the electron speed v (≪ c), the 3^{rd} Newton's law indicates that the centrifugal force, $\frac{m\times v^2}{r}$, must constantly counter the centripetal gravitational attractive force, $-\frac{GMm}{r^2}$, as : $\frac{m\times v^2}{r} - \frac{GMm}{r^2} = 0$, giving rise to : $m \times v^2 = \frac{GMm}{r}$. Therefore, at r=$r_P$, the planet speed given by this Newton's law can be determined by: $v_{P,NL} = \sqrt{\frac{GM}{r_P}}$.

Now, being inspired by the best expression of the kinetic energy of the planet, in motion, with v=c, $\frac{2m\times c^2}{2}$, proposed by Einstein in 1905[2-6], we can propose a **gobal effective kinetic mass**, valid at any v, by[5, 6] :

$$m^*(v; p > 0) = m \times (1 + p \times \frac{v^2}{c^2}), \qquad (1)$$

increasing with increasing v, and noting that at lowest v: $m^*(v; p) \simeq m$, given in the non-relativistic case, and then, at v=c, given in the relativistic case: $m^*(v = c; p) = m \times (1 + p)$.

Then, from Eq. (1), the planet is in motion, due to the **global effective Newton force**:

$$F^*_{GEN}(v; p) \equiv m^*(v; p) \times \frac{dv}{dt} = m \times \left(1 + p \times \frac{v^2}{c^2}\right) \times \frac{dv}{dt}, \qquad (2)$$

where $\frac{dv}{dt}$ is its acceleration. Further, it is attracted by the sun of the mass M, due to the **global effective gravitational force**, and defined as:

$$F^*_{GEG}(v; p) \equiv -\frac{GMm^*(v;p)}{r^2} = -\frac{GMm\times(1+p\times\frac{v^2}{c^2})}{r^2}, \qquad (3)$$

Where r is the distace between the sun and the planet.

From Eq. (2), noting that $\frac{dv}{dt} \times dr = vdv$, our **global effective kinetic energy** is defined by:

$$K^*(v; p) \equiv \int F^*_{GEN}(v; p) \times dr = \int m \times \left(1 + p \times \frac{v^2}{c^2}\right) \times vdv = m \times v^2 \times \left[\frac{2+p\times\frac{v^2}{c^2}}{4}\right]. \qquad (4)$$

Eq. (4) is reduced to the correct result at the lowest v ($\ll$ c) : $\frac{m\times v^2}{2}$, given in the non-relativistic case, and at v=c, to: $K_o(p) \equiv m \times c^2 \times \left[\frac{2+p}{4}\right]$, giving rise to a following assumption, by putting: x=$\frac{2+p}{4}$.

If x is known, then p is determined by : p=4x−2.

For example, **(i)** if x=3/4, then p=1, according to : $K_o(p = 1) = (\frac{3}{4}) \times mc^2$, **(ii)** if x=1, then p=2, according to : $\mathbf{K_o(p = 2) = mc^2}$, in good accordance with that proposed by Einstein in the relativistic case[2], (iii) if x=5/4, then p=3, according to : $K_o(p = 3) = (\frac{5}{4}) \times mc^2$, and so on. This assumption is used to determine $K_o(p)$, given in next Tables 2-10 and 12-21 in Appendix 1.

Further, from Eq. (3), our global effective gravitational energy, $U^*(v, r; p)$, is defined by:

$$U^*(v, r; p) \equiv -\int_\infty^r F^*_{GEG}(v; p) \times dx \equiv -\int_\infty^r -\frac{GMm^*(v;p)}{x^2} dx = -\frac{GMm^*(v;p)}{r} = -\frac{GMm\times(1+p\times\frac{v^2}{c^2})}{r},$$

being reduced to the correct result at the lowest v ($\ll$ c) as: $= -\frac{GMm}{r}$, given in the non-relativistic case, and at v=c, to: $-\frac{GMm\times(1+p)}{r}$, given in the relativistic case. Here, we choose: $r = r_P$, being the distance from the planet to the sun at perihelion (or aphelion), and $v_{P,NL} \leq v \leq c$, where the values of $v_{P,NL}$ are given in Tables 1 and 11 in Appendix 1.That gives :

$$U^*(v; p) = -\frac{GMm\times(1+p\times\frac{v^2}{c^2})}{r_P}, \quad (5)$$

according at v=c to: $U_o(p) \equiv= -\frac{GMm\times(1+p)}{r_P}$, given in the relativistic case.

Therefore, from Equations (4, 5), the **global effective total enegy**, $E^*(v; p)$, is found to be given by:

$$E^*(v; p) \equiv m \times v^2 \times \left[\frac{2+p\times\frac{v^2}{c^2}}{4}\right] - \frac{GMm\times(1+p\times\frac{v^2}{c^2})}{r_P}, \quad (6)$$

according at v=c to: $E_o(p) = K_o(p) + U_o(p) = m \times v^2 \times \left[\frac{2+p}{4}\right] - \frac{GMm\times(1+p)}{r_P}$.

Furthermore, it is interesting to evaluate the relative errors between $K^*(v; p)$ and $E^*(v; p)$, defined by:

$$RE(v; p) \equiv 1 - \frac{E^*(v;p)}{K^*(v;p)}. \quad (7)$$

Then, in following Tables 2-10 and 11-21 in Appendix 1, the numerical results of $\mathrm{RE}(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$ are obtained for p=1, 2 and 3, respectively, using Equations (7, 4, 5, 6), noting that, for a given p, $\mathrm{RE}(v;p)$ decreases with increasing v, and at v=c, one obtains $K^*(v;p) \cong E^*(v;p)$, with highest precision.

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APPENDIX 1

A) At Perihelion, we obtain the following numerical results.

Table 1. The numerical results of the planetary parameters are given by: the rest planet mass, m (Kg), the distance from the planet to the sun at **Perihelion**, $r_P(m)$, and the planet speed at **Perihelion**, average values, $v_{P,Aver.}$, and corresponding Newton ones, $v_{P,NL}$, being obtained by a 3rd Newton Law. Further, the sun mass M, universal gravitational constant G, and light speed c, are found to be given respectively by : $M = 1.988475 \times 10^{30}$ kg, $G = 6.6743 \times 10^{-11} \frac{m^3}{kg \times s^2}$, and $c = 2.9979 \times 10^8 \left(\frac{m}{s}\right)$. It should be noted that, for the Moon-Sun interaction system, the value of $v_{P,Aver.} = 1.03 \left(\frac{10^3 \times m}{s}\right)$, given in literature, is completely wrong !!!

Celestial body	m (Kg)	$r_P(m)$	$v_{P,Aver.} \left(\frac{10^3 \times m}{s}\right)$	$v_{P,NL} \left(\frac{10^3 \times m}{s}\right)$
Mercury	3.30101×10^{23}	4.60009×10^{10}	47.87	53.7130
Venus	4.86732×10^{24}	1.07477×10^{11}	35.02	35.1403
Earth	5.97219×10^{24}	1.47100×10^{11}	29.78	30.0370
Mars	6.41693×10^{23}	2.06645×10^{11}	24.13	25.3425
Jupiter	1.89852×10^{27}	7.40603×10^{11}	13.06	13.3866
Saturn	5.68460×10^{26}	1.35096×10^{12}	9.64	9.9115
Uranus	8.68192×10^{25}	2.73854×10^{12}	6.79	6.9615
Neptune	1.02431×10^{26}	4.46384×10^{12}	5.43	5.4527
Moon	7.34581×10^{22}	3.62106×10^{8}	1.03	605.4037

Table 2. In the **Mercury-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 2.22506339 \times 10^{40}$ J, $U_o(p) = -1.90474291 \times 10^{33}$ J and $E_o(p) = 2.2250632 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $8.56039842 \times 10^{-8}$.				
0.00017917	**2.00000331**	**$2.14009613 \times 10^{-8}$**	**0.50000002**	**$-2.1401034 \times 10^{-8}$**

0.09	7.95826684×10^{-6}	0.00542187	0.50405	0.00542183
0.30	7.44085668×10^{-7}	0.0627	0.545	0.06269996
0.40	4.30992282×10^{-7}	0.1152	0.58	0.11519996
0.60	2.0554629×10^{-7}	0.2832	0.68	0.28319997
0.80	1.24636483×10^{-7}	0.5632	0.82	0.56319998
0.90	1.02110987×10^{-7}	0.7587	0.905	0.75869999
0.95	9.32589377×10^{-8}	0.87316875	0.95125	0.87316874
1	8.56039842×10^{-8}	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 2.96675118 \times 10^{40}}$ **J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -2.85711437 \times 10^{33}$ J and $E_o(p) = 2.9667509 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 9.63044823×10^{-8}.

0.00017917	**2.00000334**	$\mathbf{1.60507213\times 10^{-8}}$	**0.33333335**	$\mathbf{-1.60507764\times 10^{-8}}$
0.09	7.98998196×10^{-6}	0.00408281	0.33873333	0.00408277
0.30	7.72268359×10^{-7}	0.04905	0.39333333	0.04904997
0.40	4.5661608×10^{-7}	0.0928	0.44	0.09279997
0.60	2.25549713×10^{-7}	0.2448	0.57333333	0.24479997
0.80	1.39465332×10^{-7}	0.5248	0.76	0.52479998
0.90	1.14734212×10^{-7}	0.73305	0.87333333	0.73304999
0.95	1.04885688×10^{-7}	0.85850312	0.935	0.85850312
1	9.63044823×10^{-8}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 3.70843898 \times 10^{40}$ J, $U_o(p) = -3.80948582 \times 10^{33}$ J and $E_o(p) = 3.7084386 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.02724781×10^{-7}.

0.00017917	**2.00000337**	$\mathbf{1.28405772\times 10^{-8}}$	**0.25000002**	$\mathbf{-1.28406218\times 10^{-8}}$
0.09	8.02144326×10^{-6}	0.00327937	0.256075	0.00327934
0.30	7.98216299×10^{-7}	0.04086	0.3175	0.04085997
0.40	4.78933581×10^{-7}	0.07936	0.37	0.07935997
0.60	2.40877012×10^{-7}	0.22176	0.52	0.22175997
0.80	1.49452109×10^{-7}	0.50176	0.73	0.50175998
0.90	1.2274127×10^{-7}	0.71766	0.8575	0.71765999
0.95	1.12054385×10^{-7}	0.84970375	0.926875	0.84970374
1	1.02724781×10^{-7}	**1**	**1**	**1**

Table 3. In the **Venus-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 3.28084299 \times 10^{41}$ J, $U_o(p) = -1.20207127 \times 10^{34}$ J and $E_o(p) = 3.28084287 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.66390978×10^{-8}.				
0.00011722	**1.99999722**	**9.15978731×10^{-9}**	**0.50000001**	**$-9.15976219\times 10^{-8}$**
0.09	3.4061933×10^{-6}	0.00542187	0.50405	0.00542185
0.30	3.18473817×10^{-7}	0.0627	0.545	0.06269998
0.40	1.8446768×10^{-7}	0.1152	0.58	0.11519998
0.60	8.79752348×10^{-8}	0.2832	0.68	0.28319999
0.80	5.33452774×10^{-8}	0.5632	0.82	0.56319999
0.90	4.37042093×10^{-8}	0.7587	0.905	0.75869999
0.95	3.99154708×10^{-8}	0.87316875	0.95125	0.87316875
1	3.66390978×10^{-8}	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 4.37445732 \times 10^{41}}$ **J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.80310691 \times 10^{34}$ J and $E_o(p) = 4.37445714 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 4.1218985×10^{-8}.				
0.00011722	**1.99999724**	**6.86984053×10^{-9}**	**0.33333334**	**$-6.86954053\times 10^{-9}$**
0.09	3.41976759×10^{-6}	0.00408281	0.33873333	0.00408279
0.30	3.30536204×10^{-7}	0.04905	0.39333333	0.04904999
0.40	1.95434843×10^{-7}	0.0928	0.44	0.09279999
0.60	9.65368387×10^{-8}	0.2448	0.57333333	0.24479999
0.80	5.96921278×10^{-8}	0.5248	0.76	0.52479999
0.90	4.91070372×10^{-8}	0.73305	0.87333333	0.73304999
0.95	4.48918005×10^{-8}	0.85850312	0.935	0.85850312
1	4.1218985×10^{-8}	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 5.46807165 \times 10^{41}$ J, $U_o(p) = -2.40414255 \times 10^{34}$ J and $E_o(p) = 5.46807141 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 4.39669173×10^{-8}.				
0.00011722	**2.40869722**	**4.56335052×10^{-9}**	**0.25000001**	**$-6.42837949\times 10^{-9}$**
0.09	3.43323324×10^{-6}	0.00327937	0.256075	0.00327935
0.30	3.41642102×10^{-7}	0.04086	0.3175	0.04085999
0.40	2.04986888×10^{-7}	0.07936	0.37	0.07935999
0.60	1.03097029×10^{-7}	0.22176	0.52	0.22175999

0.80	6.39665372×10^{-8}	0.50176	0.73	0.50175999
0.90	5.2534×10^{-8}	0.71766	0.8575	0.71765999
0.95	4.79600526×10^{-8}	0.84970375	0.926875	0.84970375
1	4.39669173×10^{-8}	**1**	**1**	**1**

Table 4. In the **Earth-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \le v \le c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 4.02558651 \times 10^{41}$ J, $U_o(p) = -1.07764768 \times 10^{34}$ J and $E_o(p) = 4.0255864 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.67699546×10^{-8}.				
0.00010019	**2.00000036**	$\mathbf{6.69248749\times 10^{-9}}$	**0.50**	$\mathbf{-6.69249011\times 10^{-9}}$
0.09	2.48869774×10^{-6}	0.00542187	0.50405	0.00542186
0.30	2.32689398×10^{-7}	0.0627	0.545	0.06269999
0.40	1.34779285×10^{-7}	0.1152	0.58	0.11519999
0.60	6.42781395×10^{-8}	0.2832	0.68	0.28319999
0.80	3.89761413×10^{-8}	0.5632	0.82	0.56319999
0.90	3.19320006×10^{-8}	0.7587	0.905	0.7587
0.95	2.91638005×10^{-8}	0.87316875	0.95125	0.87316875
1	2.67699546×10^{-8}	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 5.36744867 \times 10^{41}}$ **J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.61647152 \times 10^{34}$ J and $E_o(p) = 5.36744851 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.01161989×10^{-8}.				
0.00010019	**2.00000037**	$\mathbf{5.01936564\times 10^{-9}}$	**0.33333334**	$\mathbf{-5.01936767\times 10^{-9}}$
0.09	2.49861564×10^{-6}	0.00408281	0.33873333	0.00408279
0.30	2.41502648×10^{-7}	0.04905	0.39333333	0.04904999
0.40	1.42792322×10^{-7}	0.0928	0.44	0.09279999
0.60	7.05335813×10^{-8}	0.2448	0.57333333	0.24479999
0.80	4.36133978×10^{-8}	0.5248	0.76	0.52479999
0.90	3.58795175×10^{-8}	0.73305	0.87333333	0.73305
0.95	3.27997012×10^{-8}	0.85850312	0.935	0.85850312
1	3.01161989×10^{-8}	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 6.70931084 \times 10^{41}$ J,$U_o(p) = -2.15529536 \times 10^{34}$ J and $E_o(p) = 6.70931063 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.21239455×10^{-8}.				

0.00010019	**2.00000038**	**4.01549253× 10^{-9}**	**0.25000001**	**-4.01549421× 10^{-9}**
0.09	2.50845418× 10^{-6}	0.00327937	0.256075	0.00327936
0.30	2.49617051× 10^{-7}	0.04086	0.3175	0.04085999
0.40	1.49771419× 10^{-7}	0.07936	0.37	0.07935999
0.60	7.5326712× 10^{-8}	0.22176	0.52	0.22175999
0.80	4.6736448× 10^{-8}	0.50176	0.73	0.50175999
0.90	3.83834731 × 10^{-8}	0.71766	0.8575	0.71766
0.95	3.50414858× 10^{-8}	0.84970375	0.926875	0.84970375
1	3.21239455× 10^{-8}	**1**	**1**	**1**

Table 5. In the **Mars-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 4.32536587 \times 10^{40}$ J, $U_o(p) = -8.24248669 \times 10^{32}$ J and $E_o(p) = 4.32536579 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.90561606× 10^{-8}.				
8.4534×10^{-5}	**2.00000943**	**4.76401772× 10^{-9}**	**0.50**	**-4.76406276× 10^{-9}**
0.09	1.77157655× 10^{-6}	0.00542187	0.50405	0.00542186
0.30	1.65639674× 10^{-7}	0.0627	0.545	0.06269999
0.40	9.59424754× 10^{-8}	0.1152	0.58	0.11519999
0.60	4.57563181× 10^{-8}	0.2832	0.68	0.28319999
0.80	2.77451202× 10^{-8}	0.5632	0.82	0.5632
0.90	2.27307571× 10^{-8}	0.7587	0.905	0.7587
0.95	2.07602171× 10^{-8}	0.87316875	0.95125	0.87316875
1	1.90561606× 10^{-8}	**1**	**1**	**1**
Here, for **p=2** and at v=c, **$K_o(p) = mc^2 = 5.7671545 \times 10^{40}$ J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.236373 \times 10^{33}$ J and $E_o(p) = 5.76715437 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.14381807× 10^{-8}.				
8.4534×10^{-5}	**2.00000944**	**3.57301331× 10^{-9}**	**0.33333334**	**-3.57304712× 10^{-9}**
0.09	1.7786366× 10^{-6}	0.00408281	0.33873333	0.0040828
0.30	1.71913376× 10^{-7}	0.04905	0.39333333	0.04904999
0.40	1.01646547× 10^{-7}	0.0928	0.44	0.09279999
0.60	5.02092468× 10^{-8}	0.2448	0.57333333	0.24479999
0.80	3.10461459× 10^{-8}	0.5248	0.76	0.52479999
0.90	2.55407924× 10^{-8}	0.73305	0.87333333	0.73305

0.95	2.33484286× 10^{-8}	0.85850312	0.935	0.85850312
1	2.14381807× 10^{-8}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 7.20894312 \times 10^{40}$ J,$U_o(p) = -1.64849734 \times 10^{33}$ J and $E_o(p) = 7.20894296 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.28673928× 10^{-8}.

8.4534×10^{-5}	**2.00000945**	**2.85841065× 10^{-9}**	**0.25**	**-2.85843773× 10^{-9}**
0.09	1.78564015× 10^{-6}	0.00327937	0.256075	0.00327936
0.30	1.77689604× 10^{-7}	0.04086	0.3175	0.04085999
0.40	1.06614608× 10^{-7}	0.07936	0.37	0.07935999
0.60	5.36212312× 10^{-8}	0.22176	0.52	0.22175999
0.80	3.32692857× 10^{-8}	0.50176	0.73	0.50175999
0.90	2.73232301× 10^{-8}	0.71766	0.8575	0.71766
0.95	2.49442406× 10^{-8}	0.84970375	0.926875	0.84970375
1	2.28673928× 10^{-8}	**1**	**1**	**1**

Table 6. In the **Jupiter-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 1.27970753 \times 10^{44}$ J, $U_o(p) = -6.80433307 \times 10^{35}$ J and $E_o(p) = 1.27970752 \times 10^{44}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 5.31710009× 10^{-9}.				
4.4653×10^{-5}	**1.99999917**	**1.32927559× 10^{-9}**	**0.50**	**-1.32927449× 10^{-9}**
0.09	4.94309957× 10^{-7}	0.00542187	0.50405	0.00542187
0.30	4.62172181× 10^{-8}	0.0627	0.545	0.0627
0.40	2.67701222× 10^{-8}	0.1152	0.58	0.1152
0.60	1.27670483× 10^{-8}	0.2832	0.68	0.2832
0.80	7.74151654× 10^{-9}	0.5632	0.82	0.5632
0.90	6.34239572× 10^{-9}	0.7587	0.905	0.7587
0.95	5.79257042× 10^{-9}	0.87316875	0.95125	0.87316875
1	5.31710009× 10^{-9}	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 1.7062767 \times 10^{44}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -1.02064996 \times 10^{36}$ J and $E_o(p) = 1.70627669 \times 10^{44}$ J , suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 5.98173766× 10^{-9}.				
4.4653×10^{-5}	**1.99999917**	**9.96956695× 10^{-10}**	**0.33333333**	**-9.96955873× 10^{-10}**
0.09	4.96279871× 10^{-7}	0.0040828	0.33873333	0.0040828

0.30	4.79677231×10^{-8}	0.04905	0.39333333	0.04905
0.40	2.83616872×10^{-8}	0.0928	0.44	0.0928
0.60	1.40095162×10^{-8}	0.2448	0.57333333	0.2448
0.80	8.66257732×10^{-9}	0.5248	0.76	0.5248
0.90	7.1264592×10^{-9}	0.73305	0.87333333	0.73305
0.95	6.51474008×10^{-9}	0.85850312	0.935	0.85850312
1	5.98173766×10^{-9}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p)=\frac{5}{4}\times mc^2=2.13284588\times 10^{44}$ J,$U_o(p)=-1.36086661\times 10^{36}$ J and $E_o(p)=2.13284586\times 10^{44}$ J, suggesting that $E_o(p)\cong K_o(p)$, with a precision of the order of 6.38052022×10^{-9}.

$\mathbf{4.4653\times 10^{-5}}$	**1.99999917**	$\mathbf{7.97565357\times 10^{-10}}$	**0.25**	$\mathbf{-7.97564701\times 10^{-10}}$
0.09	4.98234019×10^{-7}	0.00327937	0.256075	0.00327936
0.30	4.95794213×10^{-8}	0.04086	0.3175	0.04086
0.40	2.97478889×10^{-8}	0.07936	0.37	0.07936
0.60	1.49615371×10^{-8}	0.22176	0.52	0.22176
0.80	9.28288357×10^{-9}	0.50176	0.73	0.50176
0.90	7.6237997×10^{-9}	0.71766	0.8575	0.71766
0.95	6.96000757×10^{-9}	0.84970375	0.926875	0.84970375
1	6.38052022×10^{-9}	**1**	**1**	**1**

Table 7. In the **Saturn-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL}\le v\le c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$

Here, for **p=1** and at v=c, $K_o(p)=\left(\frac{3}{4}\right)\times mc^2=3.83173493\times 10^{43}$ J, $U_o(p)=-1.11689739\times 10^{35}$ J and $E_o(p)=3.83173492\times 10^{43}$ J, suggesting that $E_o(p)\cong K_o(p)$, with a precision of the order of 2.9148608×10^{-9}.

$\mathbf{3.3061\times 10^{-5}}$	**2.00002118**	$\mathbf{7.2870748\times 10^{-10}}$	**0.50**	$\mathbf{-7.28722913\times 10^{-10}}$
0.09	2.7098318×10^{-7}	0.00542187	0.50405	0.00542187
0.30	2.53365091×10^{-8}	0.0627	0.545	0.0627
0.40	1.46755144×10^{-8}	0.1152	0.58	0.1152
0.60	6.99895952×10^{-9}	0.2832	0.68	0.2832
0.80	4.24393787×10^{-9}	0.5632	0.82	0.5632
0.90	3.47693296×10^{-9}	0.7587	0.905	0.7587
0.95	3.17551596×10^{-9}	0.87316875	0.95125	0.87316875
1	2.9148608×10^{-9}	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 5.10897991 \times 10^{43}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -1.67534608 \times 10^{35}$ J and $E_o(p) = 5.10897989 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.27921834×10^{-9}.

$\mathbf{3.3061 \times 10^{-5}}$	**2.00002118**	$\mathbf{5.4653061\times 10^{-10}}$	**0.33333333**	$\mathbf{-5.46542186\times 10^{-10}}$
0.09	2.72063096×10^{-7}	0.00408281	0.33873333	0.0040828
0.30	2.62961447×10^{-8}	0.04905	0.39333333	0.04905
0.40	1.55480181×10^{-8}	0.0928	0.44	0.0928
0.60	7.68008668×10^{-8}	0.2448	0.57333333	0.2448
0.80	4.74886808×10^{-9}	0.5248	0.76	0.5248
0.90	3.90676047×10^{-9}	0.73305	0.87333333	0.73305
0.95	3.57141294×10^{-9}	0.85850312	0.935	0.85850312
1	3.27921834×10^{-9}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 6.38622489 \times 10^{43}$ J,$U_o(p) = -2.23379477 \times 10^{35}$ J and $E_o(p) = 6.38622487 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.49783291×10^{-9}.

$\mathbf{3.3061 \times 10^{-5}}$	**2.00002118**	$\mathbf{4.37224489\times 10^{-10}}$	**0.25**	$\mathbf{-4.37233749\times 10^{-10}}$
0.09	2.73134371×10^{-7}	0.00327937	0.256075	0.00327937
0.30	2.71796856×10^{-8}	0.04086	0.3175	0.04086
0.40	1.63079409×10^{-8}	0.07936	0.37	0.07936
0.60	8.2019892×10^{-9}	0.22176	0.52	0.22176
0.80	5.08892306×10^{-9}	0.50176	0.73	0.50176
0.90	4.17940482×10^{-9}	0.71766	0.8575	0.71766
0.95	3.81551091×10^{-9}	0.84970375	0.926875	0.84970375
1	3.49783291×10^{-9}	**1**	**1**	**1**

Table 8. In the **Uranus-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v; p)$, $K^*(v; p)/K_o(p)$, $U^*(v; p)/U_o(p)$ and $E^*(v; p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \le v \le c$.

X(v)=v/c	$RE(v; p)$	$K^*(v; p)/K_o(p)$	$U^*(v; p)/U_o(p)$	$E^*(v; p)/E_o(p)$

Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 5.85209446 \times 10^{42}$ J, $U_o(p) = -8.41496949 \times 10^{33}$ J and $E_o(p) = 5.85209445 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.43794143×10^{-9}.

$\mathbf{2.3221 \times 10^{-5}}$	**2.00000514**	$\mathbf{3.59484452\times 10^{-10}}$	**0.50**	$\mathbf{-3.59486299\times 10^{-10}}$
0.09	1.33679785×10^{-7}	0.00542187	0.50405	0.00542187
0.30	1.24988536×10^{-8}	0.0627	0.545	0.0627
0.40	7.23963600×10^{-9}	0.1152	0.58	0.1152
0.60	3.45268436×10^{-9}	0.2832	0.68	0.2832

0.80	2.09359374×10^{-9}	0.5632	0.82	0.5632
0.90	1.71521952×10^{-9}	0.7587	0.905	0.7587
0.95	1.56652635×10^{-9}	0.87316875	0.95125	0.87316875
1	1.43794143×10^{-9}	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 7.80279261 \times 10^{42}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -1.26224542 \times 10^{34}$ J and $E_o(p) = 7.80279260 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.61768410×10^{-9}.

$\mathbf{2.3221 \times 10^{-5}}$ **2.00000514**		$\mathbf{2.69613339\times 10^{-10}}$	**0.33333333**	$\mathbf{-2.69614725\times 10^{-10}}$
0.09	1.34212522×10^{-7}	0.00408281	0.33873333	0.0040828
0.30	1.29722553×10^{-8}	0.04905	0.39333333	0.04905
0.40	7.67005426×10^{-9}	0.0928	0.44	0.0928
0.60	3.78869391×10^{-9}	0.2448	0.57333333	0.2448
0.80	2.34268294×10^{-9}	0.5248	0.76	0.5248
0.90	1.92725935×10^{-9}	0.73305	0.87333333	0.73305
0.95	1.76182779×10^{-9}	0.85850312	0.935	0.85850312
1	1.61768410×10^{-9}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 9.75349076 \times 10^{42}$ J,$U_o(p) = -1.6829939 \times 10^{34}$ J and $E_o(p) = 9.75349075 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.72552972×10^{-9}.

$\mathbf{2.3221 \times 10^{-5}}$ **2.00000514**		$\mathbf{2.15690671\times 10^{-10}}$	**0.25**	$\mathbf{-2.1569178\times 10^{-10}}$
0.09	1.34740997×10^{-7}	0.00327937	0.256075	0.00327937
0.30	1.34081182×10^{-8}	0.04086	0.3175	0.04086
0.40	8.04493483×10^{-8}	0.07936	0.37	0.07936
0.60	4.04615574×10^{-9}	0.22176	0.52	0.22176
0.80	2.51043675×10^{-9}	0.50176	0.73	0.50176
0.90	2.06175876×10^{-9}	0.71766	0.8575	0.71766
0.95	1.88224480×10^{-9}	0.84970375	0.926875	0.84970375
1	1.72552972×10^{-9}	**1**	**1**	**1**

Table 9. In the **Neptune-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$

Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 6.90441616 \times 10^{42}$ J, $U_o(p) = -6.09086043 \times 10^{33}$ J and $E_o(p) = 6.90441615 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $8.82168782\times 10^{-10}$.

1.8188×10^{-5}	**1.99997251**	**2.20545228$\times 10^{-10}$**	**0.50**	**-2.20539166$\times 10^{-10}$**
0.09	8.2011774$\times 10^{-8}$	0.00542187	0.50405	0.00542187
0.30	7.66797437$\times 10^{-9}$	0.0627	0.545	0.0627
0.40	4.44147485$\times 10^{-9}$	0.1152	0.58	0.1152
0.60	2.11820184$\times 10^{-9}$	0.2832	0.68	0.2832
0.80	1.28440769$\times 10^{-9}$	0.5632	0.82	0.5632
0.90	1.05227727$\times 10^{-9}$	0.7587	0.905	0.7587
0.95	9.61054791$\times 10^{-10}$	0.87316875	0.95125	0.87316875
1	8.82168782$\times 10^{-10}$	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 9.20588821 \times 10^{42}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -9.13629064 \times 10^{33}$ J and $E_o(p) = 9.20588820 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 9.92439908$\times 10^{-10}$.

1.8188×10^{-5}	**1.99997251**	**1.65408921$\times 10^{-10}$**	**0.33333333**	**-1.65404375$\times 10^{-10}$**
0.09	8.23386056$\times 10^{-8}$	0.00408281	0.33873333	0.0040828
0.30	7.95840338$\times 10^{-9}$	0.04905	0.39333333	0.04905
0.40	4.70553407$\times 10^{-9}$	0.0928	0.44	0.0928
0.60	2.32434172$\times 10^{-9}$	0.2448	0.57333333	0.2448
0.80	1.43722245$\times 10^{-9}$	0.5248	0.76	0.5248
0.90	1.18236254$\times 10^{-9}$	0.73305	0.87333333	0.73305
0.95	1.08087117$\times 10^{-9}$	0.85850312	0.935	0.85850312
1	9.92439908$\times 10^{-10}$	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 1.15073603 \times 10^{43}$ J,$U_o(p) = -1.21817209 \times 10^{34}$ J and $E_o(p) = 1.150736025 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.05860254$\times 10^{-9}$.

1.8188×10^{-5}	**1.99997251**	**1.32327137$\times 10^{-10}$**	**0.25**	**-1.323235$\times 10^{-10}$**
0.09	8.26628215$\times 10^{-8}$	0.00327937	0.256075	0.00327937
0.30	8.22580293$\times 10^{-9}$	0.04086	0.3175	0.04086
0.40	4.93552099$\times 10^{-9}$	0.07936	0.37	0.07936
0.60	2.48229315$\times 10^{-9}$	0.22176	0.52	0.22176
0.80	1.54013835$\times 10^{-9}$	0.50176	0.73	0.50176
0.90	1.26487709$\times 10^{-9}$	0.71766	0.8575	0.71766
0.95	1.15474630$\times 10^{-9}$	0.84970375	0.926875	0.84970375
1	1.05860254$\times 10^{-9}$	**1**	**1**	**1**

Table 10. In the **Moon-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in above Table 1, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 4.95148239 \times 10^{39}$ J, $U_o(p) = -5.38467907 \times 10^{34}$ J and $E_o(p) = 4.95142854 \times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.08748828×10^{-5}.				
0.00201943	**2.00000406**	**2.71872627$\times 10^{-6}$**	**0.50**	**-2.71876688$\times 10^{-6}$**
0.09	0.001011	0.00542187	0.50405	0.00541645
0.30	9.45264934$\times 10^{-5}$	0.0627	0.545	0.06269475
0.40	5.47520142$\times 10^{-5}$	0.1152	0.58	0.11519495
0.60	2.61120068$\times 10^{-5}$	0.2832	0.68	0.28319568
0.80	1.58334586$\times 10^{-5}$	0.5632	0.82	0.56319721
0.90	1.29718847$\times 10^{-5}$	0.7587	0.905	0.75869841
0.95	1.18473460$\times 10^{-5}$	0.87316875	0.95125	0.87316790
1	1.08748828$\times 10^{-5}$	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 6.60197652 \times 10^{39}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -8.07701861 \times 10^{34}$ J and $E_o(p) = 6.60189575 \times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.22342432×10^{-5}.				
0.00201943	**2.00000814**	**2.03904886$\times 10^{-6}$**	**0.33333333**	**-2.0390904$\times 10^{-6}$**
0.09	0.00101502	0.00408281	0.33873333	0.00407871
0.30	9.8106741$\times 10^{-5}$	0.04905	0.39333333	0.04904579
0.40	5.80071874$\times 10^{-5}$	0.0928	0.44	0.09279575
0.60	2.86531839$\times 10^{-5}$	0.2448	0.57333333	0.24479598
0.80	1.77172729$\times 10^{-5}$	0.5248	0.76	0.52479712
0.90	1.45755029$\times 10^{-5}$	0.73305	0.87333333	0.73304828
0.95	1.33243748$\times 10^{-5}$	0.85850312	0.935	0.85850219
1	1.22342432$\times 10^{-5}$	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 8.25247065 \times 10^{39}$ J, $U_o(p) = -1.07693581 \times 10^{35}$ J and $E_o(p) = 8.25236296 \times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.30498594×10^{-5}.				
0.00201943	**2.00001222**	**1.63124242$\times 10^{-6}$**	**0.25**	**-1.63128363$\times 10^{-6}$**
0.09	0.00101902	0.00327937	0.256075	0.00327607
0.30	0.0001014	0.04086	0.3175	0.04085639
0.40	6.08423383$\times 10^{-5}$	0.07936	0.37	0.07935621
0.60	3.06003196$\times 10^{-5}$	0.22176	0.52	0.22175611

0.80	1.89859641×10^{-5}	0.50176	0.73	0.50175702
0.90	1.55926963×10^{-5}	0.71766	0.8575	0.71765818
0.95	1.42350654×10^{-5}	0.84970375	0.926875	0.84970274
1	1.30498594×10^{-5}	**1**	**1**	**1**

B) At Aphelion, we obtain the following numerical results

Table 11. The numerical results of the planetary parameters are given by: the rest planet mass, m (Kg), the distance from the planet to the sun at **Alphelion**, $r_P(m)$, and the planet speed at **Alphelion**, average values, $v_{P,Aver.}$, and corresponding Newton ones, $v_{P,NL}$, being obtained by a 3rd Newton Law. Further, the sun mass M, universal gravitational constant G, and light speed c, are found to be given respectively by : $M = 1.988475 \times 10^{30}$ kg, $G = 6.6743 \times 10^{-11} \frac{m^3}{kg\times s^2}$, and $c = 2.9979 \times 10^8 \left(\frac{m}{s}\right)$. It should be noted that, for the Moon-Sun interaction system, the value of $v_{P,Aver.} = 1.03 \left(\frac{10^3\times m}{s}\right)$, given in literature, is completely wrong !!!

Celestial body	m (Kg)	$r_P(m)$	$v_{P,Aver.} \left(\frac{10^3\times m}{s}\right)$	$v_{P,NL} \left(\frac{10^3\times m}{s}\right)$
Mercury	3.30101×10^{23}	6.98173×10^{10}	47.87	43.5995
Venus	4.86732×10^{24}	1.08940×10^{11}	35.02	34.9035
Earth	5.97219×10^{24}	1.52096×10^{11}	29.78	29.5396
Mars	6.41693×10^{23}	2.49233×10^{11}	24.13	23.0760
Jupiter	1.89852×10^{27}	8.16038×10^{11}	13.06	12.7529
Saturn	5.68460×10^{26}	1.50724×10^{12}	9.64	9.3836
Uranus	8.68192×10^{25}	3.01104×10^{12}	6.79	6.6390
Neptune	1.02431×10^{26}	4.54594×10^{12}	5.43	5.4032
Pluto	1.46158×10^{22}	7.38868×10^{12}	4.74	4.2382
Moon	7.34581×10^{22}	4.04689×10^{8}	1.03	572.6671

Table 12. In the **Mercury-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p)=\left(\frac{3}{4}\right)\times mc^2=2.22506339\times10^{40}$ J, $U_o(p)=-1.25498821\times10^{33}$ J and $E_o(p)=2.22506326\times10^{40}$ J, suggesting that $E_o(p)\cong K_o(p)$, with a precision of the order of 5.64023577×10^{-8}.				
0.00014543	**1.99999906**	**1.41005963** $\times 10^{-8}$	**0.50000001**	**-1.41005839** $\times 10^{-8}$
0.09	5.24350608×10^{-6}	0.00542187	0.50405	0.00542184
0.30	4.90259727×10^{-7}	0.0627	0.545	0.06269997
0.40	2.83970203×10^{-7}	0.1152.	0.58	0.11519997
0.60	1.3542939×10^{-7}	0.2832	0.68	0.28319998
0.80	8.21199099×10^{-8}	0.5632	0.82	0.56319999
0.90	6.72784152×10^{-8}	0.7587	0.905	0.75869999
0.95	6.14460178×10^{-8}	0.87316875	0.95125	0.87316875
1	5.64023577×10^{-8}	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p)=mc^2=2.966751183\times10^{40}}$ **J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p)=-1.88248231\times10^{33}$ J and $E_o(p)=2.96675099\times10^{40}$ J, suggesting that $E_o(p)\cong K_o(p)$, with a precision of the order of 6.34526522×10^{-8}.				
0.00014543	**1.999999908**	**1.05754473** $\times 10^{-8}$	**0.33333335**	**-1.05754383** $\times 10^{-9}$
0.09	5.26440239×10^{-6}	0.00408281	0.33873333	0.00408278
0.30	5.08828608×10^{-7}	0.04905	0.39333333	0.04904998
0.40	3.00853092×10^{-7}	0.0928	0.44	0.09279998
0.60	1.48609153×10^{-7}	0.2448	0.57333333	0.24479998
0.80	9.18902738×10^{-8}	0.5248	0.76	0.52479999
0.90	7.55955478×10^{-8}	0.73305	0.87333333	0.73304999
0.95	6.91065974×10^{-8}	0.85850312	0.935	0.85850312
1	6.34526522×10^{-8}	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p)=\frac{5}{4}\times mc^2=3.70843898\times10^{40}$ J,$U_o(p)=-2.50997641\times10^{33}$ J and $E_o(p)=3.70843873\times10^{40}$ J, suggesting that $E_o(p)\cong K_o(p)$, with a precision of the order of 6.7682829×10^{-8}.				
0.00014543	**1.9999991**	**8.46035796** $\times 10^{-9}$	**0.25000002**	**-8.46035796** $\times 10^{-9}$
0.09	5.28513147×10^{-6}	0.00327937	0.256075	0.00327935
0.30	5.25925067×10^{-7}	0.04086	0.3175	0.04085998
0.40	3.15557545×10^{-7}	0.07936	0.37	0.07935998
0.60	1.58707933×10^{-7}	0.22176	0.52	0.22175998

0.80	9.84703149$\times 10^{-8}$	0.50176	0.73	0.50175998
0.90	8.08712007$\times 10^{-8}$	0.71766	0.8575	0.71765999
0.95	7.38298757$\times 10^{-8}$	0.84970375	0.926875	0.84970374
1	6.7682829$\times 10^{-8}$	**1**	**1**	**1**

Table 13. In the **Venus-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \le v \le c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 3.28084299 \times 10^{41}$ J, $U_o(p) = -1.18592816 \times 10^{34}$ J and $E_o(p) = 3.28084287 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.61470563$\times 10^{-8}$.				
0.00011643	**2.00000246**	**9.0367531$\times 10^{-9}$**	**0.50000001**	**-9.03677563$\times 10^{-9}$**
0.09	3.36045013$\times 10^{-6}$	0.00542187	0.50405	0.00542185
0.30	3.14196901$\times 10^{-7}$	0.0627	0.545	0.06269998
0.40	1.81990388$\times 10^{-7}$	0.1152	0.58	0.11519998
0.60	8.67937794$\times 10^{-8}$	0.2832	0.68	0.28319999
0.80	5.26288817$\times 10^{-8}$	0.5632	0.82	0.56319999
0.90	4.31172874$\times 10^{-8}$	0.7587	0.905	0.75869999
0.95	3.93794296$\times 10^{-8}$	0.87316875	0.95125	0.87316875
1	3.61470563$\times 10^{-8}$	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 4.37445732 \times 10^{41}}$ **J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.77889225 \times 10^{34}$ J and $E_o(p) = 4.3744571454 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 4.06654384$\times 10^{-8}$.				
0.00011643	**2.00000247**	**6.77756487$\times 10^{-9}$**	**0.33333334**	**-6.77756487$\times 10^{-9}$**
0.09	3.37384212$\times 10^{-6}$	0.00408280	0.33873333	0.00408279
0.30	3.26097297$\times 10^{-7}$	0.04905	0.39333333	0.04904999
0.40	1.92810268$\times 10^{-7}$	0.0928	0.44	0.09279999
0.60	9.52404057$\times 10^{-8}$	0.2448	0.57333333	0.24479999
0.80	5.88904977$\times 10^{-8}$	0.5248	0.76	0.52479999
0.90	4.84475586$\times 10^{-8}$	0.73305	0.87333333	0.73304999
0.95	4.42889301$\times 10^{-8}$	0.85850312	0.935	0.85850312
1	4.06654384$\times 10^{-8}$	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 5.46807165 \times 10^{41}$ J,$U_o(p) = -2.37185633 \times 10^{34}$ J and $E_o(p) = 5.46807142 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 4.33764676$\times 10^{-8}$.				

0.00011643	**2.00000248**	**5.42205194×10^{-9}**	**0.25000001**	**-5.42206564×10^{-9}**
0.09	3.38712695×10^{-6}	0.00327937	0.256075	0.00327936
0.30	3.37054049×10^{-7}	0.04086	0.3175	0.04085999
0.40	2.02234035×10^{-7}	0.07936	0.37	0.07935999
0.60	1.01712496×10^{-7}	0.22176	0.52	0.22175999
0.80	6.31075043×10^{-8}	0.50176	0.73	0.50175999
0.90	5.1828611×10^{-8}	0.71766	0.8575	0.71765999
0.95	4.73159774×10^{-8}	0.84970375	0.926875	0.84970375
1	4.33764676×10^{-8}	**1**	**1**	**1**

Table 14. In the **Earth-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 4.02558651 \times 10^{41}$ J, $U_o(p) = -1.04224946 \times 10^{34}$ J and $E_o(p) = 4.0255864 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.58906238×10^{-8}.				
9.8534×10^{-5}	**1.99999469**	**6.47267318×10^{-9}**	**0.50**	**-6.47263901×10^{-9}**
0.09	2.4069498×10^{-6}	0.00542187	0.50405	0.00542186
0.30	2.25046092×10^{-7}	0.0627	0.545	0.06269999
0.40	1.30352099×10^{-7}	0.1152	0.58	0.11519999
0.60	6.21667521×10^{-8}	0.2832	0.68	0.28319999
0.80	3.76958657×10^{-8}	0.5632	0.82	0.56319999
0.90	3.08831086×10^{-8}	0.7587	0.905	0.7587
0.95	2.82058374×10^{-8}	0.87316875	0.95125	0.87316875
1	2.58906238×10^{-8}	**1**	**1**	**1**
Here, for **p=2** and at v=c, **$K_o(p) = mc^2 = 5.36744867 \times 10^{41}$ J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.56337419 \times 10^{34}$ J and $E_o(p) = 5.36744852 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.91269519×10^{-8}.				
9.8534×10^{-5}	**1.9999947**	**4.85450491×10^{-9}**	**0.33333334**	**-4.85447934×10^{-9}**
0.09	2.41654193×10^{-6}	0.00408281	0.33873333	0.0040828
0.30	2.33569848×10^{-7}	0.04905	0.39333333	0.04904999
0.40	1.38101927×10^{-7}	0.0928	0.44	0.09279999
0.60	6.82167172×10^{-8}	0.2448	0.57333333	0.24479999
0.80	4.21807991×10^{-8}	0.5248	0.76	0.52479999
0.90	3.47009589×10^{-8}	0.73305	0.87333333	0.73305
0.95	3.17223072×10^{-8}	0.85850312	0.935	0.85850312

1	2.91269519×10^{-8}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 6.70931084 \times 10^{41}$ J,$U_o(p) = -2.08449892 \times 10^{34}$ J and $E_o(p) = 6.70931063 \times 10^{41}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.10687486×10^{-8}.

9.8534×10^{-5}	**1.99999471**	**3.88360395×10^{-9}**	**0.25000001**	**-3.88358354×10^{-9}**
0.09	2.42605729×10^{-6}	0.00327937	0.256075	0.00327936
0.30	2.41417711×10^{-7}	0.04086	0.3175	0.04085999
0.40	1.44851776×10^{-7}	0.07936	0.37	0.07935999
0.60	7.28524046×10^{-8}	0.22176	0.52	0.22175999
0.80	4.52012645×10^{-8}	0.50176	0.73	0.50175999
0.90	3.71226653×10^{-8}	0.71766	0.8575	0.71766
0.95	3.38904546×10^{-8}	0.84970375	0.926875	0.84970375
1	3.10687486×10^{-8}	**1**	**1**	**1**

Table 15. In the **Mars-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$

Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 4.32536587 \times 10^{40}$ J, $U_o(p) = -6.83404149 \times 10^{32}$ J and $E_o(p) = 4.32536580 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.57999155×10^{-8}.

8.0490×10^{-5}	**1.99999657**	**3.94998566×10^{-9}**	**0.50**	**-3.94997216×10^{-9}**
0.09	1.4688562×10^{-6}	0.00542187	0.50405	0.00542186
0.30	1.37335788×10^{-7}	0.0627	0.545	0.06269999
0.40	7.95481853×10^{-8}	0.1152	0.58	0.11519999
0.60	3.79376499×10^{-8}	0.2832	0.68	0.28319999
0.80	2.30041383×10^{-8}	0.5632	0.82	0.5632
0.90	1.88466105×10^{-8}	0.7587	0.905	0.7587
0.95	1.72127891×10^{-8}	0.87316875	0.95125	0.87316875
1	1.57999155×10^{-8}	**1**	**1**	**1**

Here, for **p=2** and at v=c, **$K_o(p) = mc^2 = 5.7671545 \times 10^{40}$ J, in good agreement with that, proposed by Einstein in 1905**, $U_o(p) = -1.02510622 \times 10^{33}$ J and $E_o(p) = 5.7671544 \times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.77749048×10^{-8}.

8.0490×10^{-5}	**1.99999657**	**2.96248925×10^{-9}**	**0.33333334**	**-2.96247915×10^{-9}**
0.09	1.47470985×10^{-6}	0.00408281	0.33873333	0.0040828
0.30	1.42537463×10^{-7}	0.04905	0.39333333	0.04904999

0.40	8.42775660×10^{-8}	0.0928	0.44	0.09279999
0.60	4.1629679×10^{-8}	0.2448	0.57333333	0.24479999
0.80	2.57410969×10^{-8}	0.5248	0.76	0.5248
0.90	2.11764776×10^{-8}	0.73305	0.87333333	0.73305
0.95	1.93587368×10^{-8}	0.85850312	0.935	0.85850312
1	1.77749048×10^{-8}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4}\times mc^2 = 7.20894312\times 10^{40}$ J,$U_o(p) = -1.3668083\times 10^{33}$ J and $E_o(p) = 7.20894298\times 10^{40}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.89598985×10^{-8}.

$\mathbf{8.0490\times 10^{-5}}$	**1.8290925**	$\mathbf{2.59143521\times 10^{-9}}$	**0.25**	$\mathbf{-2.14853955\times 10^{-9}}$
0.09	1.48051666×10^{-6}	0.00327937	0.256075	0.00327936
0.30	1.47326671×10^{-7}	0.04086	0.3175	0.04085999
0.40	8.83967041×10^{-8}	0.07936	0.37	0.07935999
0.60	4.44586364×10^{-8}	0.22176	0.52	0.22175999
0.80	2.75843549×10^{-8}	0.50176	0.73	0.50176
0.90	2.26543391×10^{-8}	0.71766	0.8575	0.71766
0.95	2.06818623×10^{-8}	0.84970375	0.926875	0.84970375
1	1.89598985×10^{-8}	**1**	**1**	**1**

Table 16. In the **Jupiter-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \le v \le c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right)\times mc^2 = 1.27970753\times 10^{44}$ J, $U_o(p) = -6.17533679\times 10^{35}$ J and $E_o(p) = 1.27970752\times 10^{44}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 4.82558449×10^{-9}.				
$\mathbf{4.2539\times 10^{-5}}$	**1.9999888**	$\mathbf{1.20640288\times 10^{-9}}$	**0.50**	$\mathbf{-1.20638938\times 10^{-9}}$
0.09	4.48615674×10^{-7}	0.00542187	0.50405	0.00542187
0.30	4.19448732×10^{-8}	0.0627	0.545	0.0627
0.40	2.42954775×10^{-8}	0.1152	0.58	0.1152
0.60	1.15868555×10^{-8}	0.2832	0.68	0.2832
0.80	7.02588654×10^{-9}	0.5632	0.82	0.5632
0.90	5.75610104×10^{-9}	0.7587	0.905	0.7587
0.95	5.25710209×10^{-9}	0.87316875	0.95125	0.87316875
1	4.82558449×10^{-9}	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 1.7062767 \times 10^{44}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -9.26300519 \times 10^{35}$ J and $E_o(p) = 1.70627669 \times 10^{44}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 5.42878253×10^{-9}.

4.2539×10^{-5}	**1.9999888**	**$9.04802161\times 10^{-10}$**	**0.33333333**	**-9.04792034×10^{-9}**
0.09	4.50403487×10^{-7}	0.0040828	0.33873333	0.0040828
0.30	4.35335604×10^{-8}	0.04905	0.39333333	0.04905
0.40	2.57399173×10^{-8}	0.0928	0.44	0.0928
0.60	1.27144689×10^{-8}	0.2448	0.57333333	0.2448
0.80	7.86180399×10^{-9}	0.5248	0.76	0.5248
0.90	6.46768539×10^{-9}	0.73305	0.87333333	0.73305
0.95	5.91251392×10^{-9}	0.85850312	0.935	0.85850312
1	5.42878253×10^{-9}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 2.13284588 \times 10^{44}$ J,$U_o(p) = -1.23506736 \times 10^{36}$ J and $E_o(p) = 2.13284586 \times 10^{44}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 5.79070136×10^{-9}.

4.2539×10^{-5}	**1.907037**	**$7.59122846\times 10^{-10}$**	**0.25**	**-$6.88552513\times 10^{-10}$**
0.09	4.52176993×10^{-7}	0.00327937	0.256075	0.00327936
0.30	4.49962725×10^{-8}	0.04086	0.3175	0.04086
0.40	2.69979777×10^{-8}	0.07936	0.37	0.07936
0.60	1.35784844×10^{-8}	0.22176	0.52	0.22176
0.80	8.42476888×10^{-9}	0.50176	0.73	0.50176
0.90	6.91905144×10^{-9}	0.71766	0.8575	0.71766
0.95	6.31662078×10^{-9}	0.84970375	0.926875	0.84970375
1	5.79070136×10^{-9}	**1**	**1**	**1**

Table 17. In the **Saturn-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 3.83173493 \times 10^{43}$ J, $U_o(p) = -1.00109053 \times 10^{35}$ J and $E_o(p) = 3.83173492 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.61262989×10^{-9}.				
3.1301×10^{-5}	**2.00002061**	**6.5315075×10^{-10}**	**0.50**	**-$6.53164212\times 10^{-10}$**
0.09	2.42885962×10^{-7}	0.00542187	0.50405	0.00542187
0.30	2.27094625×10^{-8}	0.0627	0.545	0.0627
0.40	1.31538659×10^{-8}	0.1152	0.58	0.1152
0.60	6.27326391×10^{-9}	0.2832	0.68	0.2832

0.80	3.80390008×10^{-9}	0.5632	0.82	0.5632
0.90	3.1164229×10^{-9}	0.7587	0.905	0.7587
0.95	2.84625867×10^{-9}	0.87316875	0.95125	0.87316875
1	2.61262989×10^{-9}	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 5.10897991 \times 10^{43}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -1.5016358 \times 10^{35}$ J and $E_o(p) = 5.10897989 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 2.93920877×10^{-9}.

$\mathbf{3.1301 \times 10^{-5}}$	**2.00002061**	$\mathbf{4.89863063\times 10^{-10}}$	**0.33333333**	$\mathbf{-4.8987316\times 10^{-10}}$
0.09	2.43853906×10^{-7}	0.00408281	0.33873333	0.0040828
0.30	2.35695971×10^{-8}	0.04905	0.39333333	0.04905
0.40	1.39359031×10^{-8}	0.0928	0.44	0.0928
0.60	6.88376756×10^{-8}	0.2448	0.57333333	0.2448
0.80	4.25647595×10^{-9}	0.5248	0.76	0.5248
0.90	3.50168328×10^{-9}	0.73305	0.87333333	0.73305
0.95	3.2011066×10^{-9}	0.85850312	0.935	0.85850312
1	2.93920877×10^{-9}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 6.38622489 \times 10^{43}$ J,$U_o(p) = -2.00218106 \times 10^{35}$ J and $E_o(p) = 6.38622487 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 3.13515580×10^{-9}.

$\mathbf{3.1301 \times 10^{-5}}$	**2.00002061**	$\mathbf{3.91890451\times 10^{-10}}$	**0.25**	$\mathbf{-3.91898528\times 10^{-10}}$
0.09	2.44814103×10^{-7}	0.00327937	0.256075	0.00327937
0.30	2.43615271×10^{-8}	0.04086	0.3175	0.04086
0.40	1.46170324×10^{-8}	0.07936	0.37	0.07936
0.60	7.35155614×10^{-9}	0.22176	0.52	0.22176
0.80	4.56127192×10^{-9}	0.50176	0.73	0.50176
0.90	3.74605824×10^{-9}	0.71766	0.8575	0.71766
0.95	3.41989503×10^{-9}	0.84970375	0.926875	0.84970375
1	3.13515580×10^{-9}	**1**	**1**	**1**

Table 18. In the **Uranus-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$

Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 5.85209446 \times 10^{42}$ J, $U_o(p) = -7.65341229 \times 10^{33}$ J and $E_o(p) = 5.85209445 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.30780731×10^{-9}.

2.2145×10^{-5}	**2.00001841**	**3.26948835$\times 10^{-10}$**	**0.50**	**-3.26954853$\times 10^{-10}$**
0.09	1.21581725$\times 10^{-7}$	0.00542187	0.50405	0.00542187
0.30	1.13677036$\times 10^{-8}$	0.0627	0.545	0.0627
0.40	6.58444688$\times 10^{-9}$	0.1152	0.58	0.1152
0.60	3.14021542$\times 10^{-9}$	0.2832	0.68	0.2832
0.80	1.90412297$\times 10^{-9}$	0.5632	0.82	0.5632
0.90	1.55999169$\times 10^{-9}$	0.7587	0.905	0.7587
0.95	1.42475531$\times 10^{-9}$	0.87316875	0.95125	0.87316875
1	1.30780731$\times 10^{-9}$	**1**	**1**	**1**

Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 7.80279261 \times 10^{42}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -1.14801184 \times 10^{34}$ J and $E_o(p) = 7.80279260 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.47128332$\times 10^{-9}$.

2.2145×10^{-5}	**2.00001841**	**2.45211626$\times 10^{-10}$**	**0.33333333**	**-2.4521614$\times 10^{-10}$**
0.09	1.2206625$\times 10^{-7}$	0.00408281	0.33873333	0.0040828
0.30	1.17982623$\times 10^{-8}$	0.04905	0.39333333	0.04905
0.40	6.97591229$\times 10^{-9}$	0.0928	0.44	0.0928
0.60	3.44581608$\times 10^{-9}$	0.2448	0.57333333	0.2448
0.80	2.13066942$\times 10^{-9}$	0.5248	0.76	0.5248
0.90	1.75284187$\times 10^{-9}$	0.73305	0.87333333	0.73305
0.95	1.60238189$\times 10^{-9}$	0.85850312	0.935	0.85850312
1	1.47128332$\times 10^{-9}$	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 9.75349076 \times 10^{42}$ J,$U_o(p) = -1.53068246 \times 10^{34}$ J and $E_o(p) = 9.75349075 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.56936875$\times 10^{-9}$.

2.2145×10^{-5}	**2.00001841**	**1.96169301$\times 10^{-10}$**	**0.25**	**-1.96172912$\times 10^{-10}$**
0.09	1.22546897$\times 10^{-7}$	0.00327937	0.256075	0.00327937
0.30	1.21946795$\times 10^{-8}$	0.04086	0.3175	0.04086
0.40	7.31686589$\times 10^{-8}$	0.07936	0.37	0.07936
0.60	3.67997743$\times 10^{-9}$	0.22176	0.52	0.22176
0.80	2.28324148$\times 10^{-9}$	0.50176	0.73	0.50176
0.90	1.87516902$\times 10^{-9}$	0.71766	0.8575	0.71766
0.95	1.71190107$\times 10^{-9}$	0.84970375	0.926875	0.84970375
1	1.56936875$\times 10^{-9}$	**1**	**1**	**1**

Table 19. In the **Neptune-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 6.90441616 \times 10^{42}$ J, $U_o(p) = -5.98085905 \times 10^{33}$ J and $E_o(p) = 6.90441615 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $8.66236638\times 10^{-10}$.				
$\mathbf{1.8023 \times 10^{-5}}$	**2.00000034**	**2.16559153**$\times \mathbf{10^{-10}}$	**0.50**	**-2.16559226**$\times \mathbf{10^{-10}}$
0.09	8.05306355×10^{-8}	0.00542187	0.50405	0.00542187
0.30	7.52949003×10^{-9}	0.0627	0.545	0.0627
0.40	4.36126157×10^{-9}	0.1152	0.58	0.1152
0.60	2.0799471×10^{-9}	0.2832	0.68	0.2832
0.80	1.26121114×10^{-9}	0.5632	0.82	0.5632
0.90	1.03327302×10^{-9}	0.7587	0.905	0.7587
0.95	$9.43698231\times 10^{-10}$	0.87316875	0.95125	0.87316875
1	$8.66236638\times 10^{-10}$	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 9.20588821 \times 10^{42}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -8.97128858 \times 10^{33}$ J and $E_o(p) = 9.20588820 \times 10^{42}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $9.74516357\times 10^{-10}$.				
$\mathbf{1.8023 \times 10^{-5}}$	**2.00000034**	**1.62419365**$\times \mathbf{10^{-10}}$	**0.33333333**	**-1.62419419**$\times \mathbf{10^{-10}}$
0.09	8.08515644×10^{-8}	0.00408281	0.33873333	0.0040828
0.30	7.81467413×10^{-9}	0.04905	0.39333333	0.04905
0.40	4.62055161×10^{-9}	0.0928	0.44	0.0928
0.60	2.28236396×10^{-9}	0.2448	0.57333333	0.2448
0.80	1.4112661×10^{-9}	0.5248	0.76	0.5248
0.90	1.16100884×10^{-9}	0.73305	0.87333333	0.73305
0.95	1.06135067×10^{-9}	0.85850312	0.935	0.85850312
1	$9.74516357\times 10^{-10}$	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 1.150736026 \times 10^{43}$ J, $U_o(p) = -1.19617181 \times 10^{34}$ J and $E_o(p) = 1.150736025 \times 10^{43}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.03948405×10^{-9}.				
$\mathbf{1.8023 \times 10^{-5}}$	**2.00000034**	**1.29935492**$\times \mathbf{10^{-10}}$	**0.25**	**-1.29935535**$\times \mathbf{10^{-10}}$
0.09	8.11699251×10^{-8}	0.00327937	0.256075	0.00327937
0.30	8.07724443×10^{-9}	0.04086	0.3175	0.04086

0.40	4.84638507×10^{-9}	0.07936	0.37	0.07936
0.60	2.43746279×10^{-9}	0.22176	0.52	0.22176
0.80	1.51232338×10^{-9}	0.50176	0.73	0.50176
0.90	1.24203337×10^{-9}	0.71766	0.8575	0.71766
0.95	1.13389143×10^{-9}	0.84970375	0.926875	0.84970375
1	1.03948405×10^{-9}	**1**	**1**	**1**

Table 20. In the **Pluto-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \le v \le c$.

X(v)=v/c	$RE(v;p)$	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right) \times mc^2 = 9.851857903 \times 10^{38}$ J, $U_o(p) = -5.25063209 \times 10^{29}$ J and $E_o(p) = 9.8518578979 \times 10^{38}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $5.32958566\times 10^{-10}$.				
$\mathbf{1.4137 \times 10^{-5}}$	**1.99998207**	$\mathbf{1.33240837\times 10^{-10}}$	**0.50**	$\mathbf{-1.33238448\times 10^{-10}}$
0.09	4.95470689×10^{-8}	0.00542187	0.50405	0.00542187
0.30	4.63257444×10^{-9}	0.0627	0.545	0.0627
0.40	2.68329836×10^{-9}	0.1152	0.58	0.1152
0.60	1.27970279×10^{-9}	0.2832	0.68	0.2832
0.80	$7.75969511\times 10^{-10}$	0.5632	0.82	0.5632
0.90	$6.35728914\times 10^{-10}$	0.7587	0.905	0.7587
0.95	$5.80617221\times 10^{-10}$	0.87316875	0.95125	0.87316875
1	$5.32958566\times 10^{-10}$	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 1.313581054 \times 10^{39}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -7.87594813 \times 10^{29}$ J and $E_o(p) = 1.313581053 \times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $5.99578387\times 10^{-10}$.				
$\mathbf{1.4137 \times 10^{-5}}$	**1.99998207**	$\mathbf{9.99306275\times 10^{-11}}$	**0.33333333**	$\mathbf{-9.99288359\times 10^{-11}}$
0.09	4.97445228×10^{-8}	0.00408281	0.33873333	0.0040828
0.30	4.80803597×10^{-9}	0.04905	0.39333333	0.04905
0.40	2.84282864×10^{-9}	0.0928	0.44	0.0928
0.60	1.40424128×10^{-9}	0.2448	0.57333333	0.2448
0.80	$8.68291994\times 10^{-10}$	0.5248	0.76	0.5248
0.90	$7.14319381\times 10^{-10}$	0.73305	0.87333333	0.73305
0.95	$6.53003762\times 10^{-10}$	0.85850312	0.935	0.85850312
1	$5.99578387\times 10^{-10}$	**1**	**1**	**1**
Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4} \times mc^2 = 1.641976317 \times 10^{39}$ J, $U_o(p) = -1.05012642 \times 10^{30}$ J and $E_o(p) = 1.6419763161 \times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of $6.39550302\times 10^{-10}$.				

1.4137×10^{-5}	**1.99998207**	**7.9944502$\times10^{-11}$**	**0.25**	**-7.99430687$\times10^{-11}$**
0.09	4.99403965$\times10^{-8}$	0.00327937	0.256075	0.00327937
0.30	4.9695843$\times10^{-9}$	0.04086	0.3175	0.04086
0.40	2.98177427$\times10^{-9}$	0.07936	0.37	0.07936
0.60	1.49966695$\times10^{-9}$	0.22176	0.52	0.22176
0.80	9.30468147$\times10^{-10}$	0.50176	0.73	0.50176
0.90	7.64170172$\times10^{-10}$	0.71766	0.8575	0.71766
0.95	6.97635061$\times10^{-10}$	0.84970375	0.926875	0.84970375
1	6.39550302$\times10^{-10}$	**1**	**1**	**1**

Table 21. In the **Moon-Sun interaction system**, in which the values of m, r_P and $v_{P,NL}$ are given in Table 11, the numerical results of $RE(v;p)$, $K^*(v;p)/K_o(p)$, $U^*(v;p)/U_o(p)$ and $E^*(v;p)/E_o(p)$, are obtained by using Equations (7, 4, 5, 6), respectively, noting that $v_{P,NL} \leq v \leq c$.

X(v)=v/c	RE(v; p)	$K^*(v;p)/K_o(p)$	$U^*(v;p)/U_o(p)$	$E^*(v;p)/E_o(p)$
Here, for **p=1** and at v=c, $K_o(p) = \left(\frac{3}{4}\right)\times mc^2 = 4.951482389\times10^{39}$ J, $U_o(p) = -4.81808154\times10^{34}$ J and $E_o(p) = 4.9514342084\times10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 9.73058402×10^{-6}.				
0.00191023	**2.00000361**	**2.43265049$\times10^{-6}$**	**0.50**	**-2.43268295$\times10^{-6}$**
0.09	0.00090461	0.00542187	0.50405	0.00541702
0.30	8.45800366$\times10^{-5}$	0.0627	0.545	0.06269531
0.40	4.89907876$\times10^{-5}$	0.1152	0.58	0.11519548
0.60	2.33643967$\times10^{-5}$	0.2832	0.68	0.28319614
0.80	1.41673986$\times10^{-5}$	0.5632	0.82	0.5631975
0.90	1.1606931$\times10^{-5}$	0.7587	0.905	0.75869858
0.95	1.06007007$\times10^{-5}$	0.87316875	0.95125	0.87316799
1	9.73058402$\times10^{-6}$	**1**	**1**	**1**
Here, for **p=2** and at v=c, $\mathbf{K_o(p) = mc^2 = 6.601976519\times10^{39}}$ **J**, in good agreement with that, proposed by **Einstein in 1905**, $U_o(p) = -7.22712231\times10^{34}$ J and $E_o(p) = 6.60190425\times10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.0946907×10^{-5}.				
0.00191023	**2.00000726**	**1.82449119$\times10^{-6}$**	**0.33333333**	**-1.82452442$\times10^{-6}$**
0.09	0.00090822	0.00408281	0.33873333	0.00407914
0.30	8.77835562$\times10^{-5}$	0.04905	0.39333333	0.04904623
0.40	5.19034385$\times10^{-5}$	0.0928	0.44	0.0927962
0.60	2.56381809$\times10^{-5}$	0.2448	0.57333333	0.2447964
0.80	1.58529904$\times10^{-5}$	0.5248	0.76	0.52479743
0.90	1.304181$\times10^{-5}$	0.73305	0.87333333	0.73304846

0.95	1.19223306×10^{-5}	0.85850312	0.935	0.85850229
1	1.0946907×10^{-5}	**1**	**1**	**1**

Here, for **p=3** and further at v=c, $K_o(p) = \frac{5}{4}\times mc^2 = 8.25247065\times 10^{39}$ J,$U_o(p) = -9.63616308\times 10^{34}$ J and $E_o(p) = 8.25237429\times 10^{39}$ J, suggesting that $E_o(p) \cong K_o(p)$, with a precision of the order of 1.16767008×10^{-5}. NY

0.00191023	**2.00001091**	**1.45959562×10^{-6}**	**0.25**	**$-1.45962859\times 10^{-6}$**
0.09	0.0009118	0.00327937	0.256075	0.00327641
0.30	9.07330522×10^{-5}	0.04086	0.3175	0.04085677
0.40	5.44402634×10^{-5}	0.07936	0.37	0.07935661
0.60	2.73804312×10^{-5}	0.22176	0.52	0.22175652
0.80	1.69881848×10^{-5}	0.50176	0.73	0.50175733
0.90	1.39519702×10^{-5}	0.71766	0.8575	0.71765837
0.95	1.27371947×10^{-5}	0.84970375	0.926875	0.84970285
1	1.16767008×10^{-5}	**1**	**1**	**1**