A new hypothesis of super-quasi-crystalline vacua

Victor Christianto*, & Florentin Smarandache**

*Malang Institute of Agriculture (IPM), Malang – INDONESIA, email: victorchristianto@gmail.com

** Dept. Mathematics & Sciences, University of New Mexico, Gallup, USA. Email: smarand@unm.edu

Abstract

In this short review, we extend ideas in our preceding paper on possibility that the space consists of discrete cells, to become cells composed of superconductor quasi-crystalline. We discuss some features of this model. To our best knowledge, there is not yet similar proposal as we outlined herein.

Introduction

It is known that continuum problem is a fundamental question in theoretical physics: whether the space is discrete or continuous.

In the meantime, in our paper [2], we argue in favor of discrete cellular space to solve this continuum problem.

In our recent article submitted to this journal, we argue that although our model is far from being complete, it can be connected to a recent paper suggesting that the space is composed of graph at its smallest structure – and it is called quantum graphity.[3] The idea is to merge those graphs into a network of *dense-packed* cells. That way the space system looks **both as graph network as well as discrete cellular pattern.[3]**

In this article we put forth a new hypothesis that the discrete cellular structure of space consists of cells of superconductor quasi-cristallyne.

What is quasiperiodic crystal?

It is argued that the definition of quasicrystals should not include the requirement that they possess an axis of symmetry that is forbidden in periodic crystals. The term "quasicrystal" should simply be regarded as an abbreviation for "quasiperiodic crystal," possibly with two provisos [8].

Precious stones whose thickness capacities might be extended as a superposition of a countable number of plane waves are called practically intermittent gems. Specifically, if taking necessary direct mixes of a limited number D of wave vectors in this extension can traverse all the rest, at that point the gem is quasiperiodic. Every diffraction top is then ordered by D numbers. Occasional gems are the extraordinary situation where the ordering measurement D is equivalent to the real physical component of the gem. All tentatively watched gems to date are quasiperiodic. Albeit an official classification has not yet been settled upon, one obviously recognizes (at any rate) two exceptional classes among the group of quasiperiodic gems: disproportionately adjusted precious stones and disproportionate composite crystals. [8]

Quasicrystals are a platform of novel electronic properties because of their underlying fractal crystalline structure without periodicity.[1]

What is quasicrystal?

There are additionally (carefully aperiodic) quasiperiodic gems for which a portrayal regarding a tweak of a fundamental structure or an arrangement of at least two foundations is either unseemly or inconceivable. We contend that one ought to allude to all such precious stones as quasicrystals, paying little mind to their point-bunch evenness. The most well-known model for such gems is a quasiperiodic tiling, for example, the renowned Penrose tiling. One occupies space with "unit cells" or "tiles" in a way that keeps up long-range request without periodicity, and produces a basically discrete diffraction chart. Unmistakably, quasiperiodic gems having balances that are illegal for intermittent gems, for example, the watched icosahedral, octagonal, decagonal, and dodecagonal precious stones—can't be framed by adjusting a hidden occasional structure with a similar balance, and are subsequently all quasicrystals. Quasiperiodic gems with no taboo balances can be shaped as a change of an intermittent structure, yet that need not be the situation. [8]

A new hypothesis

To sum up, Quasicrystals display a non-periodic, yet ordered, arrangement of atoms. They contain a small set of local environments which reappear again and again, albeit not in a periodic fashion. Their structure is not random either, since the diffraction pattern shows sharp Bragg peaks, although their symmetry is noncrystallographic, with the n-fold symmetries (n = 5, 8, 10, . . .) stemming from the fact that these local environments occur with n equiprobable orientations.[5]

Recent discovery suggests that quasi-crystalline has superconductive phase in very low temperature.[4]

In the context of our recent draft [3] suggesting that the space consists of discrete cellular structures, we may recall that Finkelstein argued in favor of quasicrystalline model of vacuum [6].

What if the quasicrystalline model is not in semiconductor solid...but a superconductor quasicrystalline?

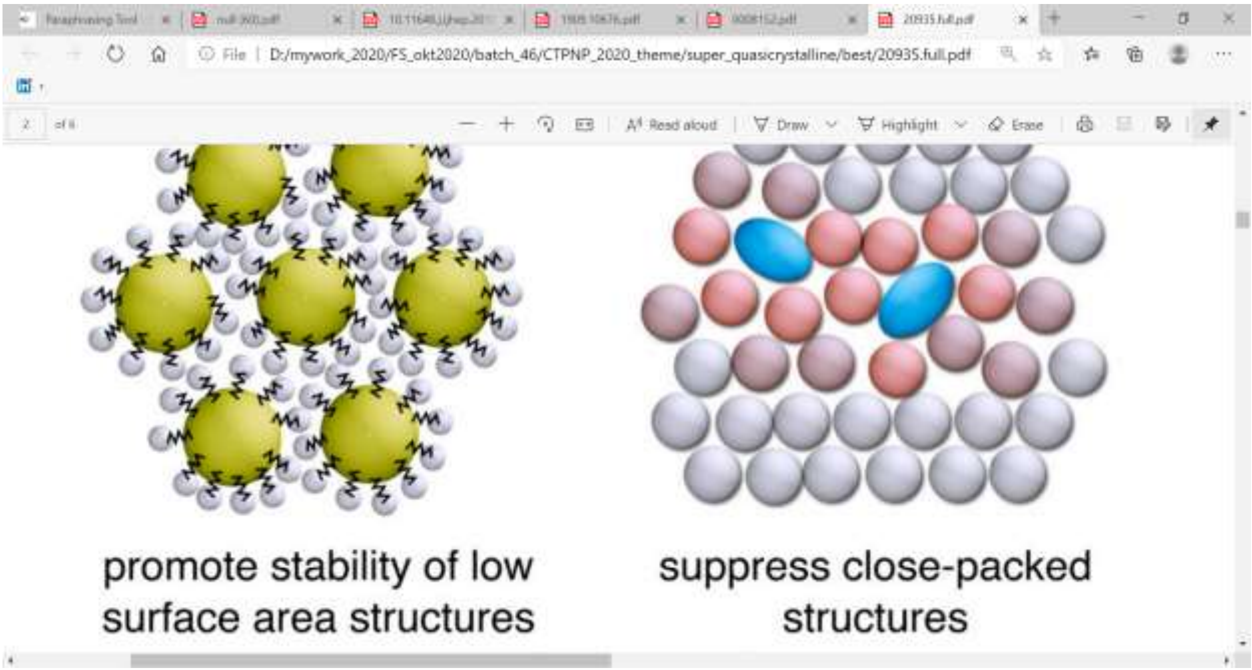
We may call it: super-crystalline.

Quasi-crystalline solid is also good because it brings in more than 3 dimensions, which may be very relevant. This also would bring in Finkelstein and Penrose and some of Frank Tony Smith's investigations. The next item to consider is a super-quasi-crytalline solid (SQC).

Because of its fractal properties, we can expect that the Superconductor Quasi-Crystalline (SQC) can extend down to the structure of space, similar to what Finkelstein envisaged.

The quasi-crystal structure of space may be composed of solid matter or soft-matter, of which its general dynamics has been outlined by Fan et al. [7].

Assembly of soft-matter quasi-crystal is shown as follows:



It exhibits a suppressed close-packed structures [9]. This dense-packed structure of space should be verified with experiment.

A few observables

a. Pairing system in outer solar system:

   As Sakai and Arita put forth in [1], it is possible that exotic pairing state of superconducting quasi-crystal can take place. It may be possible to extend further to hypothesize that the pair of Pluto-Charon may be originated from such a paired condensate/superconductor phase of quasi-crystalline. We should wait for result of future expedition to Pluto or Charon with sampling. See also discussion on Pluto-Charon pairing from superconductor model of solar system, in our forthcoming paper [16].

b. Natural quasicrystal in rock:

   Steinhardt & Bindi [10] argued that original theory suggested that quasicrystals can potentially be as robust and stable as crystals, perhaps even forming naturally. These considerations motivated a decade-long search for a natural quasicrystal culminating in the discovery of icosahedrite (Al63Cu24Fe13), an icosahedral quasicrystal found in a rock sample composed mainly of khatyrkite (crystalline (Cu,Zn)Al2) labeled as coming from the Koryak Mountains of far eastern Russia. In their paper, they argued that the analysis shows the sample to be of extraterrestrial origin.

Illustration 1. Light image of entire MSNF specimen prior to sampling, Khatyrka CV3 meteorite.[11]

Moreover, some papers argue that such a rock may be of manmade origin, as Bindi et al noted:

> "The evidence for the existence of the quasicrystal phase in the rock is therefore overwhelmingly strong. However, the observation of metallic Al in intermetallic compounds with copper and iron, which requires a highly reducing environment, is deeply puzzling. It raises the possibility that the sample originated from slag or another anthropogenic process. However, the sample was found in a remote region very far from any industrial activity."[13]

While we admit it would need further studies, as we see it such a hypothetical origin of meteorites and rock from extraterrestrial or manmade origin remains puzzling. It may be more possible to argue in favor that the quasicrystalline happens in nature was caused by the structure of space itself is composed of SQC.

c. Natural quasicrystals in solar system:
   Luca Bindi and also Matthias Meier *et al.* seem to suggest that quasicrystals have cosmic origin.[13][14] While such a hypothesis is quite reasonable, allow us to add a possibility that such a cosmic origin might yield from hidden structure of space itself. Such a hypothetical origin may be more "workable" than most of quantum gravity hypotheses [15].

Concluding remark

We hope this short remark will lead someday to clearer dense discrete cellular model of space in connection with superconductor-quasi-crystalline model (SQC). Further investigations are of course recommended.

Acknowledgment

Discussions with Robert N. Boyd are gratefully appreciated.

Version 1.0: 22 october 2020

References:

[1] S. Sakai & R. Arita. Exotic pairing state in quasicrystalline superconductors under magnetic field. arXiv:1905.01487v1 [cond-mat.supr-con]
[2] V. Christianto & F. Smarandache. How Many Points are there in a Line Segment? – A New Answer from a Discrete Cellular Space Viewpoint. *Prespacetime J.*, Vol 9 no. 4 (2018)
[3] V. Christianto. What is space? Discrete cellular space revisited. Submitted to *Prespacetime J.,* oct. 2020
[4] K. Kamiya *et al.*, Discovery of superconductivity in quasicrystal. *NATURE COMMUNICATIONS,* (2018) 9:154, DOI: 10.1038/s41467-017-02667-x | www.nature.com/naturecommunications
[5] R.N. Araujo & E.C. Andrade. Conventional superconductivity in quasicrystals. arXiv: 1903.09635v2 [cond-mat.supr-con]
[6] D. R. Finkelstein *et al.* Hypercrystalline vacua. https://arxiv.org/abs/quant-ph/9608024
[7] T-Y. Fan, et al. Review on Generalized Dynamics of Soft-Matter Quasicrystals and Its Applications. arXiv: 1909.10676

[8] R. Lifshitz. The definition of quasicrystals. Arxiv: 0008152

[9] C.R. Iacovella, *et al*. Self-assembly of soft-matter quasicrystals and their approximants. *PNAS* **|** December 27, 2011 **|** vol. 108 **|** no. 52 **|** 20935–20940

[10] Paul J. Steinhardt & Luca Bindi. In search of natural quasicrystals. *Rep. Prog. Phys.* 75 (2012) 092601 (11pp). https://dx.doi.org/10.1088/0034-4885/75/9/092601

[11] Glenn J. MacPherson et al. Khatyrka, a new CV3 find from the Koryak Mountains, Eastern Russia. *Meteoritics & Planetary Science* 48, Nr 8, 1499–1514 (2013)

[12] Luca Bindi *et al*. Icosahedrite, $Al_{63}Cu_{24}Fe_{13}$, the first natural quasicrystal. *American Mineralogist*, Volume 96, pages 928–931, 2011

[13] Matthias M.M. Meier *et al*. COSMIC HISTORY AND A CANDIDATE PARENT ASTEROID FOR THE QUASICRYSTAL-BEARING METEORITE KHATYRKA. arXiv: 1803.03513

[14] Luca Bindi. *Natural quasicrystals: The Solar System's hidden secrets.* Switzerland: Springer Nature, 2020. ISSN 2524-8596

[15] Fauser, Tolksdorf, Zeidler (eds.) *Quantum gravity: Mathematical models and experimental bounds.* Basel, Switzerland : Birkhäuser Verlag, P.O. Box 133, CH-4010, 2007

[16] Y. Umniyati, V. Christianto & F. Smarandache. An Explanation of Sedna Orbit from Condensed Matter or Superconductor Model of the Solar System: A New Perspective of TNOs. Paper accepted at SMIC 2020 conference, held at Aug. 2020, Indonesia. To appear at *AIP Proceedings Series.*