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# The Paradigm of Complex Probability and the Theory of Metarelativity: The General Model and Some Consequences of MCPP 

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#### Abstract

Calculating probabilities is a crucial task of classical probability theory. Adding supplementary dimensions to nondeterministic experiments will yield a deterministic expression of the theory of probability. This is the novel and original idea at the foundation of my complex probability paradigm. As a matter of fact, probability theory is a stochastic system of axioms in its essence; that means that the phenomena outputs are due to randomness and chance. By adding novel imaginary dimensions to the nondeterministic phenomenon happening in the set $\mathcal{R}$ will lead to a deterministic phenomenon and thus a stochastic experiment will have a certain output in the complex probability set and total universe $\mathbf{G}=\mathcal{C}$. If the chaotic experiment becomes completely predictable, then we will be fully capable to predict the output of random events that arise in the real world in all stochastic processes. Accordingly, the task that has been achieved here was to extend the random real probabilities set $\mathcal{R}$ to the deterministic complex probabilities set and total universe $\mathbf{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}$ and this by incorporating the contributions of the set $\mathcal{M}$, which is the complementary imaginary set of probabilities to the set $\mathcal{R}$. Consequently, since this extension reveals to be successful, then an innovative paradigm of stochastic sciences and prognostic was put forward in which all nondeterministic phenomena in $\mathcal{R}$ was expressed deterministically in $\mathcal{C}$. This paradigm was initiated and elaborated in my previous 21 publications. Furthermore, this model will be linked to my theory of Metarelativity, which takes into consideration faster-than-light matter and energy. This is what I named "The Metarelativistic Complex Probability Paradigm (MCPP)," which will be developed in the present two chapters 1 and 2.


Keywords: degree of our knowledge, complex random vector, chaotic factor, probability norm, complex probability set $\mathcal{C}$, imaginary number, imaginary dimensions, metarelativistic transformations, superluminal velocities, metaparticles, metamatter, dark matter, dark energy, metaenergy, metaentropy, universe $\mathbf{G}_{1}$, metauniverse $\mathbf{G}_{2}$, luminal universe $\mathbf{G}_{3}$, the total universe $\mathbf{G}$

## 1. The metarelativistic complex probability paradigm (MCPP): a more general second model

In this section, we will develop the second more general model of $M C P P$ with all its parameters [1-42].

### 1.1 The real and imaginary probabilities

Here, and in this second MCPP model, $v_{1}$ is always the velocity of a body in $R_{1}$ with $0 \leq v_{1}<c$ and is a random variable that follows the normal distribution:
$N\left(\bar{v}_{1}=c / 2, \sigma_{v 1}=c / 6\right)$ where $\bar{v}_{1}$ is the mean or the expectation of this symmetric normal probability distribution of $v_{1}$ or $P D F_{1}\left(v_{1}\right)$ and $\sigma_{v 1}$ is its corresponding standard deviation. And $v_{2}$ is also the velocity of a body in $R_{2}$ with $c<v_{2} \leq n c$ and is a random variable that follows the normal distribution: $N\left(\bar{v}_{2}=(n+1) c / 2, \sigma_{v 2}=(n-1) c / 6\right)$ for a determined and fixed value of $n$ such that $\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$ and where $\bar{v}_{2}$ is the mean or the expectation of this symmetric normal probability distribution of $v_{2}$ or $P D F_{2}\left(v_{2}\right)$ and $\sigma_{v 2}$ is its corresponding standard deviation.

First, we will define and calculate the real and imaginary probabilities in the universes $R_{1}, R_{2}, M_{1}$, and $M_{2}$ in the second model of MCPP as follows:

$$
\begin{aligned}
& P_{R 1}=P_{\text {rob }}\left(0 \leq V \leq v_{1}\right)=C D F_{1}\left(0 \leq V \leq v_{1}\right)=\int_{0}^{v 1} P D F_{1}(v) d v=\int_{0}^{v 1} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v . \\
& \quad \text { So, if } v_{1}<0 \Rightarrow P_{R 1}=P_{\text {rob }}(V<0)=C D F_{1}(V<0)=0 . \\
& \quad \text { If } v_{1}=0 \Rightarrow P_{R 1}=P_{r o b}(V \leq 0)=C D F_{1}(V \leq 0)=\int_{0}^{0} P D F_{1}(v) d v= \\
& \int_{0}^{0} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v=0 . \\
& \text { If } v_{1}=\bar{v}_{1}=c / 2 \Rightarrow P_{R 1}=P_{\text {rob }}(0 \leq V \leq c / 2)=C D F_{1}(0 \leq V \leq c / 2)=\int_{0}^{c / 2} P D F_{1}(v) d v=0.5 . \\
& \quad \text { If } v_{1} \rightarrow c^{-} \Rightarrow P_{R 1} \rightarrow P_{\text {rob }}(0 \leq V<c)=C D F_{1}(0 \leq V<c)=\int_{0}^{c} P D F_{1}(v) d v= \\
& \int_{0}^{c} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v=1 . \\
& \text { If } v_{1}>c \Rightarrow P_{R 1}=P_{\text {rob }}(V>c)=C D F_{1}(V>c)=\int_{0}^{v 1} P D F_{1}(v) d v= \\
& \left\{\int_{0}^{c} P D F_{1}(v) d v+\int_{c}^{v 1} P D F_{1}(v) d v\right\}=(1+0)=1 .
\end{aligned}
$$

And we have for the second real probability:

$$
\begin{aligned}
P_{R 2} & =P_{\text {rob }}\left(c<V \leq v_{2}\right)=C D F_{2}\left(c<V \leq v_{2}\right) \\
& =\int_{c}^{v 2} P D F_{2}(v) d v=\int_{c}^{v 2} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v
\end{aligned}
$$

So, if $v_{2}<c \Rightarrow P_{R 2}=P_{\text {rob }}(V<c)=\operatorname{CDF}_{2}(V<c)=0$.
If $v_{2} \rightarrow c^{+} \Rightarrow P_{R 2} \rightarrow \int_{c}^{c} P D F_{2}(v) d v=\int_{c}^{c} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v=0$.

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$$
\text { If } v_{2}=\bar{v}_{2}=(n+1) c / 2 \Rightarrow P_{R 2}=P_{\text {rob }}(c<V \leq(n+1) c / 2)=
$$

$$
C D F_{2}(c<V \leq(n+1) c / 2)=\int_{c}^{(n+1) c / 2} P D F_{2}(v) d v=0.5
$$

If $v_{2}=n c$

$$
\begin{aligned}
\Rightarrow P_{R 2} & =P_{r o b}(c<V \leq n c)=C D F_{2}(c<V \leq n c) \\
& =\int_{c}^{n c} P D F_{2}(v) d v=\int_{c}^{n c} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v=1
\end{aligned}
$$

If $v_{2}>n c$

$$
\begin{aligned}
\Rightarrow P_{R 2} & =P_{r o b}(V>n c)=C D F_{2}(V>n c) \\
& =\int_{c}^{v 2} P D F_{2}(v) d v=\left\{\int_{c}^{n c} P D F_{2}(v) d v+\int_{n c}^{v 2} P D F_{2}(v) d v\right\}=(1+0)=1
\end{aligned}
$$

Moreover, the first imaginary probability is:

$$
\begin{aligned}
P_{M 1} & =i\left(1-P_{R 1}\right)=i\left[1-P_{\text {rob }}\left(0 \leq V \leq v_{1}\right)\right]=i\left[1-C D F_{1}\left(0 \leq V \leq v_{1}\right)\right]=i C D F_{1}\left(v_{1}<V<c\right) \\
& =i\left[1-\int_{0}^{v 1} P D F_{1}(v) d v\right]=i \int_{v 1}^{c} P D F_{1}(v) d v=i \int_{v 1}^{c} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v
\end{aligned}
$$

So, if $v_{1}<0 \Rightarrow$

$$
P_{M 1}=i \int_{v 1}^{c} P D F_{1}(v) d v=i\left\{\int_{v 1}^{0} P D F_{1}(v) d v+\int_{0}^{c} P D F_{1}(v) d v\right\}=i(0+1)=i \Rightarrow P_{M 1} / i=1 .
$$

If $v_{1}=0$
$\Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(V \leq 0)\right]=i\left[1-C D F_{1}(V \leq 0)\right]=i(1-0)=i \Rightarrow P_{M 1} / i=1$.
If $v_{1}=\bar{v}_{1}=c / 2$
$\Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq c / 2)\right]=i\left[1-C D F_{1}(0 \leq V \leq c / 2)\right]$

$$
=i\left[1-\int_{0}^{c / 2} P D F_{1}(v) d v\right]=i \int_{c / 2}^{c} P D F_{1}(v) d v=i(1-0.5)=0.5 i \Rightarrow P_{M 1} / i=0.5
$$

If $v_{1} \rightarrow c^{-} \Rightarrow P_{M 1} \rightarrow i\left[1-P_{r o b}(0 \leq V<c)\right]=i\left[1-C D F_{1}(0 \leq V<c)\right]=$ $i\left[1-\int_{0}^{c} P D F_{1}(v) d v\right]=i(1-1)=0 \Rightarrow P_{M 1} / i \rightarrow 0$

If $v_{1}>c \Rightarrow P_{M 1}=0 \Rightarrow P_{M 1} / i=0$.
And we have for the second imaginary probability:

$$
\begin{aligned}
P_{M 2} & =i\left(1-P_{R 2}\right)=i\left[1-P_{\text {rob }}\left(c<V \leq v_{2}\right)\right]=i\left[1-C D F_{2}\left(c<V \leq v_{2}\right)\right]=i C D F_{2}\left(v_{2}<V \leq n c\right) \\
& =i\left[1-\int_{c}^{v 2} P D F_{2}(v) d v\right]=i \int_{v 2}^{n c} P D F_{2}(v) d v=i \int_{v 2}^{n c} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v
\end{aligned}
$$

So, if $v_{2}<c \Rightarrow P_{M 2}=i \int_{v 2}^{n c} P D F_{2}(v) d v=i\left\{\int_{v 2}^{c} P D F_{2}(v) d v+\int_{c}^{n c} P D F_{2}(v) d v\right\}=$ $i(0+1)=i \Rightarrow P_{M 2} / i=1$.
If $v_{2} \rightarrow c^{+}$

$$
\begin{aligned}
\Rightarrow P_{M 2} \rightarrow i\left[1-P_{\text {rob }}\left(V \leq v_{2}\right)\right] & =i P_{\text {rob }}(c<V \leq n c)=i C D F_{2}(c<V \leq n c)=i \times 1=i \\
& =i\left[1-C D F_{2}(V<c)\right]=i(1-0)=i \\
& \Rightarrow P_{M 2} / i \rightarrow 1
\end{aligned}
$$

If $v_{2}=\bar{v}_{2}=(n+1) c / 2$

$$
\begin{aligned}
\Rightarrow P_{M 2} & =i\left[1-P_{\text {rob }}(c<V \leq(n+1) c / 2)\right]=i\left[1-C D F_{2}(c<V \leq(n+1) c / 2)\right] \\
& =i\left[1-\int_{c}^{(n+1) c / 2} P D F_{2}(v) d v\right]=i \times \int_{(n+1) c / 2}^{n c} P D F_{2}(v) d v=i(1-0.5)=0.5 i \Rightarrow P_{M 2} / i=0.5
\end{aligned}
$$

If $v_{2}=n c \Rightarrow P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq n c)\right]=i\left[1-C D F_{2}(c<V \leq n c)\right]=$

$$
i\left[1-\int_{c}^{n c} P D F_{2}(v) d v\right]=i(1-1)=0
$$

$$
\Rightarrow P_{M 2} / i=0
$$

If $v_{2}>n c \Rightarrow P_{M 2}=0 \Rightarrow P_{M 2} / i=0$.
Additionally, we have $\mathcal{R}=R_{1}(0 \leq v<c)+R_{2}(c<v \leq n c), \forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$.
Now, let $P_{R}=\frac{P_{R 1}+P_{R 2}}{2}$ and it is equal to half of the sum of the cumulative probability that $0 \leq V \leq v_{1}$ in $R_{1}$ and the cumulative probability that $c<V \leq v_{2}$ in $R_{2}$.

$$
\begin{aligned}
\Rightarrow P_{R} & =\frac{C D F_{1}\left(0 \leq V \leq v_{1}\right)+C D F_{2}\left(c<V \leq v_{2}\right)}{2} \\
& =\frac{1}{2}\left\{\int_{0}^{v 1} P D F_{1}(v) d v+\int_{c}^{v 2} P D F_{2}(v) d v\right\} \\
& =\frac{1}{2}\left\{\int_{0}^{v 1} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v+\int_{c}^{v 2} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v\right\}
\end{aligned}
$$

Hence, we have in $\mathbf{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}=\mathbf{G}_{1}+\mathbf{G}_{2}: 0 \leq v \leq n c$ with $v \neq c$.
So, if $0 \leq v<c \Rightarrow P_{R 1}=P_{\text {rob }}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{\text {rob }}(V \leq v)=P_{\text {rob }}(V<c)=C D F_{2}(V<c)=0$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+0}{2}=\frac{C D F_{1}(0 \leq V \leq v)}{2}=\frac{P_{R 1}}{2}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}$ alone.

And if $c<v \leq n c \Rightarrow P_{R 1}=P_{r o b}(V>c)=C D F_{1}(V>c)=1$.

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$$
\begin{aligned}
& \text { And } P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v) \\
& \\
& \quad \Rightarrow P_{R}=\frac{1+C D F_{2}(c<V \leq v)}{2}=\frac{1+P_{R 2}}{2}
\end{aligned}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{2}$ alone.

And if $0 \leq v \leq n c$ with $v \neq c \Rightarrow P_{R 1}=P_{r o b}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{r o b}(c<V \leq v)=C D F_{2}(c<V \leq v)$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+C D F_{2}(c<V \leq v)}{2}=\frac{P_{R 1}+P_{R 2}}{2}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}+R_{2}$.

And consequently, we can deduce from the above the real probability in the probability universe $\mathcal{R}=R_{1}+R_{2}$ for special velocity cases as follows:
if $v<0 \Rightarrow P_{R}=\frac{C D F_{1}(V<0)}{2}=\frac{0}{2}=0$.
if $v=c / 2 \Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq c / 2)+C D F_{2}(V<c)}{2}=\frac{0.5+0}{2}=0.25$.
if $v \rightarrow c^{-} \Rightarrow P_{R} \rightarrow \frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)}{2}=\frac{1+0}{2}=0.5$.
if $v=(n+1) c / 2 \Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq(n+1) c / 2)}{2}=\frac{1+0.5}{2}=0.75$.
if $v=n c \Rightarrow P_{R}=\frac{\operatorname{CDF}_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)}{2}=\frac{1+1}{2}=1$.
Furthermore, we have $\mathcal{M}=M_{1}(0 \leq v<c)+M_{2}(c<v \leq n c)$, $\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$.
Now, let $P_{M}=\frac{P_{M 1}+P_{M 2}}{2}$ and it is equal to half of the sum of the complement of the cumulative probability that $0 \leq V \leq v_{1}$ in $M_{1}$ and the complement of the cumulative probability that $c<V \leq v_{2}$ in $M_{2}$.

$$
\begin{aligned}
& \Rightarrow P_{M}=\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}=\frac{2 i-i\left(P_{R 1}+P_{R 2}\right)}{2}=i-\frac{i\left(P_{R 1}+P_{R 2}\right)}{2}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}\right)}{2}\right]=i\left(1-P_{R}\right) \\
& \Rightarrow P_{M}=\frac{i\left[1-C D F_{1}\left(0 \leq V \leq v_{1}\right)\right]+i\left[1-C D F_{2}\left(c<V \leq v_{2}\right)\right]}{2} \\
& \quad=\frac{i}{2}\left\{\int_{0}^{v 1}\left[1-P D F_{1}(v)\right] d v+\int_{c}^{v 2}\left[1-P D F_{2}(v)\right] d v\right\} \\
& =\frac{i}{2}\left\{\int_{0}^{v 1}\left[1-N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right)\right] d v+\int_{c}^{v 2}\left[1-N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right)\right] d v\right\} \\
& =\frac{i}{2}\left\{\int_{v 1}^{c} N\left(\bar{v}=c / 2, \sigma_{v}=c / 6\right) d v+\int_{v 2}^{n c} N\left(\bar{v}=(n+1) c / 2, \sigma_{v}=(n-1) c / 6\right) d v\right\}
\end{aligned}
$$

Hence, we have in $\mathbf{G}=\mathcal{C}=\mathcal{R}+\boldsymbol{\mathcal { M }}=\mathbf{G}_{\mathbf{1}}+\mathbf{G}_{\mathbf{2}}: 0 \leq v \leq n c$ with $v \neq c$.
So, if $0 \leq v<c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{r o b}(0 \leq V \leq v)\right]=i\left[1-C D F_{2}(V<c)\right]=i(1-0)=i$

$$
\Rightarrow P_{M}=\frac{i\left[1-C D F_{1}(0 \leq V \leq v)\right]+i}{2}=\frac{i+P_{M 1}}{2}=i\left[1-\frac{P_{R 1}}{2}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}$ alone.

And if $c<v \leq n c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(V>c)\right]=i\left[1-C D F_{1}(V>c)\right]=i(1-1)=0$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right]$

$$
\Rightarrow P_{M}=\frac{0+i\left[1-C D F_{2}(c<V \leq v)\right]}{2}=\frac{P_{M 2}}{2}=i\left[\frac{1-P_{R 2}}{2}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{2}$ alone.

And if
$0 \leq v \leq n c$ with $v \neq c \Rightarrow P_{M 1}=i\left[1-P_{r o b}(0 \leq V<v)\right]=i\left[1-C D F_{1}(0 \leq V<v)\right]$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right] \Rightarrow$
$P_{M}=\frac{i\left[1-C D F_{1}(0 \leq V \leq v)\right]+i\left[1-C D F_{2}(c<V \leq v)\right]}{2}=\frac{P_{M 1}+P_{M 2}}{2}=i\left[1-\frac{P_{R 1}+P_{R 2}}{2}\right]=i\left[1-P_{R}\right]$.
Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}+M_{2}$.

And consequently, we can deduce from the above the imaginary probability in the probability universe $\mathcal{M}=M_{1}+M_{2}$ for special velocity cases as follows:

$$
\begin{aligned}
& \text { if } v<0 \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(V<0)}{2}\right]=i\left[1-\frac{0}{2}\right]=i \Rightarrow P_{M} / i=1 . \\
& \text { if } v=c / 2 \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V \leq c / 2)+C D F_{2}(V<c)}{2}\right]=i\left[1-\frac{0.5+0}{2}\right]=0.75 i \\
& \Rightarrow P_{M} / i=0.75
\end{aligned}
$$

if $v \rightarrow c^{-} \Rightarrow P_{M} \rightarrow i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)}{2}\right]=i\left[1-\frac{1+0}{2}\right]=0.5 i \Rightarrow P_{M} / i \rightarrow 0.5$.
if $v=(n+1) c / 2$

$$
\begin{gathered}
\Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq(n+1) c / 2)}{2}\right]=i\left[1-\frac{1+0.5}{2}\right]=0.25 i \\
\Rightarrow P_{M} / i=0.25
\end{gathered}
$$

if $v=n c \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)}{2}\right]=i\left[1-\frac{1+1}{2}\right]=i(1-1)=0$

$$
\Rightarrow P_{M} / i=0
$$

Therefore, for any value of $0 \leq v \leq n c$ with $v \neq c$, we can write without any confusion that:
$P_{M 1}=i\left(1-P_{R 1}\right)$ and $P_{R 1}=1-P_{M 1} / i$; hence, $M_{1}$ is the imaginary complementary probability universe to the real probability universe $R_{1}$.

And $P_{M 2}=i\left(1-P_{R 2}\right)$ and $P_{R 2}=1-P_{M 2} / i$; hence, $M_{2}$ is the imaginary complementary probability universe to the real probability universe $R_{2}$.

Moreover, in all cases and for any value of $v: 0 \leq v \leq n c$ with $v \neq c$, we have:
$P_{R}=\frac{P_{R 1}+P_{R 2}}{2}$ where $\mathcal{R}=R_{1}+R_{2}$.
And $P_{M}=\frac{P_{M 1}+P_{M 2}}{2}$ where $\mathcal{M}=M_{1}+M_{2}$.
We can check that:

$$
P_{M}=\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}=\frac{2 i-i\left(P_{R 1}+P_{R 2}\right)}{2}=i-\frac{i\left(P_{R 1}+P_{R 2}\right)}{2}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}\right)}{2}\right]=i\left(1-P_{R}\right)
$$

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Hence, $\mathcal{M}$ is the imaginary complementary probability universe to the real probability universe $\mathcal{R}$.

Moreover, we have in $\mathbf{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}$, where $0 \leq v \leq n c$ with $v \neq c$,

$$
\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)
$$

Then, $\mathcal{C}=\left(R_{1}+R_{2}\right)+\left(M_{1}+M_{2}\right)=\left(R_{1}+M_{1}\right)+\left(R_{2}+M_{2}\right)=\mathcal{C}_{1}+\mathcal{C}_{2}$.
In fact, in $\mathcal{C}_{1}$ we have: $P c_{1}=P_{R 1}+P_{M 1} / i=P_{R 1}+\left(1-P_{R 1}\right)=1$.
And, in $\mathcal{C}_{2}$ we have: $P c_{2}=P_{R 2}+P_{M 2} / i=P_{R 2}+\left(1-P_{R 2}\right)=1$.
And, in $\mathcal{C}$ we have:

$$
\begin{aligned}
P c & =P_{R}+P_{M} / i=\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{P_{M 1}+P_{M 2}}{2}\right] / i=\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}\right] / i \\
& =\frac{P_{R 1}+P_{R 2}}{2}+\frac{\left(1-P_{R 1}\right)+\left(1-P_{R 2}\right)}{2}=\frac{P_{R 1}+P_{R 2}}{2}+1-\frac{P_{R 1}+P_{R 2}}{2} \\
& =1
\end{aligned}
$$

We can calculate $P_{c}$ in another way as follows:

$$
\begin{aligned}
P c & =P_{R}+P_{M} / i=\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{P_{M 1}+P_{M 2}}{2}\right] / i=\frac{P_{R 1}+P_{M 1} / i}{2}+\frac{P_{R 2}+P_{M 2} / i}{2}=\frac{P c_{1}}{2}+\frac{P c_{2}}{2} \\
& =\frac{P c_{1}+P c_{2}}{2}=\frac{1+1}{2}=1
\end{aligned}
$$

Consequently: $P c=P c_{1}=P c_{2}=1$, in accordance with $C P P$ axioms.
Furthermore, we can state now and affirm finally that in this second model:
$\mathbf{G}=\mathbf{G}_{1}(0 \leq v<c)+\mathbf{G}_{2}(c<v \leq n c)$ that means that the total universe $\mathbf{G}$ is the sum of the real subluminal universe $\mathrm{G}_{1}$ and the imaginary superluminal universe or metauniverse $\mathbf{G}_{2}$.

1. The real subluminal universe $\mathbf{G}_{1}$ corresponds to the complex probability universe $\mathcal{C}_{1}$, which is also subluminal; hence, $\mathrm{G}_{1}=\mathcal{C}_{1}=R_{1}+M_{1}$ with $(0 \leq v<c)$.
2. And the imaginary superluminal universe $\mathbf{G}_{2}$ or metauniverse corresponds to the complex probability universe $\mathcal{C}_{2}$, which is also superluminal; hence, $\mathbf{G}_{\mathbf{2}}=\mathcal{C}_{\mathbf{2}}=R_{2}+M_{2}$ with $(c<v \leq n c)$.

Therefore,

$$
\begin{aligned}
& P_{G 1}=P c_{1}=P_{R 1}+P_{M 1} / i=P_{R 1}+\left(1-P_{R 1}\right)=1 \text { and } \\
& P_{G 2}=P c_{2}=P_{R 2}+P_{M 2} / i=P_{R 2}+\left(1-P_{R 2}\right)=1 .
\end{aligned}
$$

Consequently, the complex total universe $\mathbf{G}=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{\mathbf{2}}(c<v \leq n c)$, which is the sum of the universe and the metauniverse, corresponds to the complex probability universe $\mathcal{C}$ having:
$\mathbf{G}=\mathcal{C}=\boldsymbol{R}+\boldsymbol{M}=\left(R_{1}+R_{2}\right)+\left(M_{1}+M_{2}\right)=\left(R_{1}+M_{1}\right)+\left(R_{2}+M_{2}\right)$
$=\mathcal{C}_{1}(0 \leq v<c)+\mathcal{C}_{2}(c<v \leq n c)=\mathbf{G}_{1}(0 \leq v<c)+\mathbf{G}_{2}(c<v \leq n c)$ with $0 \leq v \leq n c$ and $v \neq c$,
hence:

$$
P_{G}=P c=\frac{P_{G 1}+P_{G 2}}{2}=\frac{P c_{1}+P c_{2}}{2}=\frac{1+1}{2}=1
$$

Consequently: $P c=1$, in accordance with $C P P$ axioms.
Thus, we can conclude that, by adding the complementary imaginary probabilities universes $M_{1}, M_{2}$ and $\mathcal{M}$ to the real probabilities universes $R_{1}, R_{2}$ and $\mathcal{R}$ then all random phenomena in the complex probabilities' universes $\mathcal{C}_{1}, \mathcal{C}_{2}$, and $\mathcal{C}$, and hence in the subluminal universe $\mathrm{G}_{1}$, in the superluminal universe $\mathrm{G}_{2}$, and in the total and complex universe $\mathbf{G}$, become absolutely and perfectly deterministic with probabilities expressed totally as follows:
$P c=P c_{1}=P c_{2}=1$ and $P_{G}=P_{G 1}=P_{G 2}=1$.

### 1.2 The MCPP parameters of the second model

The MCPP parameters in this second model are similar to those of the first model and this is done by including the probabilities $P_{R}$ and $P_{M}$ corresponding to the second model.

### 1.3 The deterministic cases and the MCPP parameters of the second model

The deterministic cases in this second model are similar to those of the first model and this is done by taking into consideration the probabilities $P_{R}$ and $P_{M}$ pertaining and corresponding to the second model.

### 1.4 The second model simulations

We note that in the following simulations, $P_{R 3}$ is the real probability in the luminal universe $\mathbf{G}_{3}$ for $(v=c)$ in yellow in the simulations, where we have $\forall P_{R 3}: 0 \leq P_{R 3} \leq 1$ and that it will be included in the final most general model of $M C P P$. Thus, the current model is a simplified second model. The simulations from Figures 1-3 illustrate the second and more general model.

## 2. The metarelativistic complex probability paradigm (MCPP): a more general third model

In this section, we will develop the third more general model of $M C P P$ with all its parameters [1-42].

### 2.1 The real and imaginary probabilities

Here, and in this third MCPP model, $v_{1}$ is always the velocity of a body in $R_{1}$ with $0 \leq v_{1}<c$ and is a random variable that follows any possible probability distribution: $P D F_{1}\left(\bar{v}_{1}, \sigma_{v 1}\right)$ where $\bar{v}_{1}$ is the mean or the expectation of this general probability distribution of $v_{1}$ or $P D F_{1}\left(v_{1}\right)$ and $\sigma_{v 1}$ is its corresponding standard deviation. And $v_{2}$ is also the velocity of a body in $R_{2}$ with $c<v_{2} \leq n c$ and is a random variable that follows any possible probability distribution: $P D F_{2}\left(\bar{v}_{2}, \sigma_{v 2}\right)$ for a determined and fixed value of $n$ such that $\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$ and where $\bar{v}_{2}$ is the mean or the expectation of this general probability distribution of $v_{2}$ or $P D F_{2}\left(v_{2}\right)$ and $\sigma_{v 2}$ is its corresponding standard deviation. Note that, $P D F_{1}$ and $P D F_{2}$ do not have here to be similar probability distributions.

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All the MCPP Parameters and the Normal Distribution


Figure 1.
The MCPP second model parameters and the normal distribution for $n=6$ in $G_{2}$.


Figure 2.
The MCPP second model probabilities and the normal/normal distributions for $n=6$ in $\mathbf{G}$.


Figure 3.
The MCPP second model parameters and the normal/normal distributions for $n=6$ in $G$.

First, we will define and calculate the real and imaginary probabilities in the universes $R_{1}, R_{2}, M_{1}$, and $M_{2}$ in the third model of MCPP as follows:

$$
\begin{aligned}
& P_{R 1}=P_{\text {rob }}\left(0 \leq V \leq v_{1}\right)=C D F_{1}\left(0 \leq V \leq v_{1}\right)=\int_{0}^{v 1} P D F_{1}(v) d v . \\
& \text { So, if } v_{1}<0 \Rightarrow P_{R 1}=P_{\text {rob }}(V<0)=C D F_{1}(V<0)=0 . \\
& \text { If } v_{1}=0 \Rightarrow P_{R 1}=P_{\text {rob }}(V \leq 0)=C D F_{1}(V \leq 0)=\int_{0}^{0} P D F_{1}(v) d v=0 . \\
& \text { If } v_{1}=\operatorname{Md}\left(v_{1}\right) \Rightarrow P_{R 1}=P_{\text {rob }}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)=C D F_{1}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)= \\
& \operatorname{Md}\left(v_{1}\right) \\
& \int_{0}^{1} P D F_{1}(v) d v=0.5 .
\end{aligned}
$$

where $\operatorname{Md}\left(v_{1}\right)$ is the median of the velocity $v_{1}$ probability distribution.
If $v_{1} \rightarrow c^{-} \Rightarrow P_{R 1} \rightarrow P_{\text {rob }}(0 \leq V<c)=C D F_{1}(0 \leq V<c)=\int_{0}^{c} P D F_{1}(v) d v=1$.
If $v_{1}>c \Rightarrow P_{R 1}=P_{\text {rob }}(V>c)=C D F_{1}(V>c)=\int_{0}^{v 1} P D F_{1}(v) d v=$ $\left\{\int_{0}^{c} P D F_{1}(v) d v+\int_{c}^{v 1} P D F_{1}(v) d v\right\}=(1+0)=1$.

And we have for the second real probability:

$$
P_{R 2}=P_{r o b}\left(c<V \leq v_{2}\right)=C D F_{2}\left(c<V \leq v_{2}\right)=\int_{c}^{v 2} P D F_{2}(v) d v
$$

So, if $v_{2}<c \Rightarrow P_{R 2}=P_{\text {rob }}(V<c)=\operatorname{CDF}_{2}(V<c)=0$.

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$$
\begin{aligned}
& \text { If } v_{2} \rightarrow c^{+} \Rightarrow P_{R 2} \rightarrow \int_{c}^{c} P D F_{2}(v) d v=0 . \\
& \text { If } v_{2}=\operatorname{Md}\left(v_{2}\right) \Rightarrow P_{R 2}=P_{\text {rob }}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)=C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)= \\
& \operatorname{Md}\left(v_{2}\right) \\
& \int_{c} P D F_{2}(v) d v=0.5 .
\end{aligned}
$$

where $\operatorname{Md}\left(v_{2}\right)$ is the median of the velocity $v_{2}$ probability distribution.
If $v_{2}=n c \Rightarrow P_{R 2}=P_{\text {rob }}(c<V \leq n c)=C D F_{2}(c<V \leq n c)=\int_{c}^{n c} P D F_{2}(v) d v=1$.
If $v_{2}>n c$

$$
\begin{aligned}
\Rightarrow P_{R 2} & =P_{\text {rob }}(V>n c)=C D F_{2}(V>n c) \\
& =\int_{c}^{v 2} P D F_{2}(v) d v=\left\{\int_{c}^{n c} P D F_{2}(v) d v+\int_{n c}^{v 2} P D F_{2}(v) d v\right\}=(1+0)=1
\end{aligned}
$$

Moreover, the first imaginary probability is:

$$
\begin{aligned}
P_{M 1} & =i\left(1-P_{R 1}\right)=i\left[1-P_{\text {rob }}\left(0 \leq V \leq v_{1}\right)\right]=i\left[1-C D F_{1}\left(0 \leq V \leq v_{1}\right)\right]=i C D F_{1}\left(v_{1}<V<c\right) \\
& =i\left[1-\int_{0}^{v 1} P D F_{1}(v) d v\right]=i \int_{v 1}^{c} P D F_{1}(v) d v
\end{aligned}
$$

So, if $v_{1}<0 \Rightarrow$

$$
P_{M 1}=i \int_{v 1}^{c} P D F_{1}(v) d v=i\left\{\int_{v 1}^{0} P D F_{1}(v) d v+\int_{0}^{c} P D F_{1}(v) d v\right\}=i(0+1)=i \Rightarrow P_{M 1} / i=1 .
$$

If $v_{1}=0$
$\Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(V \leq 0)\right]=i\left[1-C D F_{1}(V \leq 0)\right]=i(1-0)=i \Rightarrow P_{M 1} / i=1$.
If $v_{1}=\operatorname{Md}\left(v_{1}\right)$

$$
\begin{aligned}
\Rightarrow P_{M 1} & =i\left[1-P_{\text {roo }}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)\right]=i\left[1-C D F_{1}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)\right] \\
& =i\left[1-\int_{0}^{\operatorname{Md}\left(v_{1}\right)} P D F_{1}(v) d v\right]=i \int_{\operatorname{Md}\left(v_{1}\right)}^{c} P D F_{1}(v) d v=i(1-0.5)=0.5 i \Rightarrow P_{M 1} / i=0.5
\end{aligned}
$$

If $v_{1} \rightarrow c^{-} \Rightarrow P_{M 1} \rightarrow i\left[1-P_{\text {rob }}(0 \leq V<c)\right]=i\left[1-C D F_{1}(0 \leq V<c)\right]=$
$i\left[1-\int_{0}^{c} P D F_{1}(v) d v\right]=i(1-1)=0$
$\Rightarrow P_{M 1} / i \rightarrow 0$
If $v_{1}>c \Rightarrow P_{M 1}=0 \Rightarrow P_{M 1} / i=0$.
And we have for the second imaginary probability:

$$
\begin{aligned}
P_{M 2} & =i\left(1-P_{R 2}\right)=i\left[1-P_{\text {rob }}\left(c<V \leq v_{2}\right)\right]=i\left[1-C D F_{2}\left(c<V \leq v_{2}\right)\right]=i C D F_{2}\left(v_{2}<V \leq n c\right) \\
& =i\left[1-\int_{c}^{v 2} P D F_{2}(v) d v\right]=i \int_{v 2}^{n c} P D F_{2}(v) d v
\end{aligned}
$$

So, if $v_{2}<c \Rightarrow$

$$
\left.\begin{array}{l}
P_{M 2}=i \int_{v 2}^{n c} P D F_{2}(v) d v=i\left\{\int_{v 2}^{c} P D F_{2}(v) d v+\int_{c}^{n c} P D F_{2}(v) d v\right\}=i(0+1)=i \Rightarrow P_{M 2} / i=1 . \\
\text { If } v_{2} \rightarrow c^{+} \\
\Rightarrow P_{M 2} \rightarrow i\left[1-P_{\text {rob }}\left(V \leq v_{2}\right)\right]
\end{array} \quad=i P_{\text {rob }}(c<V \leq n c)=i C D F_{2}(c<V \leq n c)=i \times 1=i\right\}
$$

If $v_{2}=\operatorname{Md}\left(v_{2}\right)$

$$
\begin{aligned}
\Rightarrow P_{M 2} & =i\left[1-P_{\text {rob }}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)\right]=i\left[1-C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)\right] \\
& =i\left[1-\int_{c}^{\operatorname{Md}\left(v_{2}\right)} P D F_{2}(v) d v\right]=i \times \int_{\operatorname{Md}\left(v_{2}\right)}^{n c} P D F_{2}(v) d v=i(1-0.5)=0.5 i \Rightarrow P_{M 2} / i=0.5
\end{aligned}
$$

$$
\text { If } v_{2}=n c \Rightarrow P_{M 2}=i\left[1-P_{r o b}(c<V \leq n c)\right]=i\left[1-C D F_{2}(c<V \leq n c)\right]=
$$

$$
i\left[1-\int_{c}^{n c} P D F_{2}(v) d v\right]=i(1-1)=0
$$

$$
\Rightarrow P_{M 2} / i=0
$$

$$
\text { If } v_{2}>n c \Rightarrow P_{M 2}=0 \Rightarrow P_{M 2} / i=0
$$

Furthermore, we have $\mathcal{R}=R_{1}(0 \leq v<c)+R_{2}(c<v \leq n c)$, $\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$.
Now, let $P_{R}=\frac{P_{R 1}+P_{R 2}}{2}$ and it is equal to half of the sum of the cumulative probability that $0 \leq V \leq v_{1}$ in $R_{1}$ and the cumulative probability that $c<V \leq v_{2}$ in $R_{2}$.

$$
\Rightarrow P_{R}=\frac{C D F_{1}\left(0 \leq V \leq v_{1}\right)+C D F_{2}\left(c<V \leq v_{2}\right)}{2}=\frac{1}{2}\left\{\int_{0}^{v 1} P D F_{1}(v) d v+\int_{c}^{v 2} P D F_{2}(v) d v\right\}
$$

Hence, we have in $\mathbf{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}=\mathbf{G}_{\mathbf{1}}+\mathbf{G}_{\mathbf{2}}: 0 \leq v \leq n c$ with $v \neq c$.
So, if $0 \leq v<c \Rightarrow P_{R 1}=P_{\text {rob }}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{\text {rob }}(V \leq v)=P_{\text {rob }}(V<c)=C D F_{2}(V<c)=0$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+0}{2}=\frac{C D F_{1}(0 \leq V \leq v)}{2}=\frac{P_{R 1}}{2}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}$ alone.

And if $c<v \leq n c \Rightarrow P_{R 1}=P_{\text {rob }}(V>c)=C D F_{1}(V>c)=1$.
And $P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v)$

$$
\Rightarrow P_{R}=\frac{1+C D F_{2}(c<V \leq v)}{2}=\frac{1+P_{R 2}}{2}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{2}$ alone.

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And if $0 \leq v \leq n c$ with $v \neq c \Rightarrow P_{R 1}=P_{r o b}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v)$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+C D F_{2}(c<V \leq v)}{2}=\frac{P_{R 1}+P_{R 2}}{2}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}+R_{2}$.

And consequently, we can deduce from the above the real probability in the probability universe $\mathcal{R}=R_{1}+R_{2}$ for special velocity cases as follows:
if $v<0 \Rightarrow P_{R}=\frac{C D F_{1}(V<0)}{2}=\frac{0}{2}=0$.
if $v=\operatorname{Md}\left(v_{1}\right) \Rightarrow P_{R}=\frac{C D F_{1}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)+C D F_{2}(V<c)}{2}=\frac{0.5+0}{2}=0.25$.
if $v \rightarrow c^{-} \Rightarrow P_{R} \rightarrow \frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)}{2}=\frac{1+0}{2}=0.5$.
if $v=\operatorname{Md}\left(v_{2}\right) \Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)}{2}=\frac{1+0.5}{2}=0.75$.
if $v=n c \Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)}{2}=\frac{1+1}{2}=1$.
where $\operatorname{Md}\left(v_{1}\right)$ and $\operatorname{Md}\left(v_{2}\right)$ are the medians of the velocities probabilities distributions.

Additionally, we have $\mathcal{M}=M_{1}(0 \leq v<c)+M_{2}(c<v \leq n c)$, $\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$.
Now, let $P_{M}=\frac{P_{M 1}+P_{M 2}}{2}$ and it is equal to half of the sum of the complement of the cumulative probability that $0 \leq V \leq v_{1}$ in $M_{1}$ and the complement of the cumulative probability that $c<V \leq v_{2}$ in $M_{2}$.

$$
\begin{aligned}
\Rightarrow P_{M} & =\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}=\frac{2 i-i\left(P_{R 1}+P_{R 2}\right)}{2}=i-\frac{i\left(P_{R 1}+P_{R 2}\right)}{2}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}\right)}{2}\right]=i\left(1-P_{R}\right) \\
\Rightarrow P_{M} & =\frac{i\left[1-C D F_{1}\left(0 \leq V \leq v_{1}\right)\right]+i\left[1-C D F_{2}\left(c<V \leq v_{2}\right)\right]}{2} \\
& =\frac{i}{2}\left\{\int_{0}^{v 1}\left[1-P D F_{1}(v)\right] d v+\int_{c}^{v 2}\left[1-P D F_{2}(v)\right] d v\right\}=\frac{i}{2}\left\{\int_{v 1}^{c} P D F_{1}(v) d v+\int_{v 2}^{n c} P D F_{2}(v) d v\right\}
\end{aligned}
$$

Thus, we have in $\mathbf{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}=\mathbf{G}_{\mathbf{1}}+\mathbf{G}_{2}: 0 \leq v \leq n c$ with $v \neq c$.
So, if $0 \leq v<c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{2}(V<c)\right]=i(1-0)=i$

$$
\Rightarrow P_{M}=\frac{i\left[1-C D F_{1}(0 \leq V \leq v)\right]+i}{2}=\frac{i+P_{M 1}}{2}=i\left[1-\frac{P_{R 1}}{2}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}$ alone.

And if $c<v \leq n c \Rightarrow P_{M 1}=i\left[1-P_{r o b}(V>c)\right]=i\left[1-C D F_{1}(V>c)\right]=i(1-1)=0$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right]$

$$
\Rightarrow P_{M}=\frac{0+i\left[1-C D F_{2}(c<V \leq v)\right]}{2}=\frac{P_{M 2}}{2}=i\left[\frac{1-P_{R 2}}{2}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{2}$ alone.

And if
$0 \leq v \leq n c$ with $v \neq c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right] \Rightarrow$
$P_{M}=\frac{\left.i\left[1-C D F_{1}(0 \leq V<c)\right]+i 1-C D F_{2}(c<V \leq v)\right]}{2}=\frac{P_{M 1}+P_{M 2}}{2}=i\left[1-\frac{\left.P_{R 1}+P_{R 2}\right]}{2}\right]=i\left[1-P_{R}\right]$.
Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}+M_{2}$.

And consequently, we can deduce from the above the imaginary probability in the probability universe $\mathcal{M}=M_{1}+M_{2}$ for special velocity cases as follows:

$$
\begin{aligned}
& \text { if } v<0 \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(V<0)}{2}\right]=i\left[1-\frac{0}{2}\right]=i \Rightarrow P_{M} / i=1 . \\
& \text { if } v=\operatorname{Md}\left(v_{1}\right) \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)+C D F_{2}(V<c)}{2}\right]=i\left[1-\frac{0.5+0}{2}\right]=0.75 i \\
& \Rightarrow P_{M} / i=0.75
\end{aligned}
$$

$$
\text { if } v \rightarrow c^{-} \Rightarrow P_{M} \rightarrow i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)}{2}\right]=i\left[1-\frac{1+0}{2}\right]=0.5 i \Rightarrow P_{M} / i \rightarrow 0.5
$$

$$
\text { if } v=\operatorname{Md}\left(v_{2}\right) \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)}{2}\right]=i\left[1-\frac{1+0.5}{2}\right]=0.25 i
$$

$$
\Rightarrow P_{M} / i=0.25
$$

$$
\text { if } v=n c \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)}{2}\right]=i\left[1-\frac{1+1}{2}\right]=i(1-1)=0
$$

$$
\Rightarrow P_{M} / i=0
$$

where $\operatorname{Md}\left(v_{1}\right)$ and $\operatorname{Md}\left(v_{2}\right)$ are the medians of the velocities probabilities distributions.

Therefore, for any value of $0 \leq v \leq n c$ with $v \neq c$, we can write without any confusion that:
$P_{M 1}=i\left(1-P_{R 1}\right)$ and $P_{R 1}=1-P_{M 1} / i$; hence, $M_{1}$ is the imaginary complementary probability universe to the real probability universe $R_{1}$.

And $P_{M 2}=i\left(1-P_{R 2}\right)$ and $P_{R 2}=1-P_{M 2} / i$; hence, $M_{2}$ is the imaginary complementary probability universe to the real probability universe $R_{2}$.

Moreover, in all cases and for any value of $v: 0 \leq v \leq n c$ with $v \neq c$, we have:
$P_{R}=\frac{P_{R 1}+P_{R 2}}{2}$ where $\mathcal{R}=R_{1}+R_{2}$.
And $P_{M}=\frac{P_{M 1}+P_{M 2}}{2}$ where $\mathcal{M}=M_{1}+M_{2}$.
We can check that:
$P_{M}=\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}=\frac{2 i-i\left(P_{R 1}+P_{R 2}\right)}{2}=i-\frac{i\left(P_{R 1}+P_{R 2}\right)}{2}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}\right)}{2}\right]=i\left(1-P_{R}\right)$
Hence, $\mathcal{M}$ is the imaginary complementary probability universe to the real probability universe $\mathcal{R}$.

Moreover, we have in $\mathrm{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}$ where $0 \leq v \leq n c$ with $v \neq c$,

$$
\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)
$$

Then, $\mathcal{C}=\left(R_{1}+R_{2}\right)+\left(M_{1}+M_{2}\right)=\left(R_{1}+M_{1}\right)+\left(R_{2}+M_{2}\right)=\mathcal{C}_{1}+\mathcal{C}_{2}$.

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In fact, in $\mathcal{C}_{1}$ we have: $P c_{1}=P_{R 1}+P_{M 1} / i=P_{R 1}+\left(1-P_{R 1}\right)=1$.
And, in $\mathcal{C}_{2}$ we have: $P c_{2}=P_{R 2}+P_{M 2} / i=P_{R 2}+\left(1-P_{R 2}\right)=1$.
And, in $\mathcal{C}$ we have:

$$
\begin{aligned}
P c=P_{R}+P_{M} / i & =\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{P_{M 1}+P_{M 2}}{2}\right] / i=\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)}{2}\right] / i \\
& =\frac{P_{R 1}+P_{R 2}}{2}+\frac{\left(1-P_{R 1}\right)+\left(1-P_{R 2}\right)}{2}=\frac{P_{R 1}+P_{R 2}}{2}+1-\frac{P_{R 1}+P_{R 2}}{2} \\
& =1
\end{aligned}
$$

We can calculate $P c$ using this method also:

$$
\begin{aligned}
P c & =P_{R}+P_{M} / i \\
& =\frac{P_{R 1}+P_{R 2}}{2}+\left[\frac{P_{M 1}+P_{M 2}}{2}\right] / i=\frac{P_{R 1}+P_{M 1} / i}{2}+\frac{P_{R 2}+P_{M 2} / i}{2}=\frac{P c_{1}}{2}+\frac{P c_{2}}{2}=\frac{P c_{1}+P c_{2}}{2}=\frac{1+1}{2} \\
& =1
\end{aligned}
$$

Consequently: $P c=P c_{1}=P c_{2}=1$, in accordance with CPP axioms.
Furthermore, we can state now and affirm finally that in this third model:
$\mathbf{G}=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{\mathbf{2}}(c<v \leq n c)$ that means that the total universe $\mathbf{G}$ is the sum of the real subluminal universe $\mathrm{G}_{1}$ and the imaginary superluminal universe or metauniverse $\mathbf{G}_{2}$.

1. The real subluminal universe $\mathrm{G}_{1}$ corresponds to the complex probability universe $\mathcal{C}_{1}$, which is also subluminal; hence, $\mathrm{G}_{1}=\mathcal{C}_{1}=R_{1}+M_{1}$ with $(0 \leq v<c)$.
2. And the imaginary superluminal universe $\mathbf{G}_{2}$ or metauniverse corresponds to the complex probability universe $\mathcal{C}_{2}$, which is also superluminal; hence, $\mathbf{G}_{\mathbf{2}}=\mathcal{C}_{\mathbf{2}}=R_{2}+M_{2}$ with $(c<v \leq n c)$.

Therefore,

$$
\begin{aligned}
& P_{G 1}=P c_{1}=P_{R 1}+P_{M 1} / i=P_{R 1}+\left(1-P_{R 1}\right)=1 \text { and } \\
& P_{G 2}=P c_{2}=P_{R 2}+P_{M 2} / i=P_{R 2}+\left(1-P_{R 2}\right)=1 .
\end{aligned}
$$

Consequently, the complex total universe $\mathbf{G}=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{\mathbf{2}}(c<v \leq n c)$, which is the sum of the universe and the metauniverse corresponds to the complex probability universe $\mathcal{C}$ having:
$\mathbf{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}=\left(R_{1}+R_{2}\right)+\left(M_{1}+M_{2}\right)=\left(R_{1}+M_{1}\right)+\left(R_{2}+M_{2}\right)$
$=\mathcal{C}_{1}(0 \leq v<c)+\mathcal{C}_{2}(c<v \leq n c)=\mathbf{G}_{1}(0 \leq v<c)+\mathbf{G}_{2}(c<v \leq n c)$ with $0 \leq v \leq n c$ and $v \neq c$,

Hence,

$$
P_{G}=P c=\frac{P_{G 1}+P_{G 2}}{2}=\frac{P c_{1}+P c_{2}}{2}=\frac{1+1}{2}=1
$$

Consequently: $P c=1$, in accordance with $C P P$ axioms.
Thus, we can conclude that, by adding the complementary imaginary probabilities universes $M_{1}, M_{2}$ and $\mathcal{M}$ to the real probabilities universes $R_{1}, R_{2}$ and $\mathcal{R}$ then all
random phenomena in the complex probabilities' universes $\mathcal{C}_{1}, \mathcal{C}_{2}$, and $\mathcal{C}$, and hence in the subluminal universe $G_{1}$, in the superluminal universe $G_{2}$, and in the total and complex universe $\mathbf{G}$, become absolutely and perfectly deterministic with probabilities expressed totally as follows:
$P c=P c_{1}=P c_{2}=1$ and $P_{G}=P_{G 1}=P_{G 2}=1$.

### 2.2 The MCPP parameters of the third model

The MCPP parameters in this third model are similar to those of the first and second models and this is done by including the probabilities $P_{R}$ and $P_{M}$ corresponding to the third model.

### 2.3 The deterministic cases and the MCPP parameters of the third model

The deterministic cases in this third model are similar to those of the first and second models and this is done by taking into consideration the probabilities $P_{R}$ and $P_{M}$ pertaining and corresponding to the third model.

### 2.4 The third model simulations

We note that in the following simulations, $P_{R 3}$ is the real probability in the luminal universe $\mathbf{G}_{3}$ for $(v=c)$ in yellow in the simulations, where we have $\forall P_{R 3}: 0 \leq P_{R 3} \leq 1$, and that it will be included in the final most general model of MCPP. Thus, the current model is a simplified third model. The simulations from Figures 4-6 illustrate the more general third model of $M C P P$.


Figure 4.
The MCPP third model parameters and the Beta distribution for $n=2$ in $\boldsymbol{G}_{2}$.

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All the MCPP Probabilities and the Normal / Beta Distributions
in $G=G_{1}+G_{2}=C=C_{1}+C_{2}$


Figure 5.
The MCPP third model probabilities and the Normal / Beta distributions for $\mathrm{n}=2$ in G .


Figure 6.
The MCPP third model parameters and the normal / Beta distributions for $n=2$ in $\mathbf{G}$.

## 3. The final and most general model: including the case of electromagnetic waves

In this section, we will develop the final most general model of $M C P P$ with all its parameters [1-42].

### 3.1 The real and imaginary probabilities

Here, and in this final MCPP model, $f$ is the frequency of the electromagnetic waves in $\mathbf{G}_{3}$ since the velocity of all electromagnetic waves is always $c$ with $\left(L_{b}=0 \mathrm{~Hz}\right) \leq f \leq\left(U_{b}=10^{24} \mathrm{~Hz}\right)$ and is a random variable that follows any possible probability distribution: $\operatorname{PDF}_{3}\left(\bar{f}, \sigma_{f}\right)$. Knowing that $L_{b}$ is the lower bound of the frequency in the probability distribution and $U_{b}$ is the upper bound of the frequency in the probability distribution. Additionally, $\bar{f}$ is the mean or the expectation of this general probability distribution of $f$ or $P D F_{3}(f)$ and $\sigma_{f}$ is its corresponding standard deviation. Moreover, the annihilation of two real particles in $\mathrm{G}_{1}$ or of two imaginary particles in $G_{2}$ can lead to the creation of electromagnetic waves in $G=G_{1}+G_{3}+G_{2}$, just as proved in the theory of Metarelativity.

First, we will define and calculate the real and imaginary probabilities in the universes $R_{3}$ and $M_{3}$ in the final model of MCPP as follows:
$P_{R 3}=P_{r o b}\left(v=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=C D F_{3}\left(v=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=\int_{L_{b}}^{f_{E}} P D F_{3}(v=c, f) d f$
where $f_{E}$ is a certain value of the frequency $f$ of the electromagnetic wave.
So, we have the real probability in $R_{3}$ : if $v \neq c \Rightarrow P_{R 3}=C D F_{3}(v \neq c)=0$.
And if $v=c$ then:
If $f_{E} \leq L_{b} \Rightarrow P_{R 3}=P_{\text {rob }}\left(F \leq L_{b}\right)=C D F_{3}\left(F \leq L_{b}\right)=0$.
If $f_{E}=\operatorname{Md}(f) \Rightarrow P_{R 3}=P_{\text {rob }}\left(L_{b} \leq F \leq \operatorname{Md}(f)\right)=C D F_{3}\left(L_{b} \leq F \leq \operatorname{Md}(f)\right)=$ $\operatorname{Md}(f)$
$\int_{L_{b}} P D F_{3}(f) d f=0.5$.
where $\operatorname{Md}(f)$ is the median of the frequencies probability distribution.

$$
\begin{aligned}
& \text { If } f_{E}=U_{b} \Rightarrow P_{R 3}=P_{r o b}\left(L_{b} \leq F \leq U_{b}\right)=C D F_{3}\left(L_{b} \leq F \leq U_{b}\right)=\int_{L_{b}}^{U_{b}} P D F_{3}(f) d f=1 . \\
& \begin{aligned}
\text { If } f_{E}>U_{b}
\end{aligned} \\
& \qquad \begin{array}{l}
\Rightarrow P_{R 3}
\end{array}=P_{r o b}\left(F>U_{b}\right)=C D F_{3}\left(F>U_{b}\right) \\
& \quad=\int_{L_{b}}^{f_{E}} P D F_{3}(f) d f=\left\{\int_{L_{b}}^{U_{b}} P D F_{3}(f) d f+\int_{U_{b}}^{f_{E}} P D F_{3}(f) d f\right\}=(1+0)=1
\end{aligned}
$$

Moreover, we have for the imaginary probability in $M_{3}$ :
$P_{M 3}=i\left(1-P_{R 3}\right)=i\left[1-P_{\text {rob }}\left(L_{b} \leq F \leq f_{E}\right)\right]=i\left[1-C D F_{3}\left(L_{b} \leq F \leq f_{E}\right)\right]=$
$i C D F_{3}\left(f_{E}<F \leq U_{b}\right)=i\left[1-\int_{L_{b}}^{f_{E}} P D F_{3}(f) d f\right]=i \int_{f_{E}}^{U_{b}} P D F_{3}(f) d f$.

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So, if $v \neq c \Rightarrow P_{M 3}=i\left[1-C D F_{3}(v \neq c)\right]=i(1-0)=i \Rightarrow P_{M 3} / i=1$.
And if $v=c$ then:

$$
\begin{aligned}
& \text { If } f_{E} \leq L_{b} \Rightarrow P_{M 3}=i \int_{f_{E}}^{U_{b}} P D F_{3}(f) d f=i\left\{\int_{f_{E}}^{L_{b}} P D F_{3}(f) d f+\int_{L_{b}}^{U_{b}} P D F_{3}(f) d f\right\}= \\
& i(0+1)=i \Rightarrow P_{M 3} / i=1 \\
& \text { If } f_{E}=\operatorname{Md}(f) \Rightarrow P_{M 3}=i \times \int_{\operatorname{Md}(f)}^{U_{b}} P D F_{3}(f) d f=0.5 i \Rightarrow P_{M 3} / i=0.5 . \\
& \text { If } f_{E}=U_{b} \Rightarrow P_{M 3}=i \int^{U_{b}} P D F_{3}(f) d f=i \times 0=0 \Rightarrow P_{M 3} / i=0 . \\
& \text { If } f_{E}>U_{b} \Rightarrow P_{M 3}=0 \stackrel{U_{b}}{\Rightarrow} P_{M 3} / i=0 .
\end{aligned}
$$

Therefore, for any value of $f: L_{b} \leq f \leq U_{b}$, we can write without any confusion that:

$$
P_{M 3}=i\left(1-P_{R 3}\right) \text { and } P_{R 3}=1-P_{M 3} / i
$$

hence, $M_{3}$ is the imaginary complementary probability universe of frequencies to the real probability universe $R_{3}$ of frequencies.

Furthermore, we have

$$
\begin{gathered}
\mathcal{R}=R_{1}(0 \leq v<c)+R_{2}(c<v \leq n c)+R_{3}\left(v=c \text { and } L_{b} \leq f \leq U_{b}\right), \\
\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty) .
\end{gathered}
$$

Now, let $P_{R}=\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}$ and it is equal to the sum of the cumulative probability that $0 \leq V \leq v_{1}$ in $R_{1}$ and the cumulative probability that $c<V \leq v_{2}$ in $R_{2}$ and the cumulative probability that $v_{3}=c$ and $L_{b} \leq f \leq U_{b}$ in $R_{3}$, and all divided by 3 .

$$
\begin{aligned}
\Rightarrow P_{R} & =\frac{C D F_{1}\left(0 \leq V \leq v_{1}\right)+C D F_{2}\left(c<V \leq v_{2}\right)+C D F_{3}\left(V=v_{3}=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3} \\
& =\frac{1}{3}\left\{\int_{0}^{v 1} P D F_{1}(v) d v+\int_{c}^{v 2} P D F_{2}(v) d v+\int_{L_{b}}^{f_{E}} P D F_{3}\left(v_{3}=c, f\right) d f\right\}
\end{aligned}
$$

Hence, we have in $\mathbf{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}=\mathbf{G}_{\mathbf{1}}+\mathbf{G}_{\mathbf{2}}+\mathbf{G}_{3}: 0 \leq v \leq n c$ and $L_{b} \leq f \leq U_{b}$.
So, if $0 \leq v<c \Rightarrow P_{R 1}=P_{r o b}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{\text {rob }}(V \leq v)=P_{\text {rob }}(V<c)=C D F_{2}(V<c)=0$.
And $P_{R 3}=P_{\text {rob }}(V \neq c)=C D F_{3}(V \neq c)=0$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+0+0}{3}=\frac{C D F_{1}(0 \leq V \leq v)}{3}=\frac{P_{R 1}}{3}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}$ alone.

$$
\text { if } 0 \leq v \leq c \text { and } L_{b} \leq f \leq U_{b} \Rightarrow P_{R 1}=P_{r o b}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)
$$

And $P_{R 2}=P_{r o b}(V \leq v)=P_{\text {rob }}\left(V<c^{+}\right)=C D F_{2}\left(V<c^{+}\right)=0$.
And $P_{R 3}=P_{r o b}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=C D F_{3}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+0+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{P_{R 1}+P_{R 3}}{3}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}+R_{3}$.

And if $c<v \leq n c \Rightarrow P_{R 1}=P_{\text {rob }}(V>c)=C D F_{1}(V>c)=1$.
And $P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v)$.
And $P_{R 3}=P_{\text {rob }}(V \neq c)=\operatorname{CDF}_{3}(V \neq c)=0$

$$
\Rightarrow P_{R}=\frac{1+C D F_{2}(c<V \leq v)+0}{3}=\frac{1+P_{R 2}}{3}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{2}$ alone.

And if $c \leq v \leq n c$ and $L_{b} \leq f \leq U_{b} \Rightarrow P_{R 1}=P_{r o b}(V>c)=C D F_{1}(V>c)=1$.
And $P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v)$.
And $P_{R 3}=P_{\text {rob }}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=C D F_{3}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)$

$$
\Rightarrow P_{R}=\frac{1+C D F_{2}(c<V \leq v)+C D F_{3}\left(v=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{1+P_{R 2}+P_{R 3}}{3}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{2}+R_{3}$.

And if $0 \leq v \leq n c$ and $L_{b} \leq f \leq U_{b} \Rightarrow P_{R 1}=P_{r o b}(0 \leq V \leq v)=C D F_{1}(0 \leq V \leq v)$.
And $P_{R 2}=P_{\text {rob }}(c<V \leq v)=C D F_{2}(c<V \leq v)$.
And $P_{R 3}=P_{\text {rob }}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=C D F_{3}\left(V=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)$

$$
\Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V \leq v)+C D F_{2}(c<V \leq v)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}
$$

Therefore, we say here that we are working in the real probability universe $\mathcal{R}=R_{1}+R_{2}+R_{3}$.

And consequently, we can deduce from the above the real probability in the probability universe $\mathcal{R}=R_{1}+R_{2}+R_{3}$ for special velocity and frequency cases as follows:

$$
\begin{aligned}
& \text { if } v<0 \Rightarrow P_{R}=\frac{C D F_{1}(V<0)}{3}=\frac{0}{3}=0 . \\
& \text { if } v=\operatorname{Md}\left(v_{1}\right) \Rightarrow P_{R}=\frac{C D F_{1}\left(0 \leq V \leq M d\left(v_{1}\right)\right)+C D F_{2}(V<c)+C D F_{3}(V \neq c)}{3}=\frac{0.5+0+0}{3}=0.1667 . \\
& \text { if } v \rightarrow c^{-} \Rightarrow P_{R} \rightarrow \frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)+C D F_{3}(V \neq c)}{3}=\frac{1+0+0}{3}=0.3333 . \\
& \text { if } v=c \Rightarrow P_{R}=\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(V<c^{+}\right)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3} \\
& \\
& \quad=\frac{1+0+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{1+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}
\end{aligned}
$$

So, if $f_{E}=L_{b} \Rightarrow P_{R}=\frac{1+0+0}{3}=\frac{1}{3}=0.3333$.
if $f_{E}=\operatorname{Md}(f) \Rightarrow P_{R}=\frac{1+0+0.5}{3}=\frac{1.5}{3}=0.5$.
if $f_{E}=U_{b} \Rightarrow P_{R}=\frac{1+0+1}{3}=\frac{2}{3}=0.6667$.
if $v=\operatorname{Md}\left(v_{2}\right)$

$$
\begin{aligned}
\Rightarrow P_{R} & =\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3} \\
& =\frac{1+0.5+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{1.5+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}
\end{aligned}
$$

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So, if \(f_{E}=L_{b} \Rightarrow P_{R}=\frac{1+0.5+0}{3}=\frac{1.5+0}{3}=0.5\).
if \(f_{E}=\operatorname{Md}(f) \Rightarrow P_{R}=\frac{1+0.5+0.5}{3}=\frac{2}{3}=0.6667\).
if \(f_{E}=U_{b} \Rightarrow P_{R}=\frac{1+0.5+1}{3}=\frac{2.5}{3}=0.8333\).
if \(v=n c\)
```

$$
\begin{aligned}
\Rightarrow P_{R} & =\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3} \\
& =\frac{1+1+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}=\frac{2+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}
\end{aligned}
$$

So, if $f_{E}=L_{b} \Rightarrow P_{R}=\frac{1+1+0}{3}=\frac{2}{3}=0.6667$.
if $f_{E}=\operatorname{Md}(f) \Rightarrow P_{R}=\frac{1+1+0.5}{3}=\frac{2.5}{3}=0.8333$.
if $f_{E}=U_{b} \Rightarrow P_{R}=\frac{1+1+1}{3}=\frac{3}{3}=1$.
where $\operatorname{Md}\left(v_{1}\right)$ and $\operatorname{Md}\left(v_{2}\right)$ are the medians of the velocities probabilities distributions and $\operatorname{Md}(f)$ is the median of the frequencies probability distribution.

Furthermore, we have

$$
\begin{gathered}
\mathcal{M}=M_{1}(0 \leq v<c)+M_{2}(c<v \leq n c)+M_{3}\left(v=c \text { and } L_{b} \leq f \leq U_{b}\right), \\
\forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty) .
\end{gathered}
$$

Now, let $P_{M}=\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3}$ and it is equal to the sum of the complement of the cumulative probability that $0 \leq V \leq v_{1}$ in $M_{1}$ and the complement of the cumulative probability that $c<V \leq v_{2}$ in $M_{2}$ and the complement of the cumulative probability that $v_{3}=c$ and $L_{b} \leq f \leq U_{b}$ in $M_{3}$, and all divided by 3 .

$$
\begin{aligned}
\Rightarrow P_{M} & =\frac{i\left[1-C D F_{1}\left(0 \leq V \leq v_{1}\right)\right]+i\left[1-C D F_{2}\left(c<V \leq v_{2}\right)\right]+i\left[1-C D F_{3}\left(V=v_{3}=c \text { and } L_{b} \leq F \leq f_{E}\right)\right]}{3} \\
& =\frac{i}{3}\left\{\int_{0}^{v 1}\left[1-P D F_{1}(v)\right] d v+\int_{c}^{v 2}\left[1-P D F_{2}(v)\right] d v+\int_{L_{b}}^{f_{E}}\left[1-P D F_{3}\left(v_{3}=c, f\right)\right] d f\right\} \\
& =\frac{i}{3}\left\{\int_{v 1}^{c} P D F_{1}(v) d v+\int_{v 2}^{n c} P D F_{2}(v) d v+\int_{f_{E}}^{U_{b}} P D F_{3}\left(v_{3}=c, f\right) d f\right\} \\
\Rightarrow P_{M} & =\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)+i\left(1-P_{R 3}\right)}{3} \\
& =\frac{3 i-i\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}=i-\frac{i\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}\right]=i\left(1-P_{R}\right)
\end{aligned}
$$

We have in $\mathbf{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}=\mathbf{G}_{\mathbf{1}}+\mathbf{G}_{\mathbf{2}}+\mathbf{G}_{\mathbf{3}}: 0 \leq v \leq n c$ and $L_{b} \leq f \leq U_{b}$.
So, if $0 \leq v<c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{r o b}(0 \leq V \leq v)\right]=i\left[1-C D F_{2}(V<c)\right]=i(1-0)=i$.
And $P_{M 3}=i\left[1-P_{\text {rob }}(V \neq c)\right]=i\left[1-\right.$ CDF $\left._{3}(V \neq c)\right]=i(1-0)=i$

$$
\Rightarrow P_{M}=\frac{i\left[1-C D F_{1}(0 \leq V \leq v)\right]+i+i}{3}=\frac{2 i+P_{M 1}}{3}=i\left[1-\frac{P_{R 1}}{3}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}$ alone.
if $0 \leq v \leq c$ and $L_{b} \leq f \leq U_{b} \Rightarrow P_{M 1}=i\left[1-P_{r o b}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{2}\left(V<c^{+}\right)\right]=i(1-0)=i$.
And $P_{M 3}=i\left[1-P_{\text {rob }}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]=$
$i\left[1-C D F_{3}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]$

$$
\begin{aligned}
\Rightarrow P_{M} & =\frac{i\left[1-C D F_{1}(0 \leq V \leq v)\right]+i+i\left[1-C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)\right]}{3} \\
& =\frac{i+\left(P_{M 1}+P_{M 3}\right)}{3}=i\left[1-\frac{P_{R 1}+P_{R 3}}{3}\right]
\end{aligned}
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}+M_{3}$.

And if $c<v \leq n c \Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(V>c)\right]=i\left[1-C D F_{1}(V>c)\right]=i(1-1)=0$
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right]$.
And $P_{M 3}=i\left[1-P_{\text {rob }}(V \neq c)\right]=i\left[1-\right.$ CDF $\left._{3}(V \neq c)\right]=i(1-0)=i$

$$
\Rightarrow P_{M}=\frac{0+i\left[1-C D F_{2}(c<V \leq v)\right]+i}{3}=\frac{i+P_{M 2}}{3}=i\left[\frac{2-P_{R 2}}{3}\right]
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{2}$ alone.

And if $c \leq v \leq n c$ and $L_{b} \leq f \leq U_{b}$

$$
\Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(V>c)\right]=i\left[1-C D F_{1}(V>c)\right]=i(1-1)=0
$$

And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right]$.
And $P_{M 3}=i\left[1-P_{\text {rob }}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]=i\left[1-C D F_{3}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]$

$$
\begin{aligned}
\Rightarrow P_{M} & =\frac{0+i\left[1-C D F_{2}(c<V \leq v)\right]+i\left[1-C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)\right]}{3}=\frac{P_{M 2}+P_{M 3}}{3} \\
& =i\left[\frac{2-\left(P_{R 2}+P_{R 3}\right)}{3}\right]
\end{aligned}
$$

Therefore, we say here that we are working in the imaginary probability universe $\boldsymbol{M}=M_{2}+M_{3}$.

And if $0 \leq v \leq n c$ and $L_{b} \leq f \leq U_{b}$
$\Rightarrow P_{M 1}=i\left[1-P_{\text {rob }}(0 \leq V \leq v)\right]=i\left[1-C D F_{1}(0 \leq V \leq v)\right]$.
And $P_{M 2}=i\left[1-P_{\text {rob }}(c<V \leq v)\right]=i\left[1-C D F_{2}(c<V \leq v)\right]$.
And $P_{M 3}=i\left[1-P_{\text {rob }}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]=$
$i\left[1-C D F_{3}\left(V=c\right.\right.$ and $\left.\left.L_{b} \leq F \leq f_{E}\right)\right]$

$$
\begin{aligned}
\Rightarrow P_{M} & =\frac{i\left[1-C D F_{1}(0 \leq V<c)\right]+i\left[1-C D F_{2}(c<V \leq v)\right]+i\left[1-C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)\right]}{3} \\
& =\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3}=i\left[1-\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}\right]=i\left[1-P_{R}\right]
\end{aligned}
$$

Therefore, we say here that we are working in the imaginary probability universe $\mathcal{M}=M_{1}+M_{2}+M_{3}$.

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And consequently, we can deduce from the above the imaginary probability in the probability universe $\mathcal{M}=M_{1}+M_{2}+M_{3}$ for special velocity and frequency cases as follows:

$$
\begin{aligned}
& \text { if } v<0 \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(V<0)}{3}\right]=i\left[1-\frac{0}{3}\right]=i \Rightarrow P_{M} / i=1 . \\
& \quad \text { if } v=\operatorname{Md}\left(v_{1}\right) \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}\left(0 \leq V \leq \operatorname{Md}\left(v_{1}\right)\right)+C D F_{2}(V<c)+C D F_{3}(V \neq c)}{3}\right]= \\
& i\left[1-\frac{0.5+0+0}{3}\right]=0.8333 i \Rightarrow P_{M} / i=0.8333 . \\
& \quad \text { if } v \rightarrow c^{-} \Rightarrow P_{M} \rightarrow i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(V<c)+C D F_{3}(V \neq c)}{3}\right]= \\
& i\left[1-\frac{1+0+0}{3}\right]=\frac{2 i}{3}=0.6667 i \Rightarrow P_{M} / i \rightarrow 0.6667 . \\
& \quad \text { if } v=c
\end{aligned} \quad \begin{aligned}
& \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(V<c^{+}\right)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right] \\
& \quad=i\left[1-\frac{1+0+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]=i\left[\frac{2-C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]
\end{aligned}
$$

So, if $f_{E}=L_{b} \Rightarrow P_{M}=i\left[\frac{2-0}{3}\right]=0.6667 i \Rightarrow P_{M} / i=0.6667$.
if $f_{E}=\operatorname{Md}(f) \Rightarrow P_{M}=i\left[\frac{2-0.5}{3}\right]=0.5 i \Rightarrow P_{M} / i=0.5$.
if $f_{E}=U_{b} \Rightarrow P_{M}=i\left[\frac{2-1}{3}\right]=0.3333 i \Rightarrow P_{M} / i=0.3333$.
If $v=\operatorname{Md}\left(v_{2}\right) \Rightarrow P_{M}=i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}\left(c<V \leq \operatorname{Md}\left(v_{2}\right)\right)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]$

$$
=i\left[1-\frac{1+0.5+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]=i\left[0.5-\frac{C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right] .
$$

So, if $f_{E}=L_{b} \Rightarrow P_{M}=i\left[0.5-\frac{0}{3}\right]=0.5 i \Rightarrow P_{M} / i=0.5$.
if $f_{E}=\operatorname{Md}(f) \Rightarrow P_{M}=i\left[0.5-\frac{0.5}{3}\right]=0.3333 i \Rightarrow P_{M} / i=0.3333$.
if $f_{E}=U_{b} \Rightarrow P_{M}=i\left[0.5-\frac{1}{3}\right]=0.1667 i \Rightarrow P_{M} / i=0.1667$.
if $v=n c$

$$
\begin{aligned}
\Rightarrow P_{M} & =i\left[1-\frac{C D F_{1}(0 \leq V<c)+C D F_{2}(c<V \leq n c)+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right] \\
& =i\left[1-\frac{1+1+C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]=i\left[\frac{1-C D F_{3}\left(V=c \text { and } L_{b} \leq F \leq f_{E}\right)}{3}\right]
\end{aligned}
$$

So, if $f_{E}=L_{b} \Rightarrow P_{M}=i\left[\frac{1-0}{3}\right]=\frac{i}{3}=0.3333 i \Rightarrow P_{M} / i=0.3333$.
if $f_{E}=\operatorname{Md}(f) \Rightarrow P_{M}=i\left[\frac{1-0.5}{3}\right]=0.1667 i \Rightarrow P_{M} / i=0.1667$.
if $f_{E}=U_{b} \Rightarrow P_{M}=i\left[\frac{1-1}{3}\right]=0 \Rightarrow P_{M} / i=0$.
where $\operatorname{Md}\left(v_{1}\right)$ and $\operatorname{Md}\left(v_{2}\right)$ are the medians of the velocities probabilities distributions and $\operatorname{Md}(f)$ is the median of the frequencies probability distribution.

Therefore, for any value of $0 \leq v \leq n c$, we can write without any confusion that:
$P_{M 1}=i\left(1-P_{R 1}\right)$ and $P_{R 1}=1-P_{M 1} / i$; hence, $M_{1}$ is the imaginary complementary probability universe to the real probability universe $R_{1}$.

And $P_{M 2}=i\left(1-P_{R 2}\right)$ and $P_{R 2}=1-P_{M 2} / i$; hence, $M_{2}$ is the imaginary complementary probability universe to the real probability universe $R_{2}$.

And $P_{M 3}=i\left(1-P_{R 3}\right)$ and $P_{R 3}=1-P_{M 3} / i$; hence, $M_{3}$ is the imaginary complementary probability universe to the real probability universe $R_{3}$.

Moreover, in all cases and for any value of $v: 0 \leq v \leq n c$, we have:
$P_{R}=\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}$ where $\mathcal{R}=R_{1}+R_{2}+R_{3}$.
And $P_{M}=\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3}$ where $\boldsymbol{\mathcal { M }}=M_{1}+M_{2}+M_{3}$.

Thus, we can check that:

$$
\begin{aligned}
P_{M} & =\frac{i\left(1-P_{R 1}\right)+i\left(1-P_{R 2}\right)+i\left(1-P_{R 3}\right)}{3} \\
& =\frac{3 i-i\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}=i-\frac{i\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}=i\left[1-\frac{\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}\right]=i\left(1-P_{R}\right)
\end{aligned}
$$

Hence, $\mathcal{M}$ is the imaginary complementary probability universe to the real probability universe $\mathcal{R}$.

Furthermore, we can state now and affirm finally that in this final MCPP model:
$\mathbf{G}=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{\mathbf{2}}(c<v \leq n c)+\mathbf{G}_{\mathbf{3}}(v=c)$ that means that the total universe $\mathbf{G}$ is the sum of the real subluminal universe $\mathbf{G}_{\mathbf{1}}$ and the imaginary superluminal universe or metauniverse $G_{2}$ in addition to the electromagnetic waves' universe $G_{3}$, which stands between $\mathrm{G}_{1}$ and $\mathrm{G}_{2}$.

1. The real subluminal universe $\mathrm{G}_{1}$ corresponds to the complex probability universe $\mathcal{C}_{1}$, which is also subluminal; hence, $\mathrm{G}_{1}=\mathcal{C}_{1}=R_{1}+M_{1}$ with $(0 \leq v<c)$.
2. The imaginary superluminal universe $\mathbf{G}_{2}$ or metauniverse corresponds to the complex probability universe $\mathcal{C}_{2}$, which is also superluminal; hence, $\mathbf{G}_{2}=\mathcal{C}_{2}=R_{2}+M_{2}$ with $(c<v \leq n c), \forall n, n \in \mathbb{R}^{+}: n>1 \Leftrightarrow n \in(1,+\infty)$.
3. In addition, the luminal universe $\mathrm{G}_{3}$ of electromagnetic waves corresponds to the complex probability universe $\mathcal{C}_{3}$ of frequencies, which is also luminal; hence, $\mathbf{G}_{3}=\mathcal{C}_{3}=R_{3}+M_{3}$ with $\left(v=c\right.$ and $\left.L_{b} \leq f \leq U_{b}\right)$.

Therefore,

$$
\begin{gathered}
P_{G 1}=P c_{1}=P_{R 1}+P_{M 1} / i=P_{R 1}+\left(1-P_{R 1}\right)=1 \text { and } \\
P_{G 2}=P c_{2}=P_{R 2}+P_{M 2} / i=P_{R 2}+\left(1-P_{R 2}\right)=1 \text { and } \\
P_{G 3}=P c_{3}=P_{R 3}+P_{M 3} / i=P_{R 3}+\left(1-P_{R 3}\right)=1 .
\end{gathered}
$$

Consequently, the complex total universe

$$
\mathbf{G}=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{2}(0<v \leq n c)+\mathbf{G}_{\mathbf{3}}(v=c),
$$

which is the sum of the universe and the metauniverse and the luminal electromagnetic waves universe and which corresponds to the complex probability universe $\mathcal{C}$ having:
$\mathbf{G}=\mathcal{C}=\boldsymbol{\mathcal { R }}+\boldsymbol{\mathcal { M }}=\left(R_{1}+R_{2}+R_{3}\right)+\left(M_{1}+M_{2}+M_{3}\right)=\left(R_{1}+M_{1}\right)+\left(R_{2}+M_{2}\right)+$ $\left(R_{3}+M_{3}\right)$
$=\mathcal{C}_{1}(0 \leq v<c)+\mathcal{C}_{2}(c<v \leq n c)+\mathcal{C}_{3}\left(v=c\right.$ and $\left.L_{b} \leq f \leq U_{b}\right)$
$=\mathbf{G}_{\mathbf{1}}(0 \leq v<c)+\mathbf{G}_{\mathbf{2}}(c<v \leq n c)+\mathbf{G}_{\mathbf{3}}\left(v=c\right.$ and $\left.L_{b} \leq f \leq U_{b}\right)$.
Hence,

$$
P_{G}=P c=\frac{P_{G 1}+P_{G 2}+P_{G 3}}{3}=\frac{P c_{1}+P c_{2}+P c_{3}}{3}=\frac{1+1+1}{3}=1
$$

Additionally,

$$
P_{G}=P_{R}+P_{M} / i=P_{R}+\left(1-P_{R}\right)=1
$$

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Consequently, $P c=P c_{1}=P c_{2}=P c_{3}=1$ in accordance with CPP axioms.
Thus, we can conclude that, by adding the complementary imaginary probabilities universes $M_{1}, M_{2}, M_{3}$, and $\mathcal{M}$ to the real probabilities' universes $R_{1}, R_{2}, R_{3}$ and $\mathcal{R}$ then all random phenomena in the complex probabilities' universes $\mathcal{C}_{1}, \mathcal{C}_{2}, \mathcal{C}_{3}$, and $\mathcal{C}$, and hence in the subluminal universe $\mathrm{G}_{1}$, in the superluminal universe $\mathrm{G}_{2}$, in the luminal universe $\mathbf{G}_{3}$ of electromagnetic waves, and in the total and complex universe $\mathbf{G}$, become absolutely and perfectly deterministic with probabilities expressed totally as follows:
$P c=P c_{1}=P c_{2}=P c_{3}=1$ and $P_{G}=P_{G 1}=P_{G 2}=P_{G 3}=1$.

### 3.2 The MCPP parameters in $\mathrm{G}_{3}=\mathcal{C}_{3}=R_{3}+M_{3}$

In this section, we will determine and calculate all the MCPP parameters in $\mathrm{G}_{3}$ as follows:

The real probabilities in $\mathcal{R}=R_{3}: P_{R 3}=P_{\text {rob }}\left(v=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=$
$C D F_{3}\left(v=c\right.$ and $\left.L_{b} \leq F \leq f_{E}\right)=\int_{L_{b}}^{f_{E}} P D F_{3}(v=c, f) d f$ for any value of $f: L_{b} \leq f \leq U_{b}$.
The imaginary complementary probabilities in $\mathcal{M}=M_{3}$ :

$$
P_{M 3}=i\left(1-P_{R 3}\right)
$$

The real complementary probabilities in $\mathcal{R}=R_{3}$ :

$$
P_{M 3} / i=1-P_{R 3}
$$

The complex random vector:

$$
Z_{3}=P_{R 3}+P_{M 3}
$$

The degree of our knowledge:

$$
D O K_{3}=\left|Z_{3}\right|^{2}=\left|P_{R 3}+P_{M 3}\right|^{2}=P_{R 3}^{2}+\left[P_{M 3} / i\right]^{2}=P_{R 3}^{2}+\left[1-P_{R 3}\right]^{2}
$$

The chaotic factor:

$$
\operatorname{Chf}_{3}=2 i P_{R 3} P_{M 3}=2 i P_{R 3} i\left(1-P_{R 3}\right)=2 i^{2} P_{R 3}\left(1-P_{R 3}\right)=-2 P_{R 3}\left(1-P_{R 3}\right)
$$

The magnitude of the chaotic factor:
$M$ Chf $_{3}=\mid$ Chf $_{3} \mid=-2 i P_{R 3} P_{M 3}=-2 i P_{R 3} i\left(1-P_{R 3}\right)=-2 i^{2} P_{R 3}\left(1-P_{R 3}\right)=2 P_{R 3}\left(1-P_{R 3}\right)$
The deterministic probability in $\mathbf{G}_{3}=\mathcal{C}_{3}=R_{3}+M_{3}$ :

$$
\begin{aligned}
P c_{3}^{2} & =\left[P_{R 3}+P_{M 3} / i\right]^{2}=\left[P_{R 3}+\left(1-P_{R 3}\right)\right]^{2}=1^{2}=1 \\
& =D O K_{3}-\text { Chf }_{3}=1 \\
& =D O K_{3}+M C h f_{3}=1 \\
& =P c_{3}
\end{aligned}
$$

### 3.3 The final MCPP parameters in $\mathrm{G}=\mathrm{G}_{1}+\mathrm{G}_{2}+\mathrm{G}_{3}=\mathcal{C}=\mathcal{C}_{1}+\mathcal{C}_{2}+\mathcal{C}_{3}=\mathcal{R}+\mathcal{M}$ of the final and most general model

The MCPP parameters in this final and most general model are similar to those of the first and second and third models and this is done by including the probabilities $P_{R}$ and $P_{M}$ corresponding to the final model. These paradigm parameters are determined and computed as follows:

The real probabilities in $\mathcal{R}=R_{1}+R_{2}+R_{3}: P_{R}=\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}$.
The imaginary complementary probabilities in $\mathcal{M}=M_{1}+M_{2}+M_{3}$ :

$$
P_{M}=\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3}=i\left(1-P_{R}\right)=i\left[1-\frac{\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}\right]
$$

The real complementary probabilities in $\mathcal{R}=R_{1}+R_{2}+R_{3}$ :

$$
P_{M} / i=\left[\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3}\right] / i=\frac{P_{M 1} / i+P_{M 2} / i+P_{M 3} / i}{3}=i\left(1-P_{R}\right) / i=1-\frac{\left(P_{R 1}+P_{R 2}+P_{R 3}\right)}{3}
$$

The complex random vectors:

$$
\begin{aligned}
Z & =\frac{Z_{1}+Z_{2}+Z_{3}}{3}=\frac{\left(P_{R 1}+P_{M 1}\right)+\left(P_{R 2}+P_{M 2}\right)+\left(P_{R 3}+P_{M 3}\right)}{3}=\frac{P_{R 1}+P_{R 2}+P_{R 3}}{3}+\frac{P_{M 1}+P_{M 2}+P_{M 3}}{3} \\
& =P_{R}+P_{M}
\end{aligned}
$$

The degree of our knowledge:

$$
D O K=|Z|^{2}=\left|P_{R}+P_{M}\right|^{2}=P_{R}^{2}+\left[P_{M} / i\right]^{2}=P_{R}^{2}+\left[1-P_{R}\right]^{2}
$$

The chaotic factor:

$$
\text { Chf }=2 i P_{R} P_{M}=2 i P_{R} i\left(1-P_{R}\right)=2 i^{2} P_{R}\left(1-P_{R}\right)=-2 P_{R}\left(1-P_{R}\right)
$$

The magnitude of the chaotic factor:

$$
M C h f=|C h f|=-2 i P_{R} P_{M}=-2 i P_{R} i\left(1-P_{R}\right)=-2 i^{2} P_{R}\left(1-P_{R}\right)=2 P_{R}\left(1-P_{R}\right)
$$

The deterministic probability in $\mathbf{G}=\mathcal{C}$

$$
\begin{aligned}
P c^{2} & =\left[P_{R}+P_{M} / i\right]^{2}=\left[P_{R}+\left(1-P_{R}\right)\right]^{2}=1^{2}=1 \\
& =D O K-C h f=1 \\
& =D O K+M C h f=1 \\
& =P c
\end{aligned}
$$

### 3.4 The deterministic cases and the MCPP parameters of the final model

The deterministic cases in this final model are similar to those of the first and second and third models and this is done by taking into consideration the probabilities $P_{R}$ and $P_{M}$ pertaining to and corresponding to the final model.

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### 3.5 The simulations in the universe $\mathrm{G}_{3}=\mathcal{C}_{3}=R_{3}+M_{3}$

All the simulations from Figures 7-10 illustrate MCPP in the luminal universe $\mathbf{G}_{3}$ of electromagnetic waves.


Figure 7.
The MCPP final model parameters and the normal distribution in $G_{3}$.


Figure 8.
The MCPP final model parameters and the Beta distribution in $G_{3}$.


Figure 9.
The MCPP final model parameters and the Rayleigh distribution in $G_{3}$.

All the MCPP Parameters and the Uniform Distribution


Figure 10.
The MCPP final model parameters and the uniform distribution in $G_{3}$.

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## 4. Some very important consequences and advantages of the MCPP paradigm

In this section, we will examine, determine, and deduce some very important consequences and advantages of MCPP that have been developed in the previous sections of the two chapters.

### 4.1 Dark matter and dark energy

According to Astronomical Observations [40-42]:
The total mass-energy of the universe contains $5 \%$ ordinary matter and energy, $27 \%$ dark matter, and $68 \%$ of a form of energy known as dark energy. Thus, dark matter constitutes $85 \%$ of total mass, while dark energy plus dark matter constitutes 95\% of total mass-energy content.
$\Rightarrow$ Dark Matter $=$ Metamatter in $\mathrm{G}_{2}$.
$\Rightarrow$ Dark Energy $=$ Metaenergy in $\mathbf{G}_{2}$.
$\mathrm{G}=\mathrm{G}_{1}+\mathbf{E W}+\mathrm{G}_{2}$
$=3 / 3=1=100 \%$
$\cong 2 / 3\left\{ \pm i\left|E_{G 2}\right|=1 / 3\left[+i\left|E_{G 2}\right|\right]+\mathbf{1} / 3\left[-i\left|E_{G 2}\right|\right]\right\}=\mathbf{6 6 . 6 6 \%}$ dark energy in $\mathbf{G}_{2}$
$+\cong 1 / 3(1 / 30+9 / 30=10 / 30)=33.33 \%$.
Iceberg similarity:
$\cong 10 \%$ of $1 / 3=1 / 30=3.33 \%$ ordinary matter and energy in $G_{1}$.
$\cong 90 \%$ of $1 / 3=9 / 30=30 \%$ dark matter in $\mathbf{G}_{2}$.
Then $\cong 2 / 3+9 / 30=87 / 90=96.6667 \%$ of the total mass-energy content in G $=($ dark energy + dark matter $)$ in $\mathrm{G}_{2}$ (refer to Figure 11).

### 4.2 Solution of the cause-effect paradox

As it is known, we have always in the subluminal universe $\mathrm{G}_{1}$ (our ordinary "real" universe) the effect of any action following the cause of this action. In fact, physicists noted that if tachyons travel in the past then we will have the action cause following


Figure 11.
The total universe $\boldsymbol{G}=\boldsymbol{G}_{\mathbf{1}}+\boldsymbol{E W}+\boldsymbol{G}_{\mathbf{2}}$ similar to an iceberg.

the action effect, which is certainly absurd. In fact, the solution of this riddle and paradox follows directly from Metarelativity, where we have $t \leq 0$ is one possible solution in $\mathbf{G}_{2}$, then metaparticles or tachyons travel in the past in the "imaginary" superluminal metauniverse $\mathbf{G}_{2}$ where $t \leq 0$ relative to the "real" subluminal universe $\mathbf{G}_{1}$, where $t \geq 0$ (Figure 12). This means the following:

1. No action effect before action cause in the universe $\mathrm{G}_{1}$ since faster-than-light particles travel in the metauniverse $\mathbf{G}_{2}$ and not in the universe $\mathbf{G}_{1}$
2. Instantaneous effect on the present in the universe $\mathbf{G}_{\mathbf{1}}$ since metaparticles travel in the metauniverse $\mathbf{G}_{2}$ and in the relative past of the universe $\mathbf{G}_{1}$; hence, the instantaneous effect of the past in $\mathbf{G}_{2}$ on the present in $\mathbf{G}_{1}$ as it is shown in the figure above since the past has already occurred and its consequences and results are direct and immediate on the present and current instant.

### 4.3 Solution of Einstein-Podolsky-Rosen (EPR) paradox or of quantum entanglement

As a consequence of the previous Section 4.2 is the solution of the very famous $E P R$ paradox that states if quantum entanglement were true than there should be faster-than-light particles, which are forbidden by classical Einstein's relativity. Metarelativity solves also this paradox. In fact, as it was mentioned, tachyons that travel in the past of $\mathbf{G}_{2}$ relatively to $\mathbf{G}_{1}$ have therefore instantaneous effect on $\mathbf{G}_{1}$. This consequence of MCPP explains and supports totally Alain Aspect's experiment and results on the instantaneous quantum entanglement of particles in $\mathbf{G}_{1}$ through the interchange of metaparticles or tachyons in $\mathbf{G}_{2}$, whose effect on the present is instantaneous in $\mathbf{G}_{\mathbf{1}}$ since they travel relatively to $\mathbf{G}_{\mathbf{1}}$ in the past in $\mathbf{G}_{\mathbf{2}}$ (since $t \leq 0$ is one possible solution in $\mathrm{G}_{2}$ ) (Figure 13).

### 4.4 Gravitational effect of $\mathrm{G}_{2}$ on $\mathrm{G}_{1}$ in G

As it was proved in metarelativity [1], light is the limit and the constant velocity in both $\mathbf{G}_{1}$ and $\mathbf{G}_{\mathbf{2}}$ (refer to Section 4.7 in Chapter 1). Consequently, gravitation behaves relatively to matter in $\mathbf{G}_{\mathbf{1}}$ just like to metamatter in $\mathbf{G}_{\mathbf{2}}$ since it has the speed of light. Therefore, metamatter exerts gravitational effects on the matter just like ordinary matter as a result of this fact. It is the effect of metamatter on matter that we observe inside and outside galaxies. Consequently, the dark matter, which is metamatter can attract ordinary matter. This is what we are actually observing in astronomy.

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Figure 13.
Quantum entanglement of particles in the real universe $\boldsymbol{G}_{\boldsymbol{1}}$.

Therefore,
$1 . \Rightarrow$ Gravitational waves travel with the velocity of light.
2. $\Rightarrow$ Light is constant and is the limit velocity in both $\mathbf{G}_{\mathbf{1}}$ and $\mathbf{G}_{2}$.
$\Rightarrow$ The gravitational effect of metamatter in $\mathbf{G}_{2}$ on ordinary matter in $\mathbf{G}_{1}$.

### 4.5 Beneath the geometric point and beyond the infinity of time

In the Metarelativistic transformations, velocity becomes larger than the velocity of light and new Metarelativisitc equations are used to express the behavior of matter (or metamatter) inside it. In fact, starting from zero, when velocity increases, time starts to dilate as it is shown in the equation $T^{\prime}=T / \sqrt{1-\frac{v^{2}}{c^{2}}}$ and space to contract as it is shown in the equation $L^{\prime}=L \sqrt{1-\frac{v^{2}}{c^{2}}}$ and according to the well-known EinsteinLorentz mathematical equations. If $v \rightarrow c$ then $L^{\prime} \rightarrow 0$ that means when reaching the velocity of light, length at the end of contraction reaches its limits and becomes equal to zero. When velocity surpasses the barrier of light, space can start expanding as it is shown in the equation: $L^{\prime}=i \times L \sqrt{\frac{v^{2}}{c^{2}}-1}$, or it can start contracting again as it is shown in the equation: $L^{\prime}=-i \times L \sqrt{\frac{v^{2}}{c^{2}}-1}$, and this after it has reached the dimensions zero which are the dimensions of a geometric point. As a matter of fact, Euclid defined in his ELEMENTS [43] the geometric point as a geometrical entity of dimensions zero. What is smaller than zero in algebra are negative numbers. What is smaller than the geometric zero is new to us. In fact, particles in the atomic world have dimensions and the smallest particles to our knowledge are the quarks, which are the constituents of protons and neutrons. Even strings, the smallest postulated entities in String Theory, have dimensions greater than zero. Surely the dimensions of the quarks are smaller than the dimensions of protons and neutrons but they still have
dimensions how small as they can be, but never the dimensions of a geometric point because zero is nothing in physics and it could not contain neither matter nor energy, except photons: photons move at the velocity of light and could never have dimensions because nature forbids that a moving body having the velocity of light has any length. The last fact was shown by Einstein in the theory of special relativity. Therefore, we can say that when space reaches zero dimensions (when $v=c$ ) it has reached the end of the shrinking process and what is smaller than zero in the four real dimensions of the universe $\mathbf{G}_{\mathbf{1}}$ is the zero in the four imaginary dimensions of the metauniverse $\mathbf{G}_{2}$. Hence, after reaching zero in $\mathbf{G}_{1}$, space starts here in the metauniverse from zero to expand opening the field to new four imaginary dimensions as it is shown in the equation derived from the theory of Metarelativity, which is: $L^{\prime}=i \times L \sqrt{\frac{v^{2}}{c^{2}}-1}$, or it can start to contract again as it is shown in the equation: $L^{\prime}=-i \times L \sqrt{\frac{v^{2}}{c^{2}}-1}$.

Moreover, starting from zero, if speed continues to increase, time will continue to dilate in special relativity as it is shown in the equation $T^{\prime}=T / \sqrt{1-\frac{v^{2}}{c^{2}}}$. If $v \rightarrow c$ then $T^{\prime} \rightarrow+\infty$ that means that if velocity reaches the velocity of light, therefore time reaches infinity. In fact, infinity in mathematics is the greatest "number" that we can ever reach while counting but we can never reach. To be more accurate, it is a symbol more than a number, since no computer could reach infinity. Infinity is not finite by nature. Infinity is extensively used in mathematics like in series and in sequences in calculus. This is why light is said to be the limit velocity and the barrier between the two geometries: the universe $\mathbf{G}_{\mathbf{1}}$ and the metauniverse $\mathbf{G}_{2}$. In fact, if $v \rightarrow c$ then $T^{\prime} \rightarrow+\infty$ and if the velocity surpasses the velocity of light: $v>c$, then time has to surpass infinity in the "real" subluminal universe $\mathrm{G}_{1}: T^{\prime}>+\infty$ and hence we start counting time anew but now in the new "imaginary" superluminal metauniverse $\mathbf{G}_{2}$. The counting is done now using clocks set up in the metauniverse or in the four imaginary dimensions that we have already discovered in the previous metarelativistic transformations. We precise again that the new dimensions are imaginary in the sense that they contain the imaginary number $i$. The time measurement can start now counterclockwise because it is negative and time is said to be dilating again since $T^{\prime}=-i \times T / \sqrt{\frac{v^{2}}{c^{2}}-1}$ or it can start clockwise because it is positive and time is said to be contracting since $T^{\prime}=i \times T / \sqrt{\frac{v^{2}}{c^{2}}-1}$ and this depends on the sign before the imaginary number $i$.

Accordingly, as we have noticed, the metauniverse is truly at a different level of experience, it is in fact beneath the atomic world when speaking about space (dimensions smaller than zero) and beyond infinity when speaking about time. In fact, we may ask where is this metauniverse if it is beyond infinity and beneath zero? The answer is evident and it is shown in the equations: in other dimensions, which form the meta-space-time of the metauniverse $\mathbf{G}_{2}$, in the world of the imaginary number $i$. If a new matter is indirectly detected (like dark matter) then Metarelativity is able to explain it and it takes into consideration its existence because no directly detectable and visible matter was found. Only its gravitational effect can be detected in $\mathbf{G}_{1}$. So, it should be another kind of matter, faster than light and unseen by our telescopes and accelerators. Thus, it should lay somewhere in space-time and this somewhere is the metauniverse $\mathrm{G}_{2}$. This will truly prove the existence of the metauniverse, which exists by mathematical and physical proofs and by the power of facts and experience. In fact, what is essentially more important in physics than the equations themselves is
the understanding and the explanations given to these equations. What is more important than mathematics is its meaning and its philosophy.

### 4.6 The energy of the void

In fact, the metauniverse or the four imaginary dimensions of meta-space-time may be regarded as a field full of potential and latent energy as we have mentioned but "invisible" in nature since it is superluminal and imaginary as it is shown in the equation $E=\frac{ \pm i m_{0} \times c^{2}}{\sqrt{\frac{\nu^{2}}{c^{2}}-1}}=E_{G 2}$. We said a field because the hidden matter that lies inside it forms a field of action and potentialities that can be discovered, like in the atom. The metauniverse is a field of latent energy relative to $\mathrm{G}_{1}$. What does the metauniverse mean relatively to itself? The answer to this question was answered before in Metarelativity [1]. The result derives from the Metarelativistic equations. The outcome is that the metauniverse relatively to itself is just like the universe relatively to itself which means as real as the universe (refer to Section 4.7 in Chapter 1). I made the separation between both (between the two space-times) but in fact they are related and bonded both mathematically through precise equations. So, we have discovered the energy of the void, which is the invisible and dark and superluminal metauniverse $\mathrm{G}_{2}$ relative to the visible universe $\mathrm{G}_{1}$ : its hidden imaginary dimensions, which lay in $\mathbf{G}_{2}$, its hidden energy (dark energy), and its hidden mass (dark matter).

### 4.7 Big Bang theory and the origin of the universe $\mathrm{G}_{1}$ : Smaller than and before Planck's length and time ( $1.6 \times 10^{-35} \mathrm{~m}$ and $10^{-43}$ seconds)

In fact, in our calculations, we expanded the Einstein-Lorentz equations to reach the metauniverse, as if we have done the backward walk by going from the universe $\mathrm{G}_{1}$ to the metauniverse $\mathrm{G}_{2}$. The direct walk is done from the metauniverse $\mathrm{G}_{2}$ to the universe $G_{1}$ and is by saying that from this latent energy, that exists in the universe $G_{2}$, the universe $G_{1}$ emerged. In fact, if we do the direct walk, we will see our whole "real" universe $\mathrm{G}_{1}$ coming out from nothing, from void, from $\mathrm{G}_{2}$, to existence like in the Big Bang model. This "nothing" or this "void" that we noted is the superluminal imaginary metauniverse that we established its existence in Section 4.6. The dot or the geometric point (Section 4.5) that we were talking about is the singularity that general relativity talks about. In fact, according to the Big Bang model, from a singularity, all real space-time was generated and all matter within it. In the early fractions of a second, the particles and matter, the space-time itself were condensed in a small portion. This is said, we could assume that our visible universe came from another universe, which is the invisible metauniverse itself. This potent and latent energy or the energy of the void that represents the metauniverse comes from the invisible matter or the dark matter that is hidden in $\mathrm{G}_{2}$ in the total universe G , which is denoted by:

$$
\mathbf{G}=\text { universe } \mathbf{G}_{1}+\mathbf{E W}+\text { universe } \mathbf{G}_{2} .
$$

which is similar to the complex set of numbers denoted in classical mathematics by $\mathbb{C}$. So, another proof of the existence of $\mathbf{G}_{2}$ is the Big Bang theory and that will be discussed more clearly and plainly in future publications.

### 4.8 Vacuum or the quantum field fluctuations and the uncertainty principle

Now, another proof of the existence of the metauniverse that will be demonstrated in forthcoming publications is at the level of the atom, where we have according to this uncertainty principle:

$$
\Delta E \times \Delta t \geq \frac{h}{4 \pi}
$$

which is called the time-energy uncertainty relation also. The explanation of the principle of vacuum fluctuation is that energy is created from void during an interval $\Delta t$ and then returns to void after creating virtual particles. In fact, the nothing or the vacuum as we have seen is the void that we have spoken about (Section 4.6) or the metauniverse $\mathbf{G}_{2}$ that we deduced from Metarelativity itself. Some physicists say that the whole universe is a quantum fluctuation phenomenon like in the principle of vacuum fluctuation. This is true if we looked at the equation from a different angle. If we reshape our minds, we may say that from the metauniverse a quantum phenomenon occurred that means a parcel of energy burst out from the metauniverse, that is full of potency, to "real existence," where the universe $\mathrm{G}_{1}$ was created and that will eventually disappear, say the physicists, in a period of time $\Delta t$, which is the age of the "real" universe $\mathrm{G}_{1}$.

Additionally, according to Metarelativity, the two complementary particles of metamatter $+i\left|m_{G 2}\right|$ and $-i\left|m_{G 2}\right|$ in the metauniverse $G_{2}$ can annihilate into the real matter in the universe $G_{1}$ or into photons in the universe $G_{3}$. Therefore, vacuum fluctuation is nothing but the annihilations of metaparticles into the "real" universe $\mathrm{G}_{1}$ or into the luminal universe $\mathrm{G}_{3}$ (refer to Section 4.2 in Chapter 1) (Figure 14).

Accordingly, "Ex Nihilo Nihil Fit," or "Nothing Comes from Nothing" as argued by the Greek Parmenides.

### 4.9 Black holes as doors to the metauniverse $\mathrm{G}_{2}$

Furthermore, and as a consequence of what has been said in the previous sections, we can understand that black holes that contain ultimately at their end the space-time singularities are nothing but doors to the metauniverse $\mathbf{G}_{2}$ (Figure 15).

### 4.10 Unification of the four interactions in $\mathrm{G}_{1}$

Therefore, since the whole "real" universe $\mathrm{G}_{1}$ was created from the metauniverse $\mathrm{G}_{2}$ then all the four interactions in $\mathrm{G}_{1}$ were also created from $\mathrm{G}_{2}$. This is to say that


Figure 14.
Vacuum fluctuation and the uncertainty principle.

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Figure 15.
Black holes as doors to the imaginary metauniverse $\boldsymbol{G}_{\mathbf{2}}$.


Figure 16.
Unification of the four interactions in the real universe $\boldsymbol{G}_{\mathbf{1}}$.
nature four interactions that exist in $\mathbf{G}_{1}$ emerged from the metauniverse $\mathbf{G}_{\mathbf{2}}$ just like the whole "real" universe $\mathrm{G}_{1}$ (Figure 16).

### 4.11 Ordinary matter/energy and positive/negative dark matter/energy

Sir Isaac Newton's law of gravitation of attraction is:
$F=k \frac{m \times m^{\prime}}{d^{2}}=F_{G 1}=$ the force in the universe $\mathrm{G}_{1}$, where $k=6.674 \times 10^{-11} \mathrm{~m}^{3} \cdot \mathrm{~kg}^{-1} \cdot \mathrm{~s}^{-2}$ approximately is the gravitational constant in the international system of units (SI).
$\Leftrightarrow F_{G}=k \frac{m_{G 2} \times m_{G 1}}{d^{2}}=k \frac{ \pm i m \times m^{\prime}}{d^{2}}= \pm i\left(k \frac{m \times m^{\prime}}{d^{2}}\right)$ in the universe G.

So, as a consequence of the first possible solution is the Metarelativistic law of gravitation of attraction:

$$
F_{G}=+i\left(k \frac{m \times m^{\prime}}{d^{2}}\right)
$$

$\Rightarrow$ Positive dark matter and energy of $\mathbf{G}_{2}$ can attract ordinary matter in $\mathbf{G}_{1}$.
$\Rightarrow$ Verification of astronomical observations and the explanation of the dark matter attraction of ordinary matter in galaxies, stars, etc.

And, as a consequence of the second possible solution is the Metarelativistic law of gravitation of repulsion:

$$
F_{G}=-i\left(k \frac{m \times m^{\prime}}{d^{2}}\right)
$$

$\Rightarrow$ Negative dark matter and energy of $\mathbf{G}_{\mathbf{2}}$ can repulse ordinary matter in $\mathbf{G}_{\mathbf{1}}$.
$\Rightarrow$ Explanation of the expansion of the universe $\mathrm{G}_{1}$.
$\Rightarrow$ Verification of astronomical observations and the explanation of Einstein's general relativity cosmological constant $\Lambda$ (his "biggest blunder").

### 4.12 Conservation of mass and energy and vacuum fluctuation

The Lavoisier principle in chemistry and science affirms that mass and energy are conserved. The Law of Conservation of Mass (or Matter) and Energy in a chemical reaction can be stated thus: In a chemical reaction, the matter is neither created nor destroyed.
"Nothing is lost, nothing is created, everything is transformed".
It was discovered by Antoine Laurent Lavoisier (1743-94) about 1785.
Knowing that vacuum fluctuations are the materialization or the annihilation or the transformation of metaparticles into real particles or photons, consequently, the total mass and the total energy in the total universe $\mathbf{G}=\mathbf{G}_{\mathbf{1}}+\mathbf{E W}+\mathbf{G}_{\mathbf{2}}$ are absolutely conserved, such that:


$$
m_{G}=\left[m_{G 1}\right]+\left[m_{G 3}\right]+\left[m_{G 2}\right] \Leftrightarrow m_{G}=\left[m_{G 1}\right]+[\text { Mass of Electromagnetic waves }]+\left[ \pm i\left|m_{G 2}\right|\right]
$$

### 4.13 Determinism and nondeterminism

The mathematical probability concept was set forth by Andrey Nikolaevich Kolmogorov in 1933 by laying down a five-axioms system. This scheme has been improved in MCPP to embody the set of imaginary numbers after adding three new axioms. Accordingly, any stochastic phenomenon is performed in the probability set and total universe $\mathbf{G}=\mathcal{C}$ of complex probabilities, which is the summation of the set $\mathcal{R}$ of real probabilities and the set $\mathcal{M}$ of imaginary probabilities. Our objective in this work was to encompass complementary imaginary dimensions to the stochastic phenomenon taking place in the "real" probability laboratory in $\mathcal{R}$ and as a consequence to gauge in the sets $\mathcal{R}, \mathcal{M}$, and $\mathcal{C}$ all the corresponding probabilities. Hence, the probability in the
entire set and total universe $\mathbf{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}$ is incessantly equal to one independently of all the probabilities of the input stochastic variable distribution in $\mathcal{R}$, and subsequently, the output of the random phenomenon in $\mathcal{R}$ can be evaluated totally and absolutely in $\mathbf{G}=\mathcal{C}$. This is due to the fact that the probability in $\mathcal{C}$ is calculated after the elimination and subtraction of the chaotic factor from the degree of our knowledge of the nondeterministic phenomenon as it is shown in the equation: $P c^{2}=D O K-C h f=D O K+M C h f=1=P c$. Consequently, we have applied this novel CPP paradigm to an important and fundamental problem in physics, which is Metarelativity theory. Hence, and what is truly crucial, is that we have demonstrated that probabilistic phenomena can be expressed totally deterministically in the complex probability set and total universe $\mathrm{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}$. Therefore, and after all, "God does not play dice!!!" as Albert Einstein put it.

### 4.14 Entropy and metaentropy

To understand the meaning of negative time in $\mathbf{G}_{2}$ relatively to $\mathbf{G}_{1}$, then entropy is the best tool. We know that entropy is defined as $d\left[S_{G 1}\right] \geq 0$ according to the second principle of thermodynamics. We say that when time grows, then entropy and chaos and disorder increase in $\mathbf{G}_{1}$. Due to the fact that time is negative as one possible solution in $\mathrm{G}_{2}$, this implies that we can have: $d\left[S_{G 2}\right] \leq 0$. Consequently, and for this case, we say that when time flows, then entropy (or metaentropy) decreases. This means directly the following: The direction of evolution in a part of $\mathbf{G}_{2}$ is the opposite to that in $\mathrm{G}_{1}$.

Additionally, $d\left[S_{G}\right]=0$ since $\operatorname{Ln}\left(P_{G}\right)=\operatorname{Ln}(P c)=\operatorname{Ln}(1)=0$ in the expression of entropy in the theory of statistical mechanics:

$$
S_{G}=-k_{B} \sum_{j} p_{j} L n\left(p_{j}\right)=-k_{B} \sum_{j} 1 \times \operatorname{Ln}(1)=0 .
$$

That means and most importantly, that for any distribution and in the complex probability set and the total universe $\mathrm{G}=\mathcal{C}=\mathcal{R}+\mathcal{M}$, we have complete order, no chaos, no ignorance, no uncertainty, no disorder, no randomness, no nondeterminism, and no unpredictability since all measurements are completely and perfectly and absolutely deterministic.

### 4.15 Conservation of information in $\mathrm{G}=\mathcal{C}$

In the complex set and total universe $\mathbf{G}=\mathcal{C}$ we have the entropy in the theory of information always equal to 0 since:

$$
\begin{gathered}
\Leftrightarrow H_{G}=-\sum_{j} p_{j} \log _{b}\left(p_{j}\right)=-\sum_{j} 1 \times \log _{b}(1)=0 \\
\Leftrightarrow d\left(H_{G}\right)=0
\end{gathered}
$$

So, no loss and no gain but complete conservation of information in G. Hence, the Lavoisier Law of Conservation of Mass and Energy applies also to information theory as it was shown here and in my previous published work $[13,15]$ so to as well MCPP. In $\mathcal{R}$, we have disorder, uncertainty, and unpredictability. In $\mathcal{C}$ we have order, certainty, and predictability since $P c=1$ permanently and entropy $=0$ constantly. Additionally, in
$\mathcal{R}$ we have chaos and imperfect and incomplete knowledge or partial ignorance. In $\mathcal{C}$ we have chaos always equal to $0(C h f=0$ and $M C h f=0)$ and $D O K=1$ continuously, thus complete and perfect and total knowledge of the now deterministic messages and the information of the now deterministic experiments occurring in $\mathbf{G}=\mathcal{C}$.

### 4.16 The duality and complementarity principle in $\mathcal{R}, \mathcal{M}$, and G

One of the fundamental principles almost omnipresent in whole nature and at all levels of experience in the physical world, including in some properties and in some characteristics of the atomic level, is duality and complementarity. This principle is present also in $\mathbf{G}_{2}$ where we have metaparticles with their corresponding metaEnergies and metaAntiparticles with their corresponding metaAntiEnergies. Also, the probability $P_{m}$ in $\mathcal{M}$ is the associated imaginary complement of the real probability $P_{r}$ in $\mathcal{R}$, their sum in $\mathcal{C}$ is $P c=1$. Additionally, and in $\mathbf{G}$, the superluminal metauniverse $G_{2}$ is the "imaginary" complement of the "real" subluminal universe $G_{1}$. Hence, we can directly see that this principle dominates nearly all existence whether in $\mathcal{R}, \mathcal{M}$, or $\mathbf{G}=\mathcal{C}$.

## 5. Conclusion and perspectives

In the current research work, the original extended model of eight axioms (EKA) of A. N. Kolmogorov was connected and applied to Metarelativity theory. Thus, a tight link between Metarelativity and the novel paradigm (CPP) was achieved. Consequently, the model of "Complex Probability" was more developed beyond the scope of my 21 previous research works on this topic.

Furthermore, the theory of Metarelativity is a system of equations written to take into consideration additional effects in the universe and about the matter inside it. Metarelativity begins with Albert Einstein's theory of special relativity and it develops a system of equations that lead us to further explanations and to a new physics paradigm. Like special relativity which was created in 1905 and then expanded later to general relativity to explain, among other things, the aberration in the motion of the planet Mercury and the gravitational lenses, Metarelativity explains many phenomena, for example, the nature of dark matter laying inside and outside galaxies and, in the universe, and the existence of superluminal particles or tachyons and their corresponding dark energy. Metarelativity is a work of pure science that encompasses mathematics and fundamental physics. All the explanations are deduced from a new system of equations called the Metarelativistic transformations that were proven mathematically and explained physically. Hence, Metarelativity was bonded here to CPP and to develop a new paradigm in science.

In addition, referring to all these obtained graphs and executed simulations throughout the whole research work, we are able to quantify and visualize both the system chaos and stochastic effects and influences (expressed and materialized by Chf and MChf) and the certain knowledge (expressed and materialized by DOK and Pc) of the new paradigm. This is without any doubt very fruitful, wonderful, and fascinating and proves and reveals once again the advantages of extending A. N. Kolmogorov's five axioms of probability and hence the novelty and benefits of my inventive and original model in the fields of prognostics, applied mathematics, and physics that can be called verily: "The Metarelativistic Complex Probability Paradigm (MCPP)."

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As a future and prospective research and challenges, we aim to more develop the novel prognostic paradigm conceived and to implement it to a large set of random and nondeterministic phenomena in physics and in science.


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