TWO-SCALE THERMAL SCIENCE FOR MODERN LIFE
Making the Impossible Possible

by

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"Everything should be made as simple as possible", as said by Albert Einstein, and thermal science is the best candidate to make a complex problem simple. This article introduces that the virus prevention is simple, only a cup of hot water is enough. Beyond its towering contribution to everyday life, thermal science is also an avid helper in each research frontier of science and technology, nothing is impossible. The new emerging two-scale thermal science is also elucidated.

Keywords: *Covid-19 virus, metabolic law, discontinuous mechanics, two-scale fractal dimensions, fractal diffusion*

Introduction

When facing the Covid-19 pandemic disease [1] for a very prolonged period as long as almost three years, what can we do?

Boring quarantine and repeatedly nucleic acid tests have been gradually assimilated into our everyday life, and we have to wear masks almost every day for public activity, while scientists have been working on vaccine urgently, however, at present, no widely approved vaccine exists for this tiresome disease. What else can we do to prevent the disease?

You might be in shock! Thermal science makes the impossible possible.

Scientists from Zhejiang Ocean University found that thermal science plays a sky-rocketing role in preventing the pandemic disease [2], they found the missing piece of the puzzle in solving this intractable problem, and it's going to change your deeply ingrained opinion, which was thought to be impossible. The most impossible thing is now possible!

A cup of hot water under the noise! Yes, a cup of hot water provides the most effective way for virus prevention, which has been proved by Liu, *et al*. [2]. All living cells are affected deadly by their environmental temperature, but the impacts on the virus and its host are quite different, and can be well explained by the thermal science [2]. This discovery has opened the path for a new way to prevent Covid-19 virus and other viruses as well.

Li-Juan Li, a doctor from Department of Ophthalmology, Jiao Zuo People's Hospital, China, gave also a clear academic explanation of the thermal therapy by thermal science [3], a relative high temperature makes viruses less metabolically active than their host cells, see fig.1.

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Thermal science is the cornerstone of modern science and technology, but it itself is under development. Here we show that the two-scale thermal science [4, 5] is a promising branch of thermal science, challenging the continuous assumption and differential equation models in the traditional thermal science.

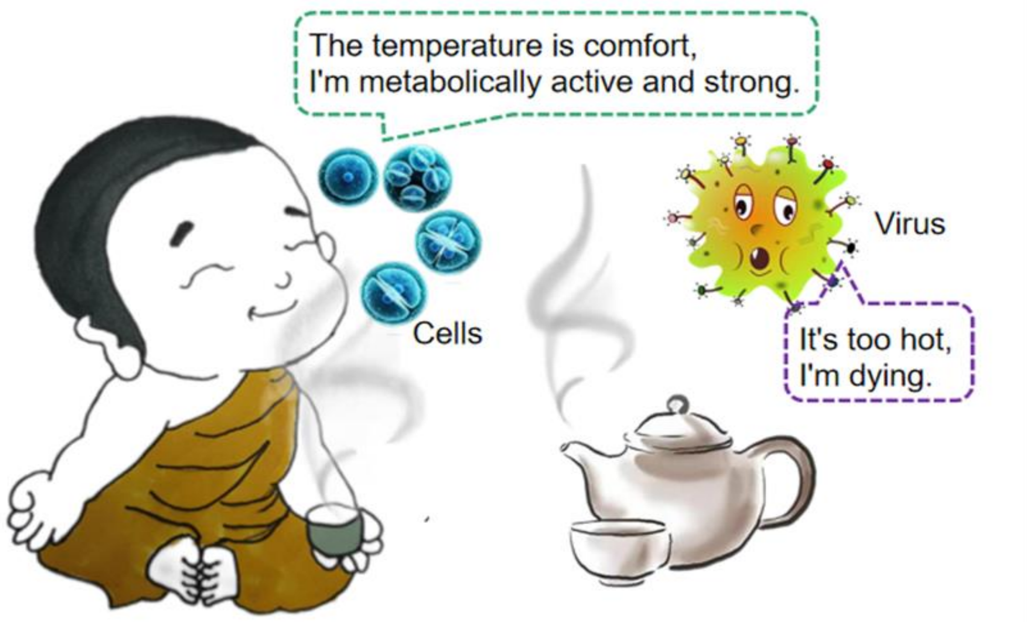

Figure 1. High temperature makes viruses less metabolically active than their host cells

Two-scale thermal science

Thermal science has been developing fast and has been assimilated into each subject of science and technology. Due to the development of the modern technology, we can observe many thermal phenomena in a molecule scale, making a towering contribution to modern thermal science, and the two-scale thermal science was born as a newly emerging branch of thermal science [6].

The two-scale thermal science is to study a thermal phenomenon using two different scales. The large scale leads to a differential equation model as that by the traditional thermal science, while the small scale, saying the molecule scale, observes the phenomenon in a fractal space. The 1-D models cannot describe any 2-D phenomena; and 2-D models cannot reveal the truth of the 3-D phenomena. Similarly any continuous models cannot depict any phenomena in a fractal (discontinuous) space. Many thermal phenomena occur in a fractal space, so the two-scale thermal science becomes a must.

Tian and He [7] found that the inherent pull-in instability of a micro-electromechanical system can become pull-in stability in a fractal space. Biesenthal *et al*. [8] elucidated some amazing properties of a fractal photonic topological insulator, that is light transport in a fractal space is quite different with that in a honeycomb lattice. When observing the heart as a fractal structure, Meyer *et al*. [9] revealed the heart's genetic and functional properties. Zuo, *et al*. [10] showed the fractal property of permeability in a porous medium. Ma [11] pointed out that a real optimal control problem should be established in a fractal space.

We use two simple experiments to elucidate the diffusion process of red ink and potassium permanganate solution in water. Water can be considered as a continuum medium at any observable scales with eyes, and all laws in fluid mechanics can be applied to describe the motion of water, however, when we observe water in a molecule scale, it becomes discontinuous, and the diffusion process takes place in the discontinuous space, see figs. 2 and 3, so a fractal diffusion has to be considered.

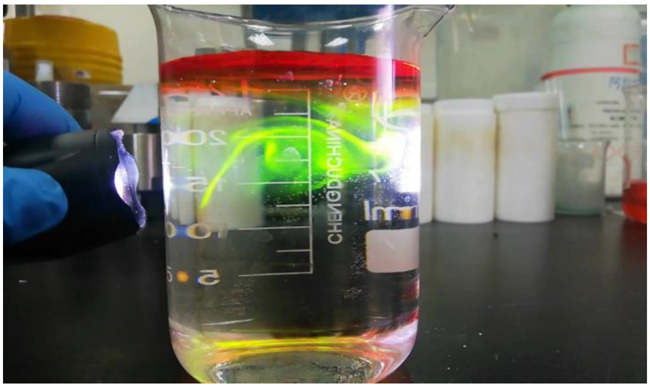

Figure 2. Red ink's fractal diffusion process in water

Figure 3. The fractal diffusion process of the potassium permanganate solution in water

As we can see in figs. 2 and 3, the diffusion process in the fractal space is not stochastic, it is determinative and follows laws in the fractal space.

Conclusion

By going beyond the confines of the traditional thermal science, the two-scale concept has paved the way toward an expanded perception of thermal science and has opened a new chapter of fractal thermodynamics. In this issue, some hot research frontiers in different fields are also reported, for examples, the molecule-scale fractal diffusion, the macromolecular scale electrospinning, the fractional thermal model, passive solar building, nanoscale flow for nanofiber fabrication, suitability of human settlements, thermal comfort for the building topography, and thermo-physiological comfort. This issue provides a good reference for audience to catch the frontiers of thermal science at intersection with other fields, *e.g.*, nanotechnology, mathematics, textile engineering and constructional engineering.

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