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From Quantum Sensing to SWEME Interaction Modeling

Rodolfo A. Fiorini

Presentation Outline

1. Introduction (09)

- Problem Definition
- The Information Double Bind (IDB) Problem

2. Current Modeling Algorithm Limitations (09)

- Information Modeling Incompleteness
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- Solid Number
- CICT EPG-IPG Fundamental Relationship

4. Final CICT Results (10)

- OECS Recurrence Relation
- Main CICT OECS Properties

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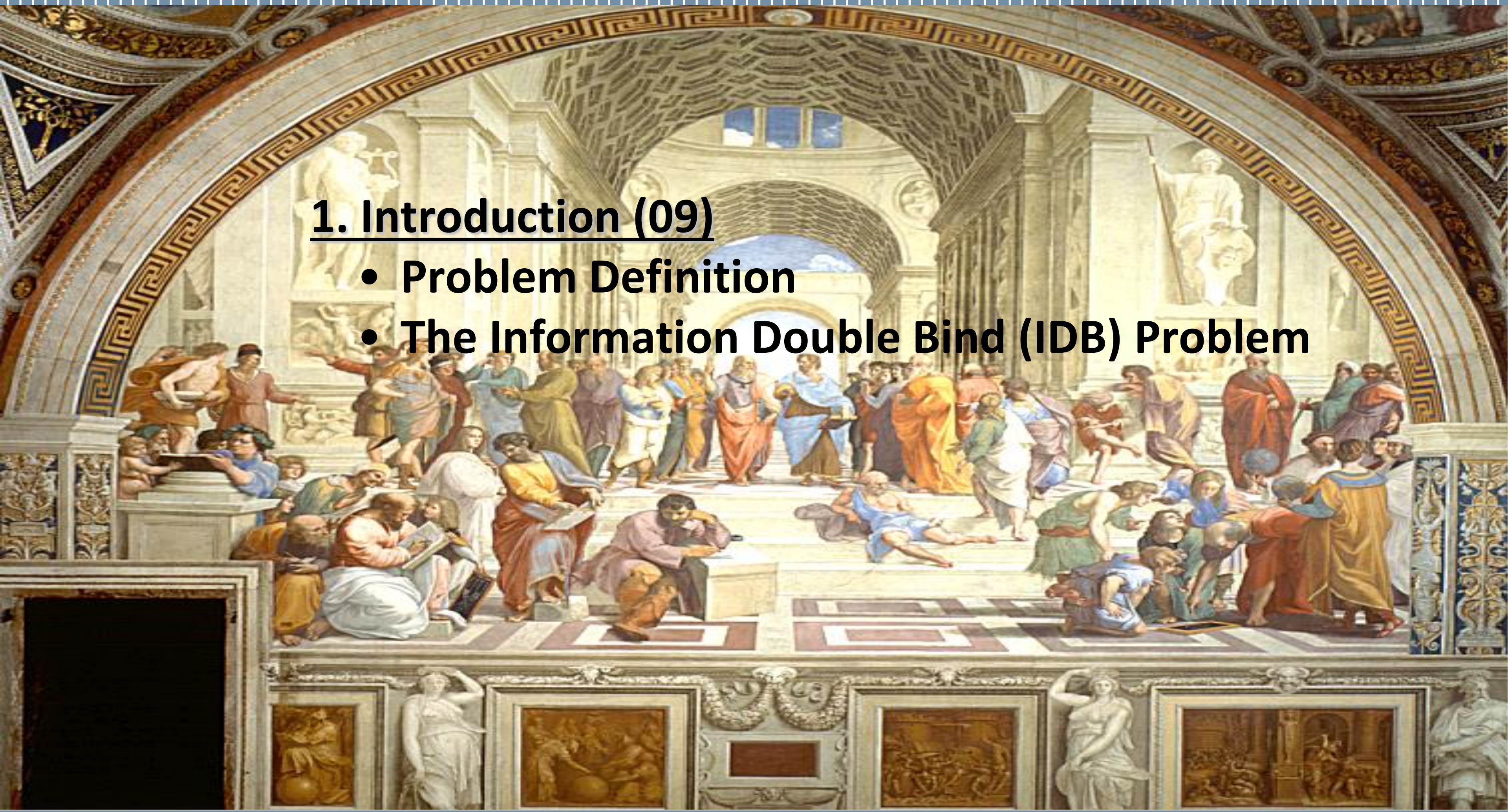

<u>1. Introduction (09)</u>

- **Problem Definition**
- **The Information Double Bind (IDB) Problem**

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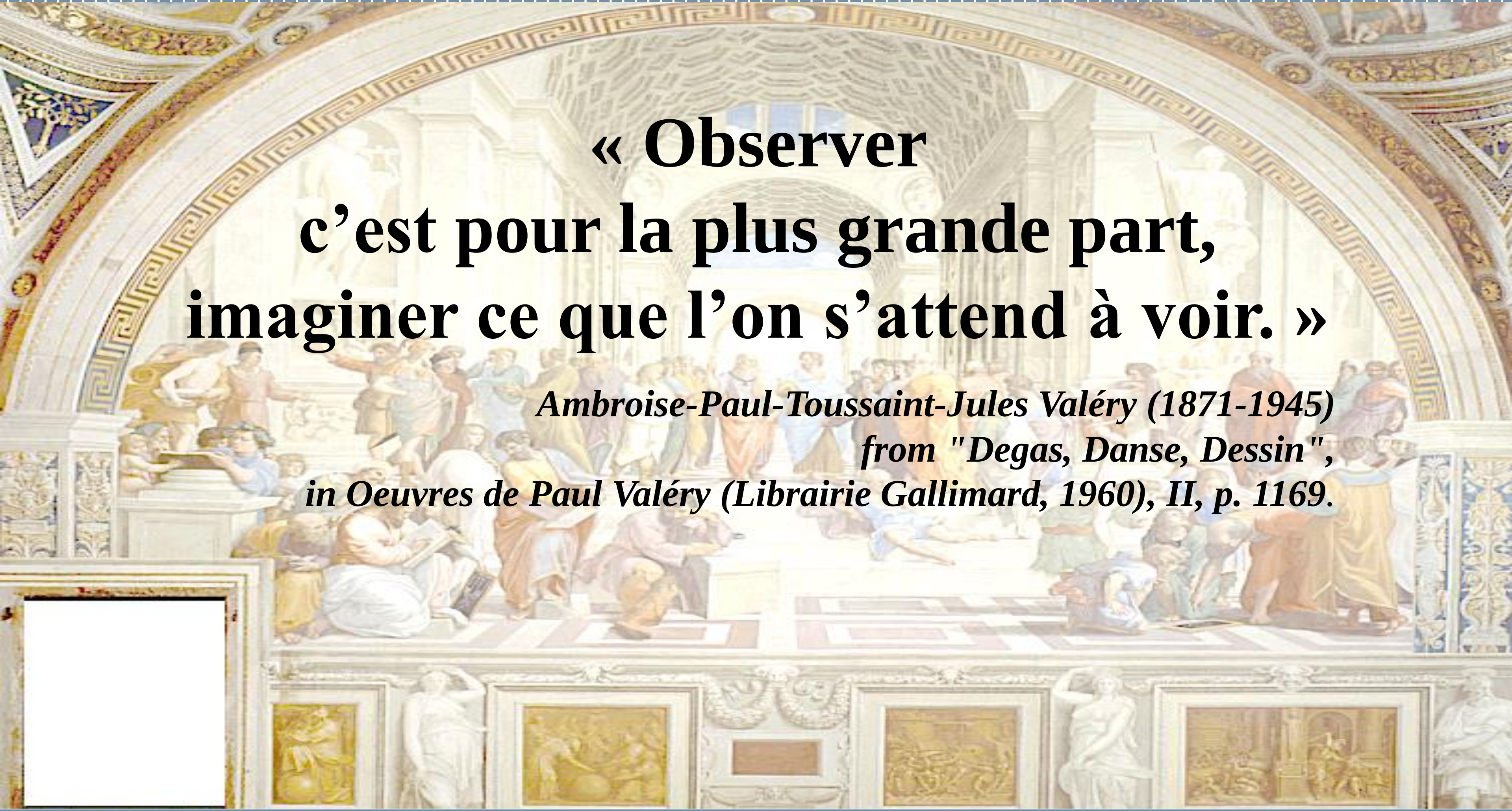
About a century ago, the presence of super weak electromagnetic emission (**SWEME**) in living organisms was revealed.

About twenty five years ago **J. Benveniste** et al. suggested that solutions of biologically active substances (BAS) emitted SWEME signals that could be **digitally recorded** using a computer and then transmitted to any distant location.

Unfortunately, even the most sensitive equipment of our time is not yet able to directly detect an objects emission several minutes after its initial excitation.

The core problem concerns the precision with which measurement on quantum resonant systems can be used to estimate quantities that appear as classical parameters in the theory at macroscale level, for example time, displacement, rotation, external fields, etc., to overcome **the information double-bind (IDB) problem** of reliable and effective quantum knowledge extraction by current scientific experimental set-up.

(R.A. Fiorini, 2013)



« Observer
c’est pour la plus grande part,
imaginer ce que l’on s’attend à voir. »

Ambroise-Paul-Toussaint-Jules Valéry (1871-1945)
from "Degas, Danse, Dessin",
***in Oeuvres de Paul Valéry (Librairie Gallimard, 1960), II, p. 1169*.**

Example (What is this?)

Colorado River in Utah, USA

It is Fundamental
to Understand the Difference
between
Unperceivable
and
Unmeasurable

Example: Image Lossless Compression Test

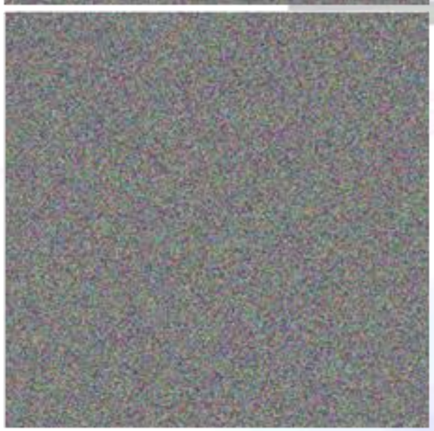
(4,096 by 4,096 pixel, 16,777,216 true color image)

$H_1(X) = 0.999292$ (single precision arithmetic)

$H_2(X) = 0.99929237704488$5 (double precision arithmetic)

$H_3(X) = 0.9992923770448853118692398478371254320637916484441241727700678337$

(64-digit precision arithmetic).

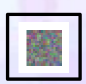


$H_1(X) = 1.000000$ (single precision arithmetic)

$H_2(X) = 0.99999999993863$ (double precision arithmetic)

$H_3(X) = 0.9999999999386299832757821470665551348090603855394427152819771884$

(64-digit precision arithmetic).



(R.A. Fiorini, 2014)

From Quantum Sensing to SWEME Interaction Modeling

Current Number Theory and modern Numeric Analysis still use LTR (Left-To-Right) mono-directional interpretation only for numeric group generator and relations, so information entropy generation cannot be avoided in current computational algorithm and application.

Furthermore, traditional digital computational resources are unable to capture and to manage not only the full information content of a single Real Number ***R***, but even Rational Number ***Q*** is managed by information dissipation (e.g. finite precision machine, truncating, rounding, etc.).

So, paradoxically if you don't know the code used to communicate a message **you can't tell the difference between an information-rich message and a random jumble of letters.**

This is **the information double-bind (IDB) problem** in contemporary classic information theory and **in current Science** (**nobody likes to talk about it**).

(R.A. Fiorini, 2013)

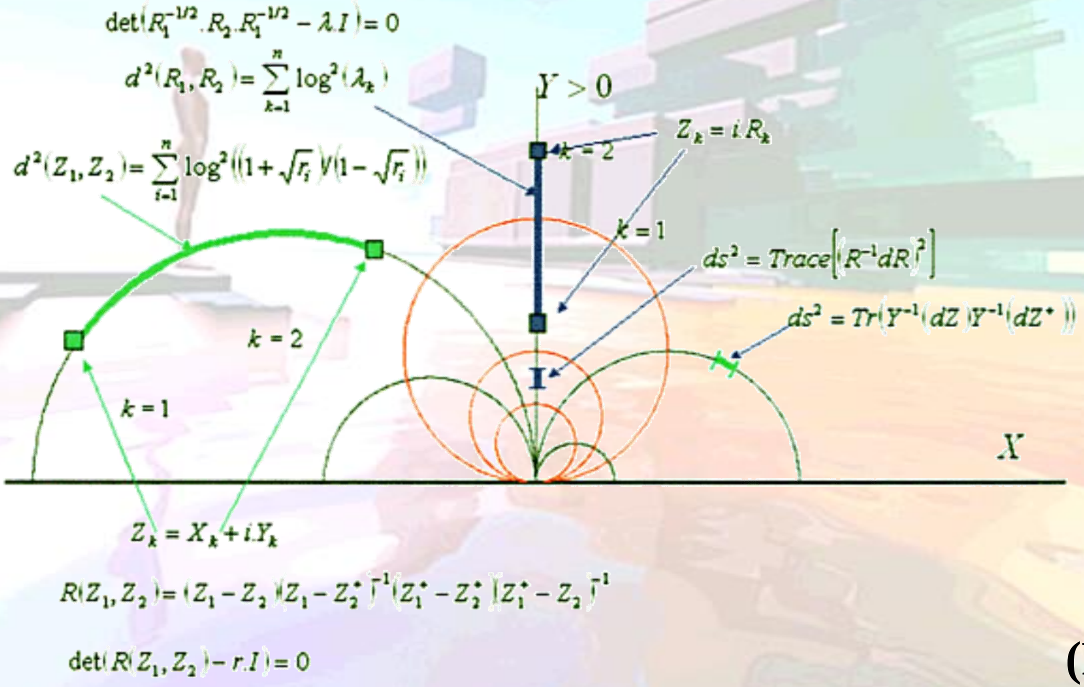
Siegel Upper-Half Space

The **Poincaré** upper-half plane (**PUHP**) for **2D problems.**

The **Siegel** upper-half space (**SUHS**) for **3D problems** (rotat. symmetry along Y axis).

Siegel Upper-Half Plane

$$SH_n = \{Z = X + iY \in Sym(n,C) \,/\, \mathrm{Im}(Z) = Y > 0\}$$



(F. Barbaresco, 2014)

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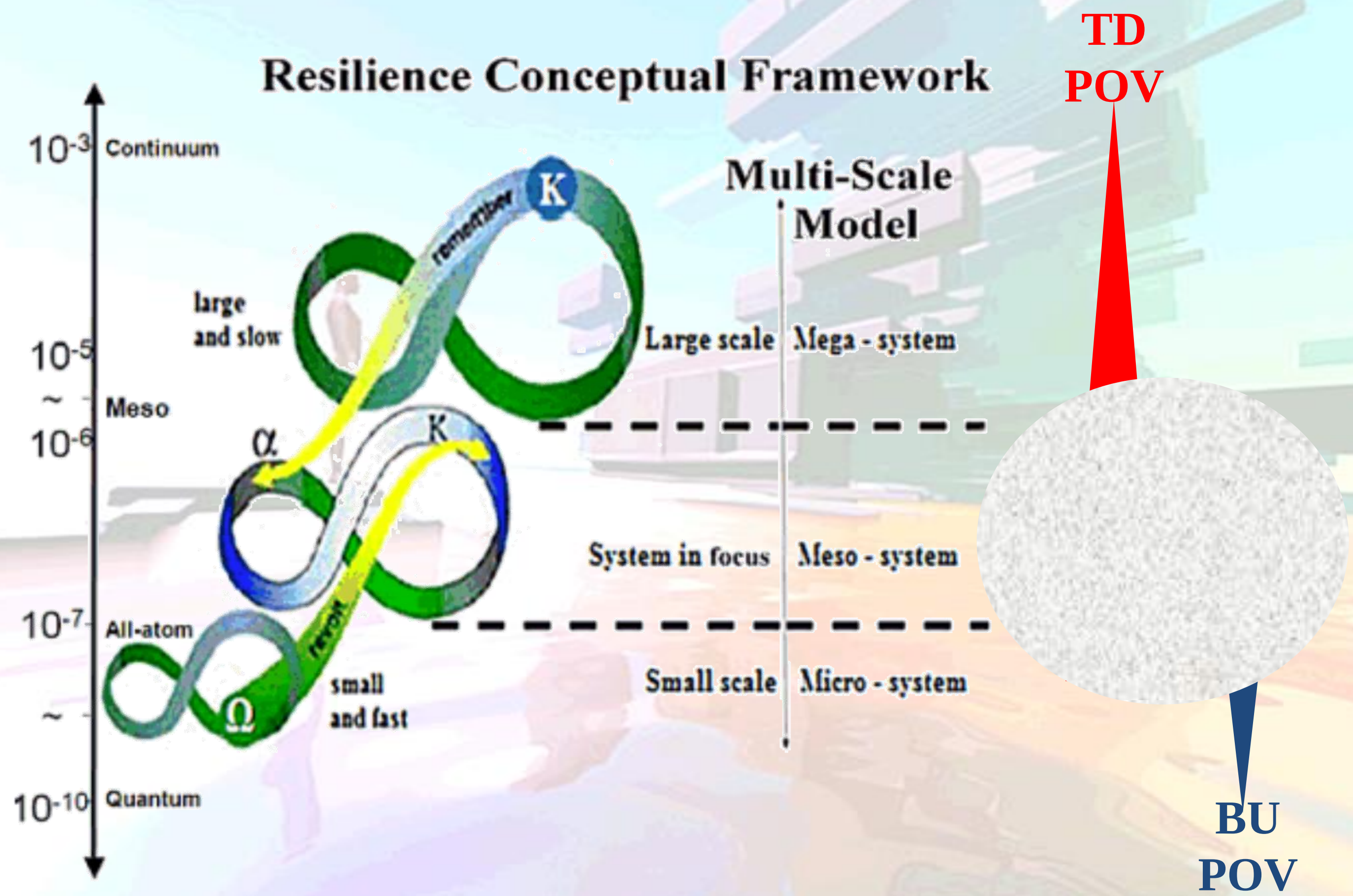
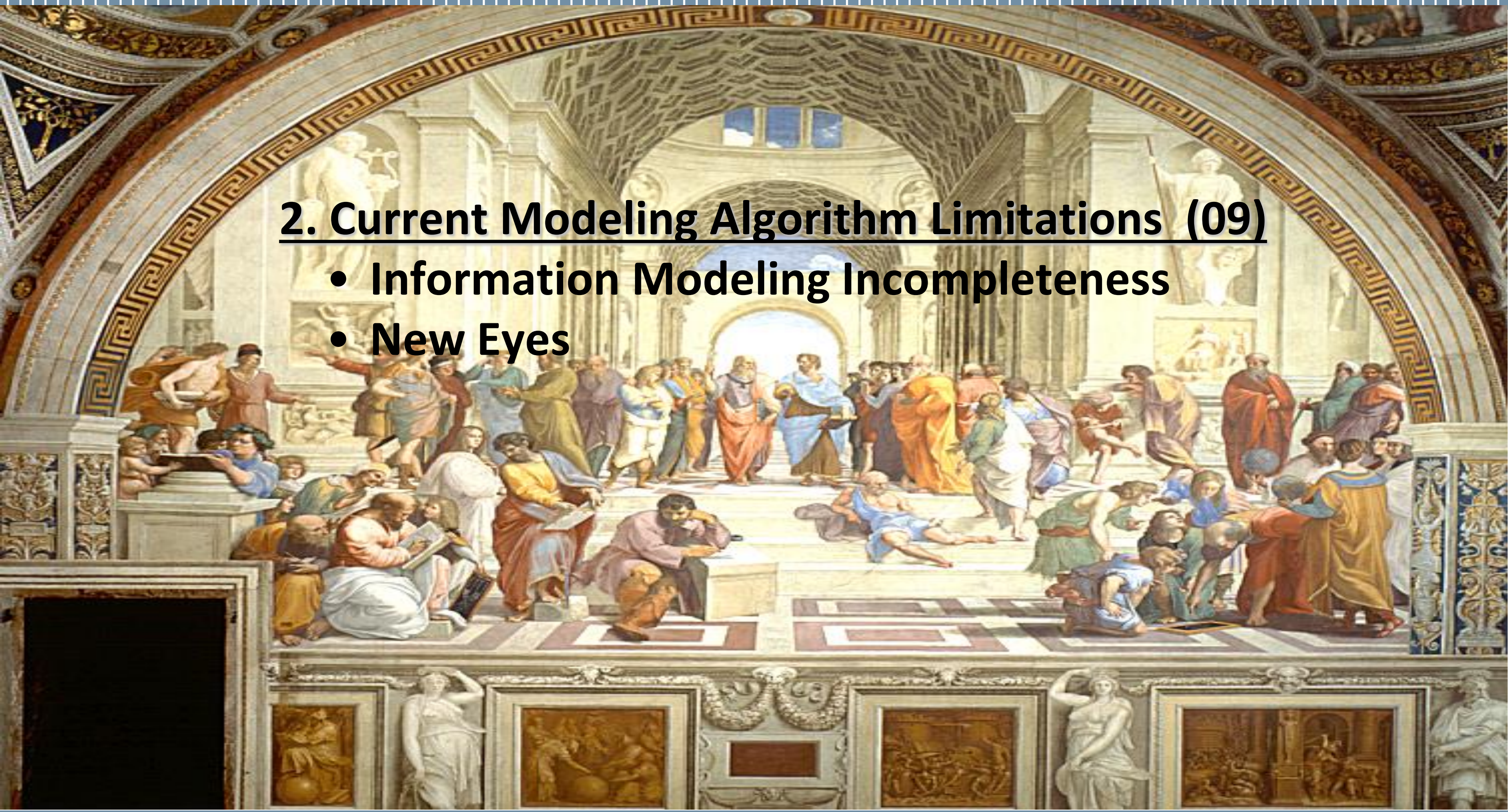
The Root of the Current Problem for AMS System Modeling



Fundamental Question for New Vision

Is Classical Mathematics Appropriate for Theory of Computation?

From Quantum Sensing to SWEME Interaction Modeling



2. Current Modeling Algorithm Limitations (09)

- **Information Modeling Incompleteness**
- **New Eyes**

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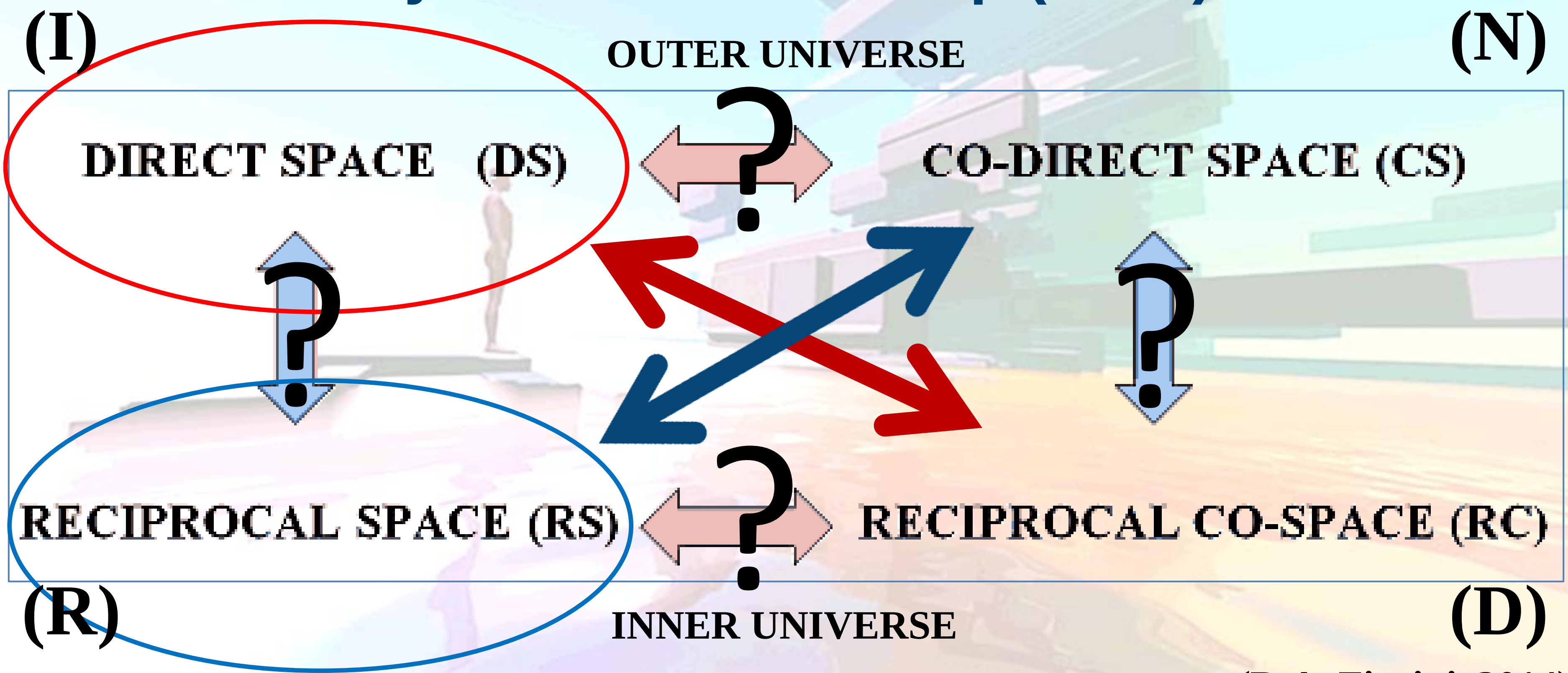
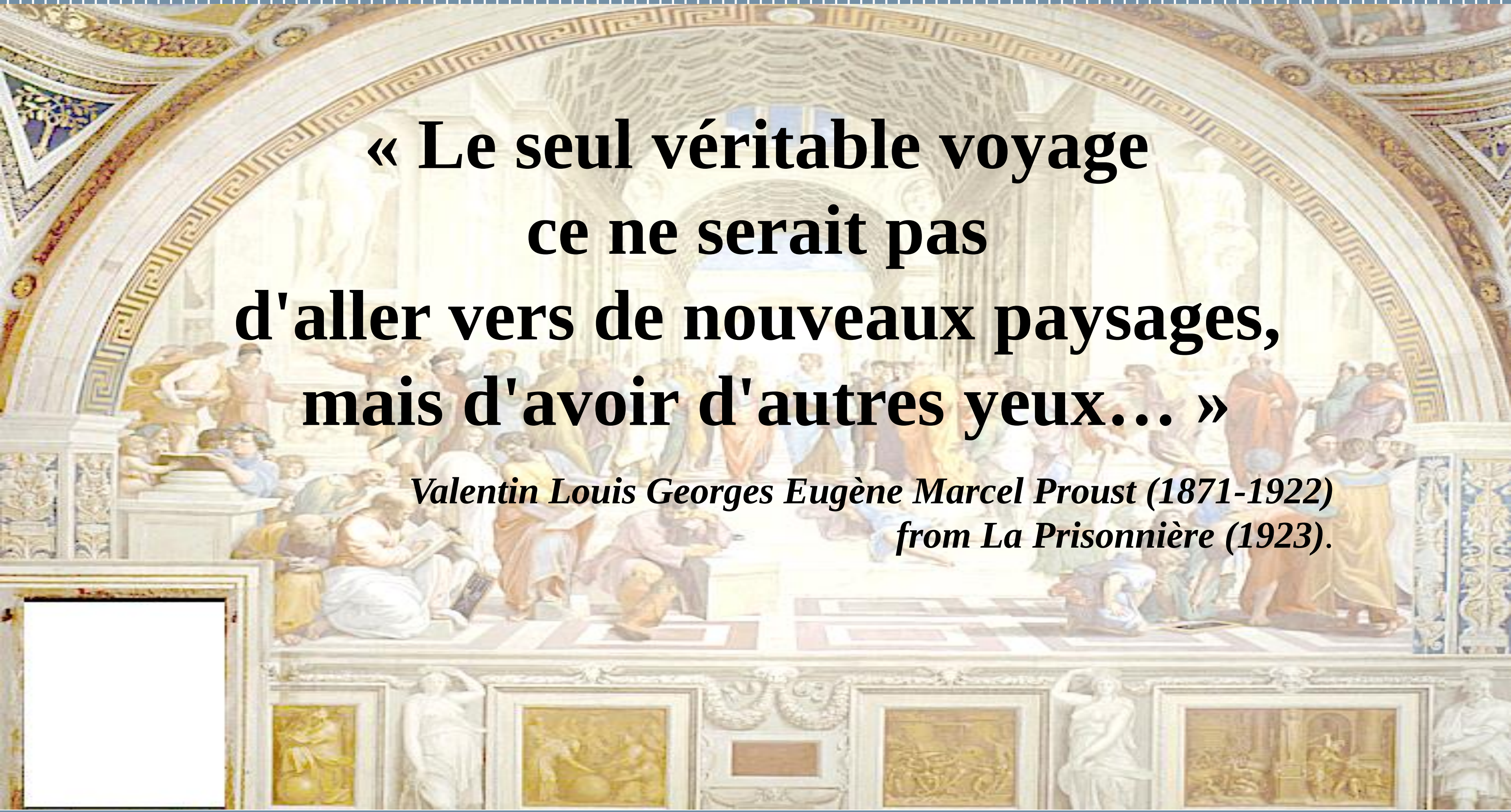
INNER vs. OUTER UNIVERSE (IOU) Mapping By KLEIN Four-Group (CICT)



(R.A. Fiorini, 2014)



« Le seul véritable voyage
ce ne serait pas
d'aller vers de nouveaux paysages,
mais d'avoir d'autres yeux… »

Valentin Louis Georges Eugène Marcel Proust (1871-1922)
from La Prisonnière (1923).

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Numerical Competence

CICT Computational Processing

In **CICT** (Computational Information Conservation Theory) **Arithmetic** the **structure of closure spaces** is defined by **Natural Numbers Reciprocal Space (RS) representation**. By this way, Natural Number can be thought as **both structured object and symbol**.

Abstract structures do not represent objects but they are symbolic information representation only. They need an appropriate structural description first. **Then we can formalize their semantics as a relationship between well-defined structures.**

So we arrive to the fundamental difference in the ontological status of **symbols** and **object represented by these symbols**. To **the difference that makes the difference**.

CICT makes this **fundamental ontological discrimination between Symbolic and OpeRational Number Representation** to achieve computational information conservation.

New Vision on *Q* Rational Number System

CICT emerged from the study of the geometrical structure of a discrete manifold of ordered hyperbolic substructures, coded by formal power series, **under the criterion of evolutive structural invariance at arbitrary precision**.

It defines an **arbitrary-scaling discrete Riemannian manifold uniquely**, under HG metric, that, **for arbitrary finite point accuracy level *L* going to infinity** (exact solution theoretically), **is homeomorphic to traditional Information Geometry Riemannian manifold**.

In other words, **HG can describe a projective relativistic geometry directly hardwired into elementary arithmetic long division remainder sequences**, offering many competitive computational advantages over traditional Euclidean approach.

New Vision on *Q* Rational Number System

Elementary Arithmetic long **Division** minority components (**Remainders**, R), for long time, **concealed relational knowledge** to their dominant result (**Quotient**, Q), not only can always allow **quotient regeneration** from their remainder information **to any arbitrary precision**, but even to achieve **information conservation** and **coding minimization,** by combinatorial **OECS** (Optimized Exponential Cyclic Sequences), for dynamical systems.

Then traditional ***Q* Arithmetic** can be even regarded as a highly sophisticated **open logic**, **powerful and flexible LTR and RTL formal numeric language of languages**, with self-defining consistent word and rule, **starting from elementary generator and relation**.

This **new awareness** can guide the development of successful more convenient algorithm, application and powerful computational system.

(Fiorini & Laguteta, 2013)

The CICT IOU Reference Framework for Stronger AMS System Simulation in Science and Industry

The **CICT fundamental relationship** that ties together numeric body information of divergent and convergent monotonic power series in any base (in this case decimal, with no loss of generality), with ***D* ending by digit 9**, is given by the following CICT fundamental LTR-RTL correspondence equation:

$$\frac{1}{D} = \sum_{k=0}^{\infty} \frac{1}{10^W}\left(\frac{\overline{D}}{10^W}\right)^k \Rightarrow \ldots \Leftarrow \; Div\left(\frac{1}{D}\right) = \sum_{k=0}^{\infty}(D+1)^k \qquad \text{Eq.(1)}$$

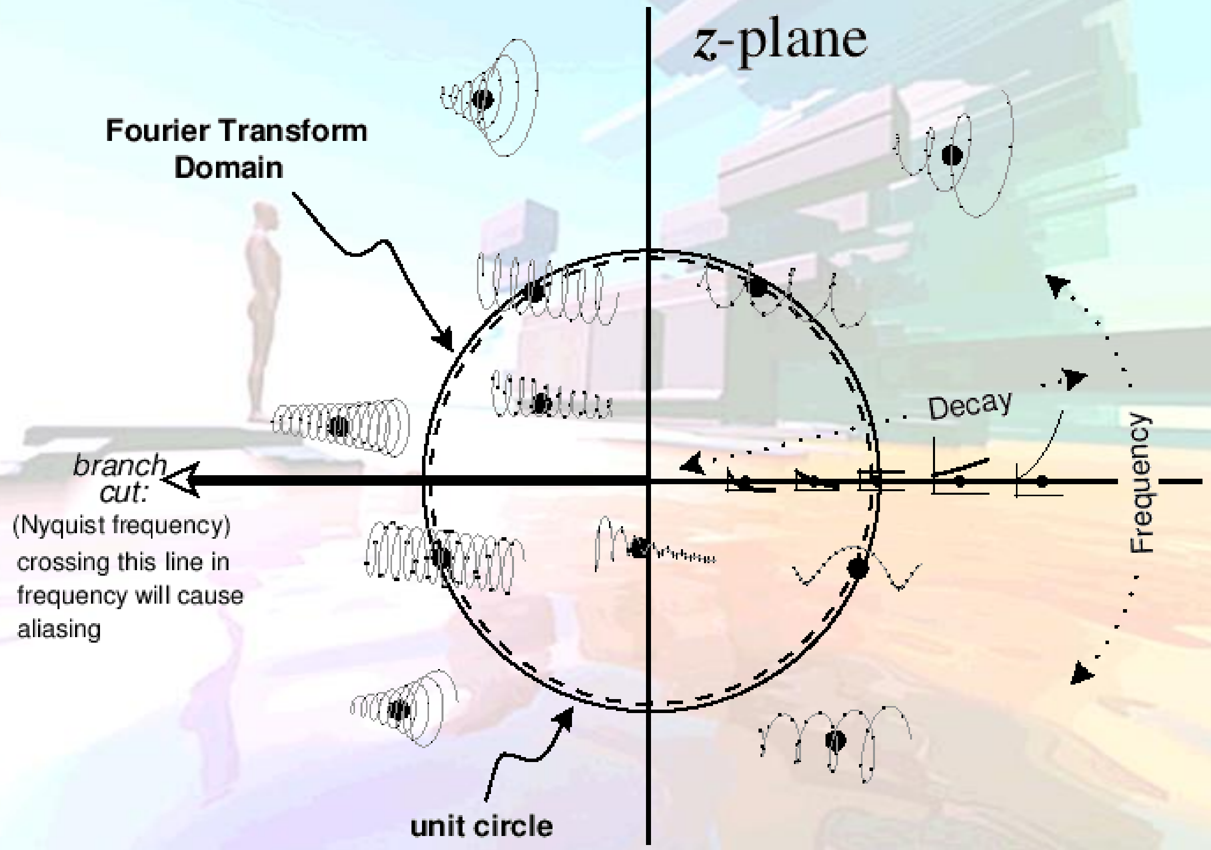
where $\overline{D}$ is the additive 10^W complement of D, i.e. $\overline{D} = (10^W - D)$, W is the word representation precision length of the denominator D and "Div" means "Divergence of".

Further generalizations related to ***D* ending by digit 1 or 3 or 7 are straightforward**. Increasing the level of representation accuracy, the total number of allowed convergent paths to 1/*D*, as allowed conservative paths, increases accordingly and can be counted exactly, till maximum machine word length and beyond: like **discrete quantum paths denser and denser to one another, towards a never ending "blending quantum continuum,"** by a TD system perspective.

(Fiorini & Laguteta, 2013)

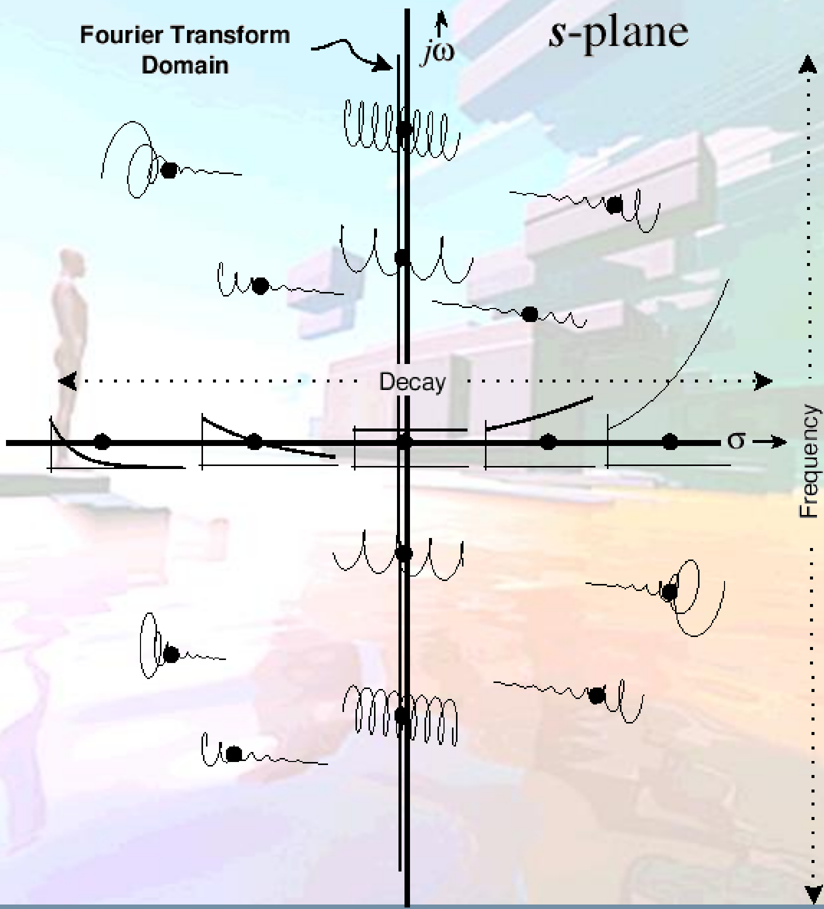
The CICT IOU Reference Framework for Stronger AMS System Simulation in Science and Industry

Domain of z-transforms

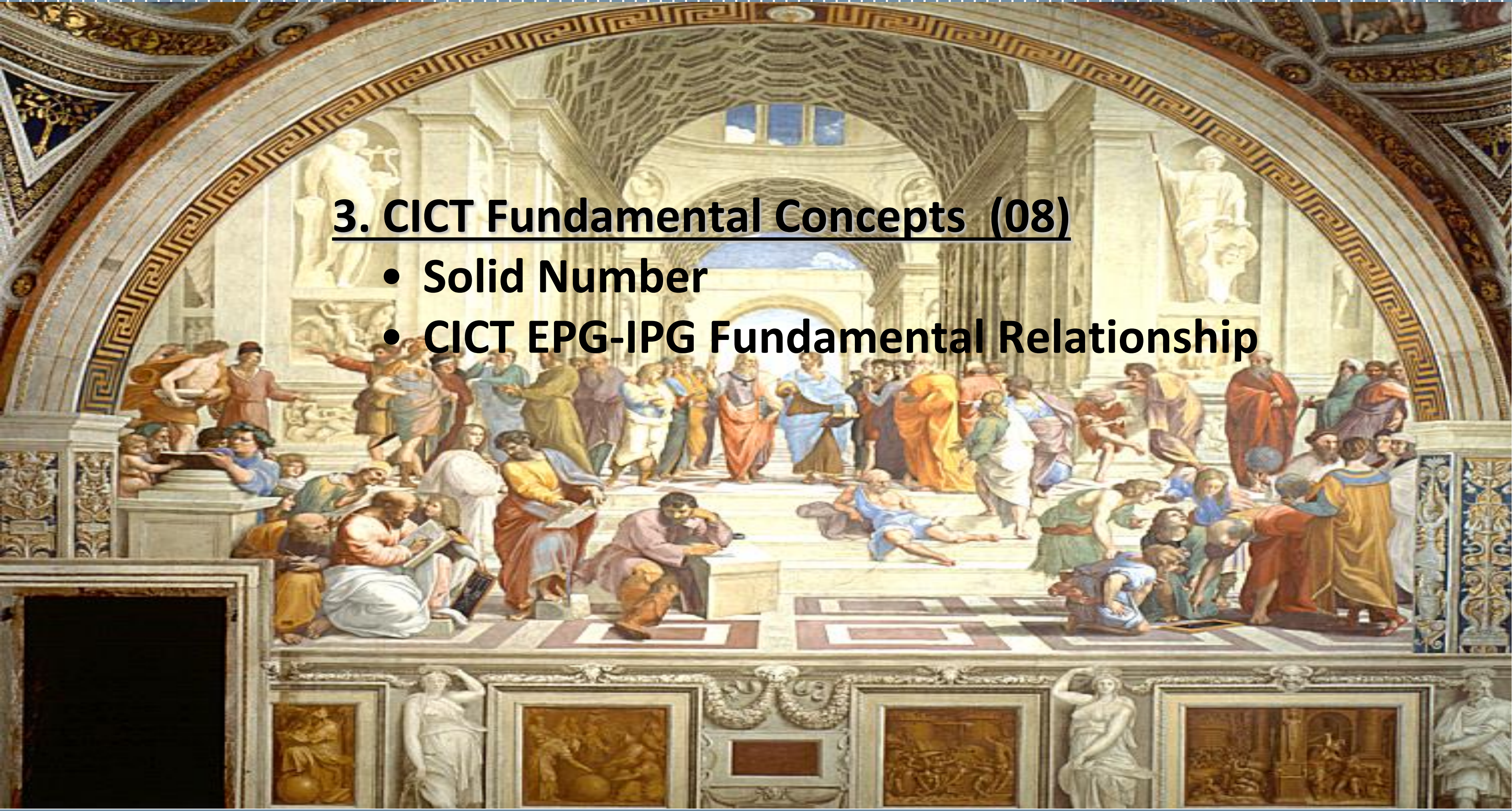


The CICT IOU Reference Framework for Stronger AMS System Simulation in Science and Industry

Domain of Laplace transforms



The CICT IOU Reference Framework for Stronger AMS System Simulation in Science and Industry



3. CICT Fundamental Concepts (08)

- **Solid Number**
- **CICT EPG-IPG Fundamental Relationship**

Solid Number (SN_x)

Quite recently, the scientific community has acquired new awareness about traditional rational number system ***Q*** properties. It can be regarded as a highly sophisticated open logic, powerful and flexible LTR and RTL formal language, with self-defining consistent words and rules, starting from elementary generators and relations.

To face the challenge of complex system modeling (**AMS system modeling**), we need to be able **to control system uncertainty quantification from macroscale, through mesoscale, till nanoscale and beyond.**

This new awareness can guide the development of new competitive algorithm and application. Specifically, knowledge about the fundamental operative difference of :

a) "Symbolic vs. OpeRational Number Representation" and

b) "Prime vs. Primitive Number" or "Solid Number" (SN_x).

SN_x can play a fundamental role by capturing and optimally encoding deterministic information.

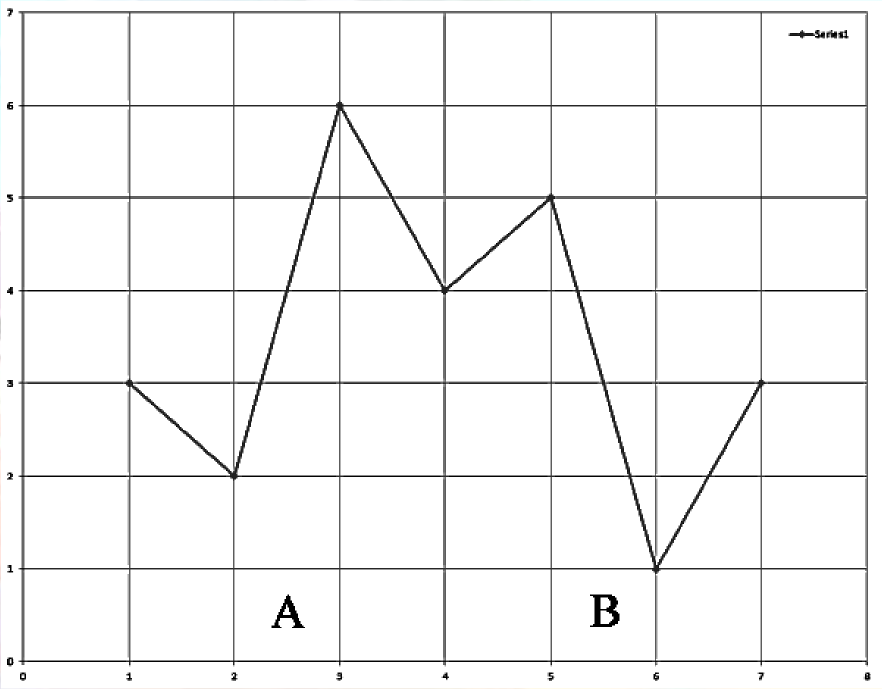
Solid Number (SN_x)

Prime
vs.
Primitive Number
Solid Number (SN_x)

RFD R_L LTR-RTL

Inner Linear Coordinate Reference (OILCR) for SN 7

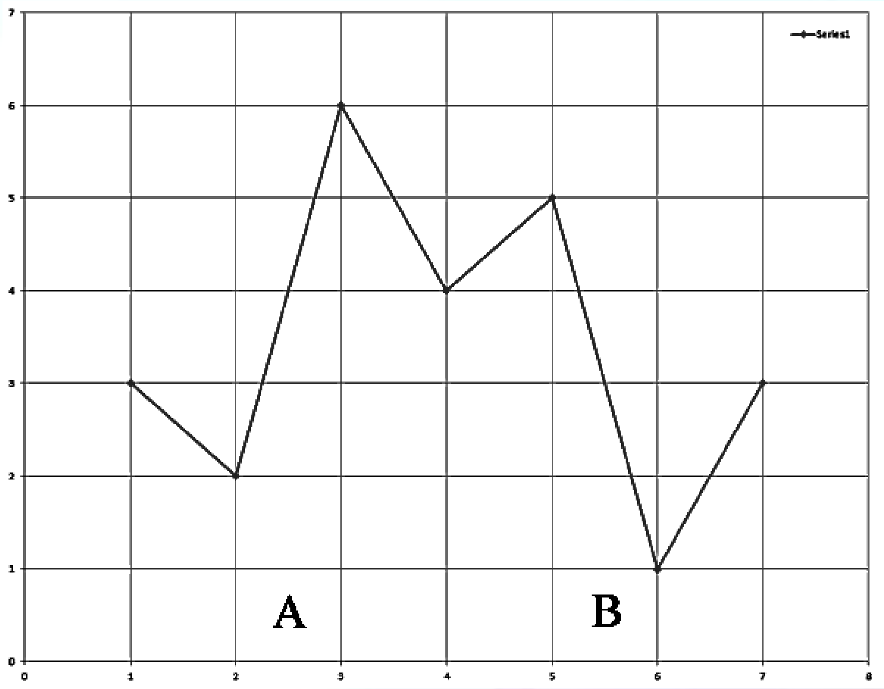
⇐	5	4	3	2	1	0	5	4	3	2	1	0	**RTL**
LTR	1	2	3	4	5	6	1	2	3	4	5	6	⇒
Q_L	1	4	2	8	5	7	1	4	2	8	5	7	
R_L	**3**	**2**	**6**	**4**	**5**	**1**	**3**	**2**	**6**	**4**	**5**	**1**	

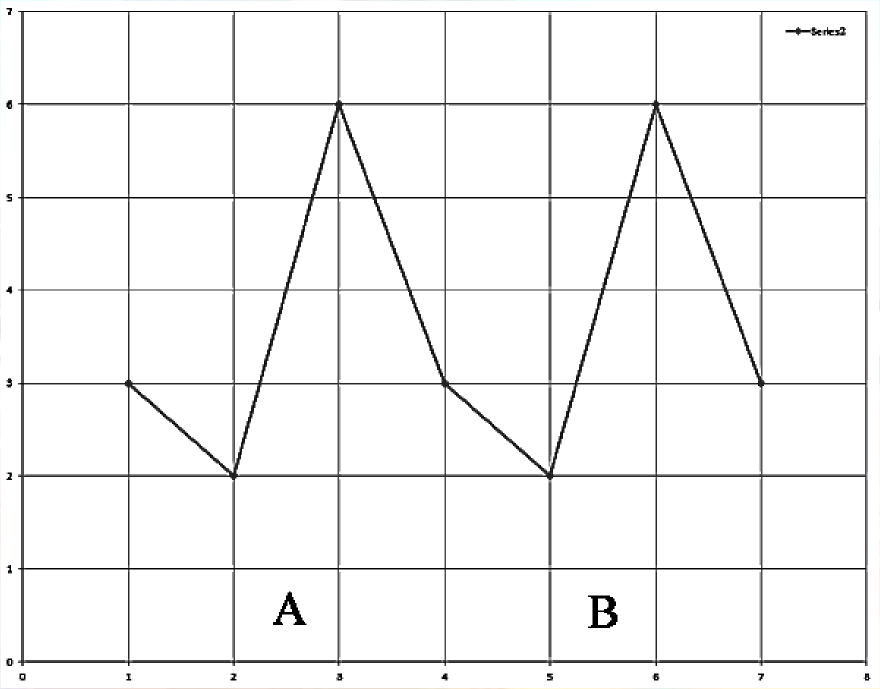


(R.A. Fiorini, 2013)

RFD R_L LTR-RTL

Inner Linear Coordinate Reference (OILCR) for SN 7





(R.A. Fiorini, 2013)

Symbolic Compression Operator (SCO)

Let us introduce a convenient LTR **symbolic compression operator** (SCO) as:

$$SCO \equiv \langle M \mid DS \rangle$$

where **DS is a finite digit string** of length L and **M is the number of times** DS **is repeated** to get our unfolded digit string in full, e.g.:

$$(4 \mid 1) \equiv 1111 \text{ or } (2 \mid 123) \equiv 123123)$$

Usual symbolic string operations can be applied to SCO.

Solid Number $SN_1 = 7$

According to our SCO approach, the correct coherent relation representation of traditional scalar modulus $D = 7$, as denominator of Egyptian fraction, is given by:

$$CQ_1 = \frac{1}{CD_1} \equiv \frac{1}{<\infty|(<\infty|0><1|7>)>} \equiv 0.|<\infty|RFD(7)> \equiv 0.<\infty|142857>$$

To conserve the full information content of rational correspondence at higher level, we realize that **we have to take into account not only the usual modulus information, but even the related periodic precision length information *W* = 6** (numeric period or external phase representation) in this case (i.e. CD_1 = 000007 as base *RFD*).

Primitive Root of Unity for Solid Number SN_1= 7

We can use Euler's identity to establish **the usual fundamental relationship between trigonometric functions and the subalgebra of complex numbers of the geometric algebra $\mathcal{C}\ell_2$** in the following way:

$$\exp(\alpha e_{12}) = \cos\alpha + e_{12}\sin\alpha \qquad \text{Eq.(2)}$$

where e_{12} is the imaginary unit, usually noted as $\boldsymbol{i} = \sqrt{-1}$.

The final result is:

$$CQQ_1 = \frac{1}{CDD_1} = \frac{1}{7}\exp\left(-\frac{\pi(1+2n)}{3}e_{12}\right) \qquad \text{Eq.(3)}$$

and

$$CDD_1 = \frac{1}{CQQ_1} = 7\exp\left(\frac{\pi(1+2n)}{3}e_{12}\right) = 7\left(\frac{1}{2}+\frac{\sqrt{3}}{2}e_{12}\right)_{(p.v.)} \qquad \text{Eq.(4)}$$

for n = 1, 2, 3, ...in ***N***, where (p.v.) means "principal value".

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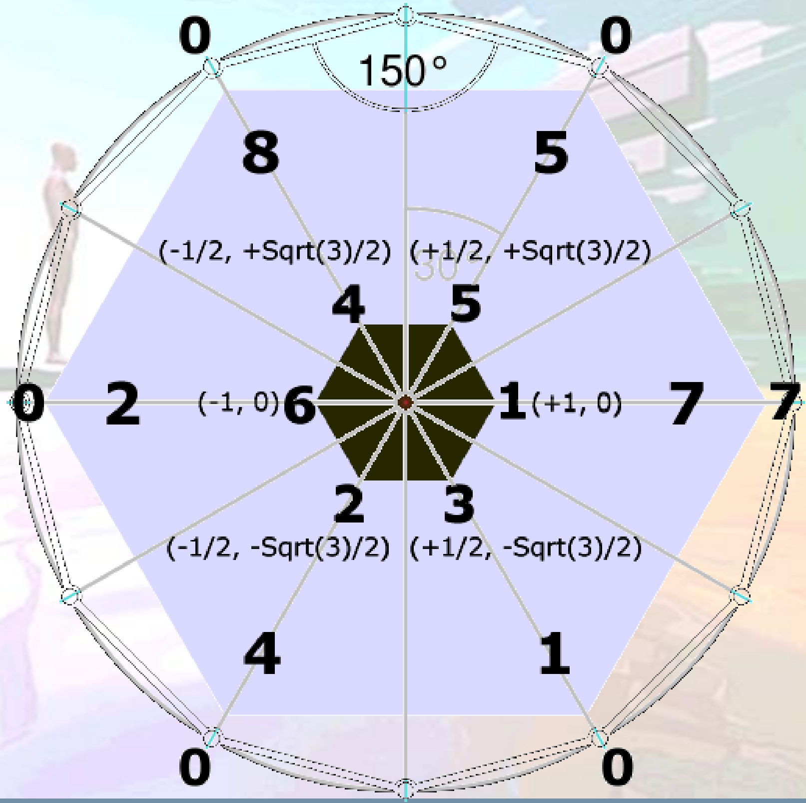
CICT EPG-IPG

Fundamental Relationship for $SN_1 = 7$



(R.A. Fiorini, 2013)

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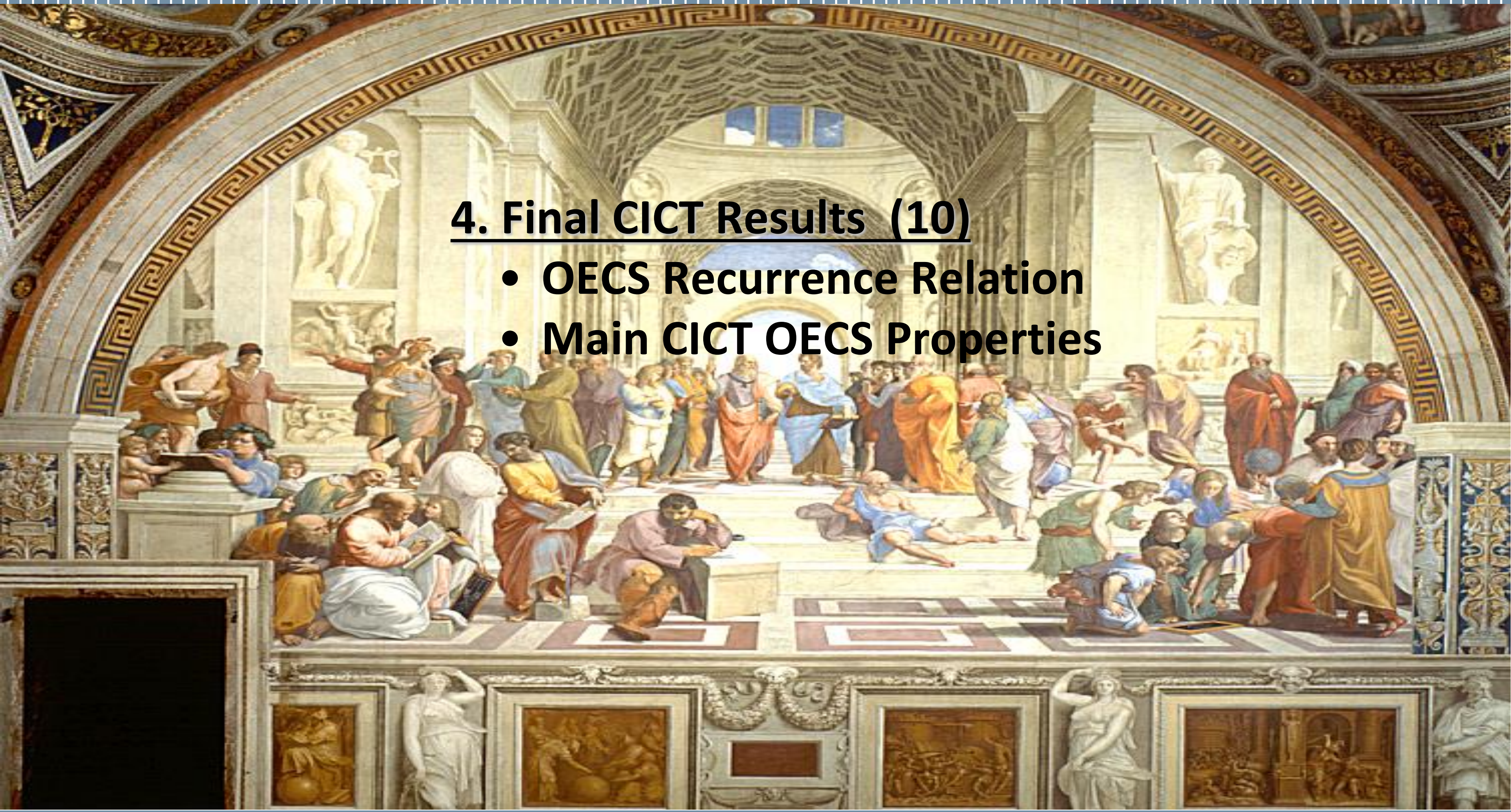


4. Final CICT Results (10)

- **OECS Recurrence Relation**
- **Main CICT OECS Properties**

Solid Number (SN_x)

CICT shows that **any natural number *D* in *N* has associated a specific, non-arbitrary exterior phase relationship** (OECS, Optimized Exponential Cyclic Sequence) **coherence information**, that we must take into account to full conserve its information content by computation in Euclidean space.

The interested reader will have already guessed **the relationship of our result to de Moivre number or primitive root of unity** (i.e. any complex number that gives +1.0 when raised to some integer power of *n*). In this way, we can exploit Rational numbers ***Q*** full information content to get stronger solutions to current AMS system modeling problems.

CICT Computational Processing

Our knowledge of **RFD** (Representation Fundamental Domain) Q_L and corresponding RFD R_L can allow reversing LTR numeric power convergent sequence to its corresponding RTL numeric power divergent sequence uniquely.

Reversing a convergent sequence into a divergent one and vice-versa is the fundamental property to reach information conservation, i.e. information reversibility.

Eventually, **OECS** (Optimized Exponential Cyclic Sequences) **have strong connection even to classic DFT algorithmic structure for discrete data**, Number-Theoretic Transform (NTT), Laplace and Mellin Transforms.

Coherent precision correspondence leads to transparency, ordering, reversibility, kosmos, simplicity, clarity, and **to algorithmic quantum incomputability on real macroscopic machines**.

SN_1 = 7 Family Group (First Order)
Remainder - Quotient OECS Recurrence Relation

1/7	0.	$Q_1 = 1$	$Q_2 = 4$	$Q_3 = 2$	$Q_4 = 8$	$Q_5 = 5$	$Q_6 = 7$
		$R_1 = 3$	$R_2 = 2$	$R_3 = 6$	$R_4 = 4$	$R_5 = 5$	$R_6 = 1$
2/7	0.	$Q_1 = 2$	$Q_2 = 8$	$Q_3 = 5$	$Q_4 = 7$	$Q_5 = 1$	$Q_6 = 4$
		$R_1 = 6$	$R_2 = 4$	$R_3 = 5$	$R_4 = 1$	$R_5 = 3$	$R_6 = 2$
3/7	0.	$Q_1 = 4$	$Q_2 = 2$	$Q_3 = 8$	$Q_4 = 5$	$Q_5 = 7$	$Q_6 = 1$
		$R_1 = 2$	$R_2 = 6$	$R_3 = 4$	$R_4 = 5$	$R_5 = 1$	$R_6 = 3$
4/7	0.	$Q_1 = 5$	$Q_2 = 7$	$Q_3 = 1$	$Q_4 = 4$	$Q_5 = 2$	$Q_6 = 8$
		$R_1 = 5$	$R_2 = 1$	$R_3 = 3$	$R_4 = 2$	$R_5 = 6$	$R_6 = 4$
5/7	0.	$Q_1 = 7$	$Q_2 = 1$	$Q_3 = 4$	$Q_4 = 2$	$Q_5 = 8$	$Q_6 = 5$
		$R_1 = 1$	$R_2 = 3$	$R_3 = 2$	$R_4 = 6$	$R_5 = 4$	$R_6 = 5$
6/7	0.	$Q_1 = 8$	$Q_2 = 5$	$Q_3 = 7$	$Q_4 = 1$	$Q_5 = 4$	$Q_6 = 2$
		$R_1 = 4$	$R_2 = 5$	$R_3 = 1$	$R_4 = 3$	$R_5 = 2$	$R_6 = 6$
7/7	0.	$Q_1 = 9$	$Q_2 = 9$	$Q_3 = 9$	$Q_4 = 9$	$Q_5 = 9$	$Q_6 = 9$
		$R_1 = 7$	$R_2 = 7$	$R_3 = 7$	$R_4 = 7$	$R_5 = 7$	$R_6 = 7$

(R.A. Fiorini, 2013)

From Quantum Sensing to SWEME Interaction Modeling

CICT SN (Solid Number) Encoding Example
True Color Image Example (512 by 768 pixel)

(R.A. Fiorini, 2013)

Main CICT OECS Properties

We got rich new knowledge about fundamental arithmetic number concept and properties by **Optimized Exponential Cyclic Sequences** (OECS):

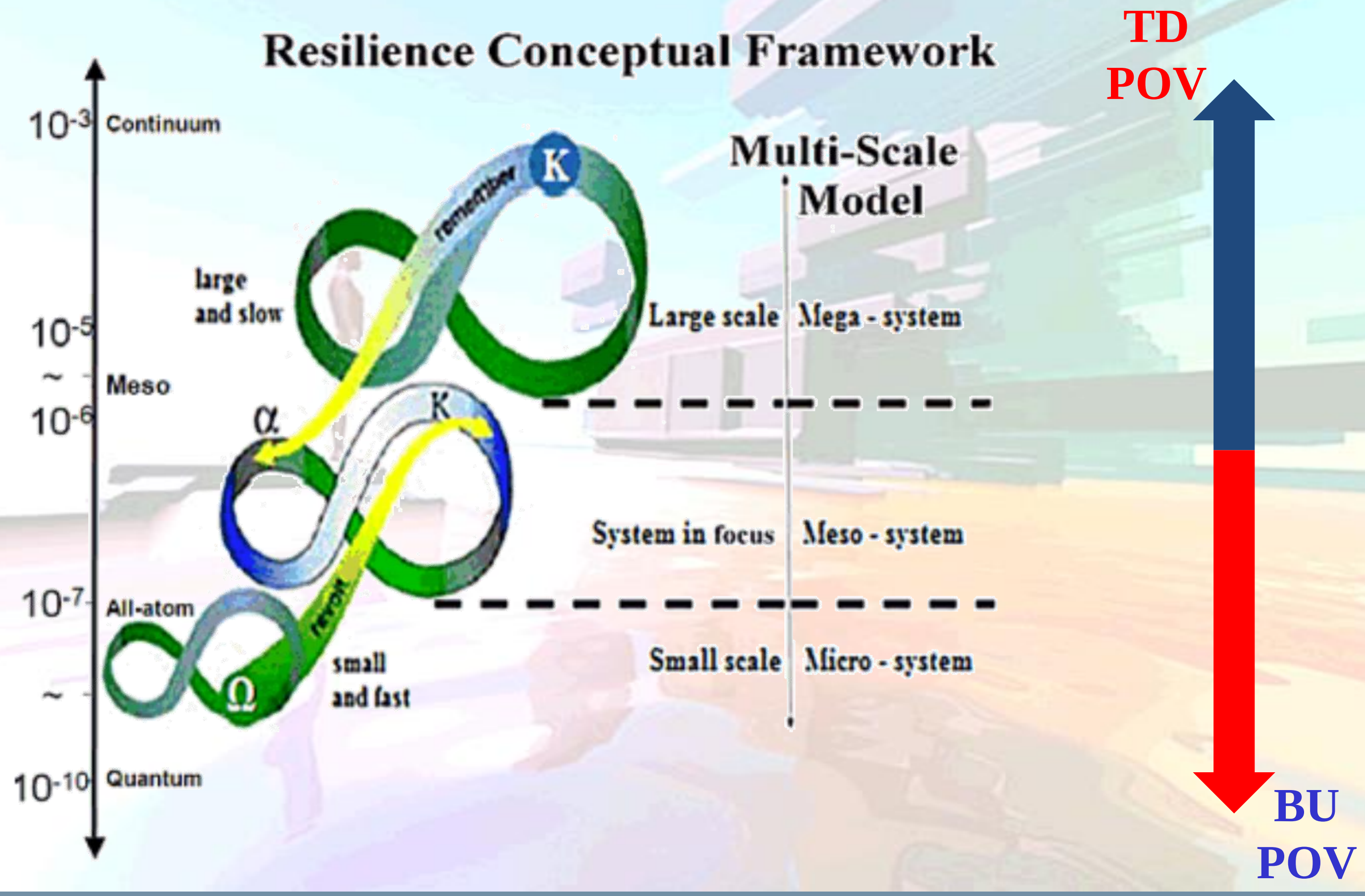
a) Symbolic vs. **OpeRational** Number Representation;
b) Prime vs. **SN Family Group Order** properties;
c) Arbitrary Precision **Exact Rational Number Representation**;
d) Incidence vs. **Correspondence** in **OECS Word Space**;
e) OECS phased generators **Fixed Point** vs. **Pairing** properties;
f) etc… etc…

More specifically, **OECS Family Group of any order** can play a fundamental role by capturing and optimally encoding deterministic information to be lossless recovered at any arbitrary precision.

Combinatorially **OECS** are totally indistinguishable from computer generated pseudo-random sequences or traditional "system noise" to an external Observer.

From Quantum Sensing to SWEME Interaction Modeling

CICT Solution to the Problem for AMS System Modeling



Half-Plane Space vs. OECS Space

Two Irreducible Complementary Operative Spaces

Half-Plane Space

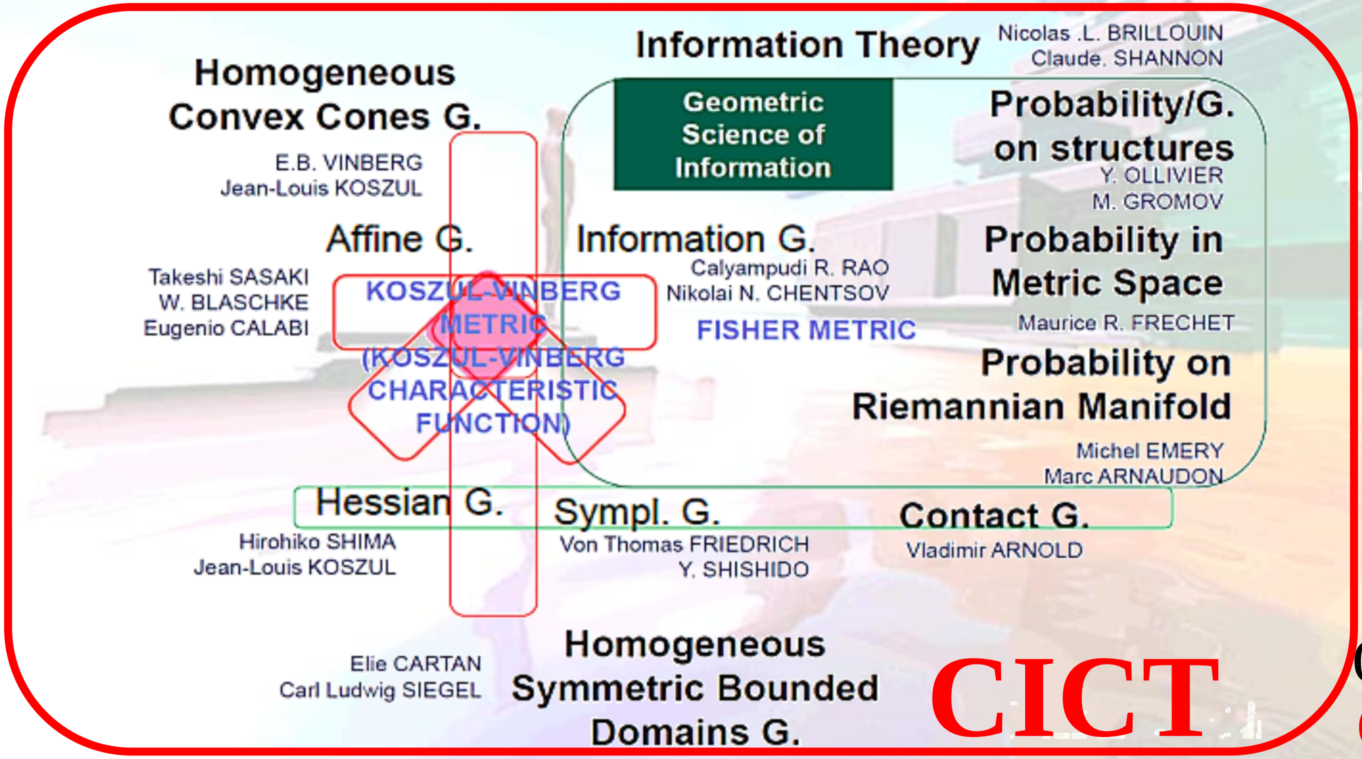
- Inert matter best operational representation compromise.
- A Representation Space endowed with full Flexibility (mapping complexity to simplicity to give space to Imagination).
- Simplified system dynamics framework (Newtonian Approach).
- To model any geometrical space and monitor system dynamics behavior only.
- A Spectator can become a system innatural perturbation.

OECS Space

- Livig matter best representation operational compromise.
- An Outer Representation Space one-to-one linked to its Inner Representation Space.
- Natural system dynamics framework (Quantum Field Theory Approach).
- To model projective relativistic geometry and to anticipate emergent system dynamics.
- An Observer can become a system natural co-artifex.

Current Landscape of Geometric Science of Information

Hessian (J.L. Koszul), Homogeneous Convex Cones (E. Vinberg), Homogeneous Symmetric Bounded Domains (E. Cartan, C.L. Siegel), Symplectic (T. von Friedrich, J.M. Souriau), Affine (T. Sasaki, E. Calabi), Information (C. Rao, N. Chentsov). Through Legendre Duality, Contact (V. Arnold) is considered as the odd-dimensional twin of symplectic geometry and could be used to understand Legendre mapping in information geometry.



(F. Barbaresco, 2014)
(R.A. Fiorini, 2014)

Immediate Effective Solution to:

- circRNA and Bioinformatics Current Ambiguities;
- Silent Gene Discovery;
- Precision Medicine Applications;
- Complex AMS System Modeling;
- Etc...

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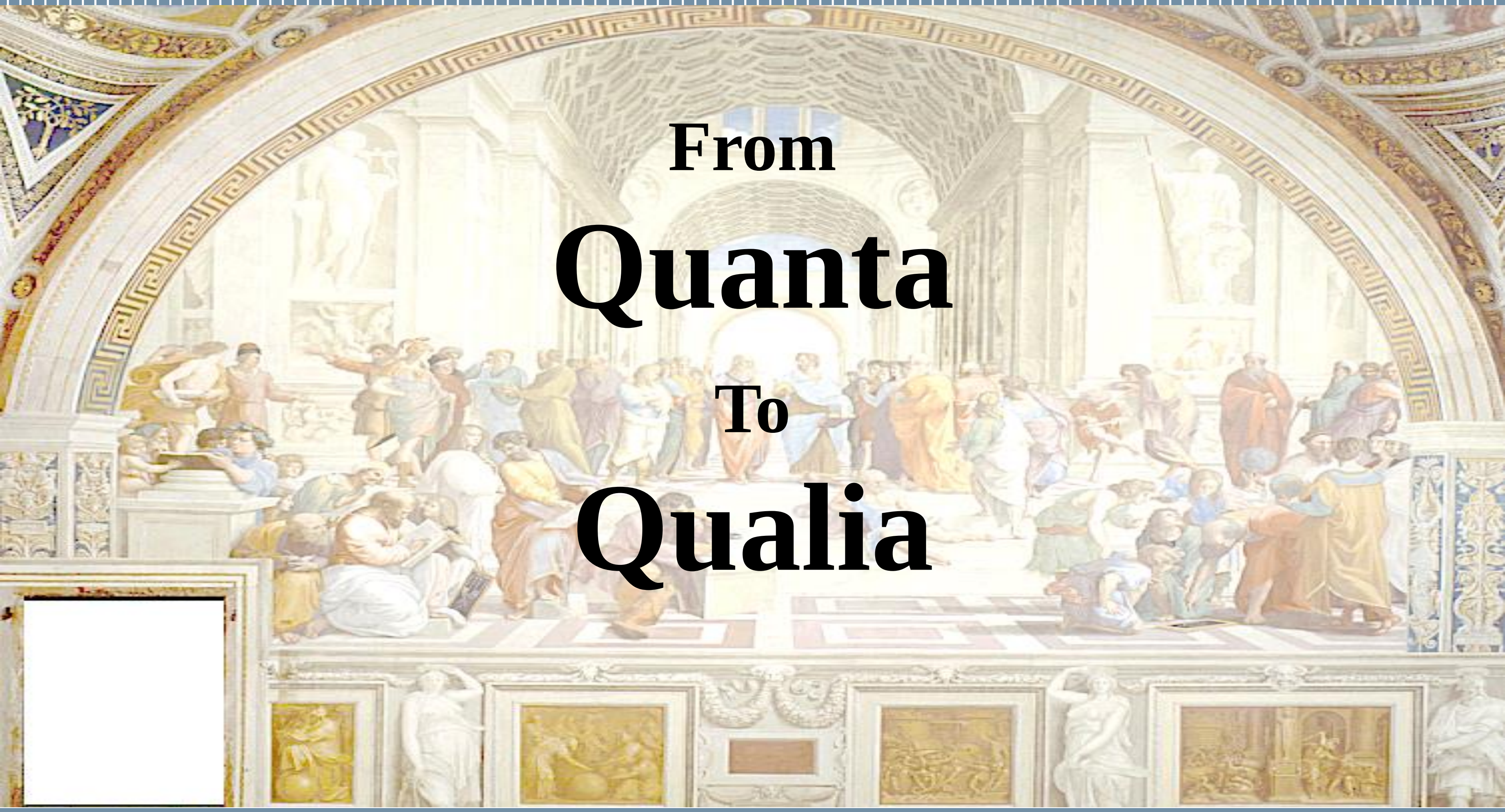

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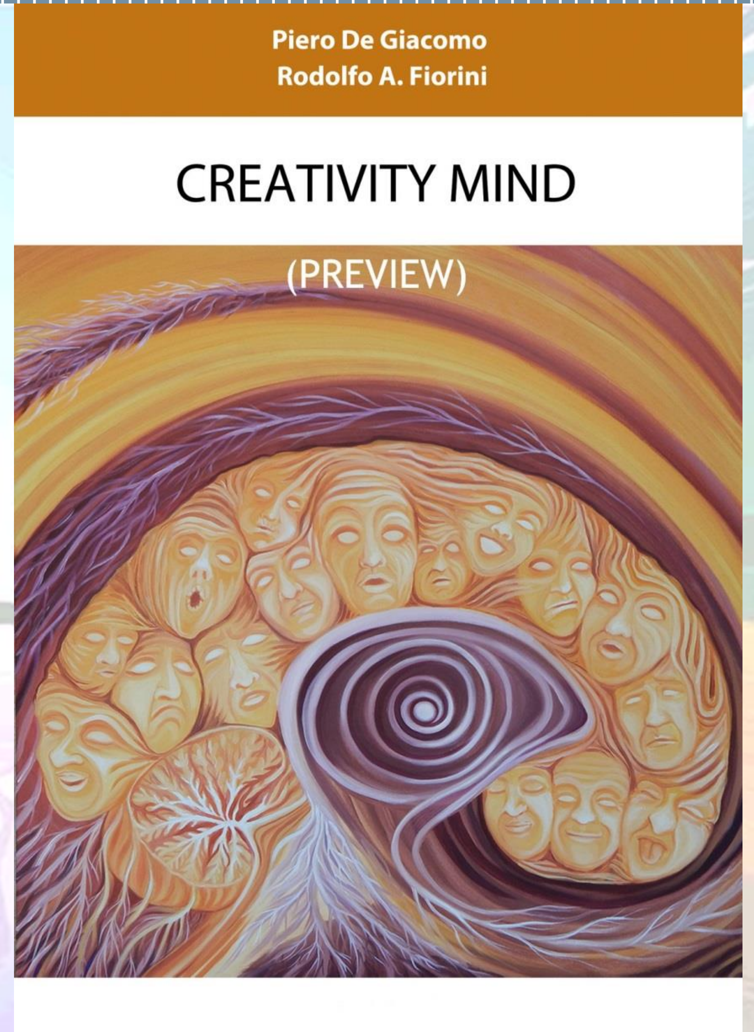

Quick Recap

- **CICT** new awareness about traditional rational number system ***Q*** numerical properties can guide the development of new competitive algorithm.

- Thanks to **CICT SN concept**, fundamental **OECS** properties have been reviewed and a few examples discussed. **OECS** can even be thought as coding sequence for finite fields Galois' geometries (Hyperbolic Geometry), indistinguishable from those generated by traditional random noise sources.

Main References

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Neuralizer Work In Progress


Thank You for
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