International Forum on Frontier Theories of Thermal Science

December 18-20, 2011, Tsinghua University, Beijing, China

Rapid developments in nanotechnology and laser techniques are leading to tremendous increases in the flux density and transport rate of heat transfer processes both in space and in time. Such huge energy density and transport rate sometimes result in anomalous thermal properties of the nanomaterials, leading to severe challenges of controlling the ultrafast heating and cooling processes. These transport phenomena exceed the limits of Fourier's law and development of innovative theories is pressing. The past two decades have seen several novel thermal science theories that describe these new heat transfer phenomena. This forum provides a communication platform and an opportunity for researchers to exchange ideas and interacting with each other on the researches of the theories. The topics include:

- Thermomass theory;
- Irreversible thermodynamics;
- Nonlocal behavior during heat transfer processes;
- Phonon gas dynamics;
- Entropy vs. Entransy;
- Applications in nanosystems and energy efficiency.

The forum is open to the public but the speakers are invited only. The highlight feature of this forum is that the discussion time is comparable to the presentation time (~1:1.3). Besides the discussions right after the presentations, we have session comments for the whole session talks. A one-hour round table discussion will be arranged at the end of the forum to discuss the frontier and promising directions in the following decade. The sponsor will provide **cover** the board and accommodation for all invitees.

The Keynote speakers are invited to give 30 minute presentations followed by 10 minutes of discussion. Other speakers will present their work in 10 minute presentations plus 5 minutes of discussion. Each speaker is expected to submit a one-page abstract two months ahead the forum. The PowerPoint file for their presentation needs to be submitted by December 5. All the files should be sent electronically to the forum chairman, Prof. Xing Zhang, Chairman of the Heat and Mass Transfer Society of China, at x-zhang@tsinghua.edu.cn or the forum secretary, Prof. Moran Wang, at mrwang@tsinghua.edu.cn.

Sponsored by:

National Natural Science Foundation of China

Ministry of Education of China

Heat and Mass Transfer Society of China

Tsinghua University

Keynote speakers

Click on names and/or institutions for related Web links

1. Zeng-Yuan Guo, Professor, Tsinghua University, China Tsinghua-Wikipedia
2. David Jou, Professor, Universitat Autonoma de Barselona, Spain
3. Robert D.Y. Tzou, Professor, University of Missouri, USA
4. Baowen Li, Professor, National University of Singapore, Singapore
5. Milivoje Kostic, Professor, Northern Illinois University, USA

More at: <http://goo.gl/6PnqR>

6. Satish Kandlikar, Professor, RIT, USA
7. Volfango Bertola, Lecturer, University of Edinburgh, United Kingdom
8. Shigeo Maruyama, Tohoku University, Japan
9. Wen-Quan Tao, Professor, Xi'an Jiaotong University, China Wiki
10. Yi Jiang, Professor, Tsinghua University, China Tsinghua-Wikipedia
11. Wei Liu, Professor, Huazhong University of Science and Technology, China Wiki
12. Xin-Gang Liang, Professor, Tsinghua University, China Tsinghua-Wikipedia

Invited Keynote Speakers:
5 from China, 3 from USA, 1 from UK, 1 from Spain, 1 from Singapore, and 1 from Japan
Click on names and/or institutions for related Web links (Links & annotation by M. Kostic)

Copy Posted at: www.kostic.niu.edu/energy/IFonFTofTS-Beijing2011China.pdf

Electromagnetic Nature of Thermo-Mechanical Mass-Energy Transfer Due to Photon Diffusive Re-Emission and Propagation

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It is widely believed that thermal heat conduction and mechanical work transfer are "massless" phenomena. However, based on existing observations of electron-shell interactions and well-established phenomena and theories, including Einstein's mass-energy equivalence and thermal radiation, it is reasoned and deduced here, that for a conduction heat transfer (e.g. through a wall) or mechanical work transfer (e.g. a rotating shaft), there has to be electromagnetic energy transfer (i.e., via photon propagation) and commensurate mass-transfer trough material systems involved, from a mass-energy source to a sink system. Otherwise, the mass-energy equivalence and the Physics law of forced interactions will be violated, since these thermo-mechanical phenomena are neither gravitational nor nuclear interactions. Actually, the deficiency of classical Fourier heat conduction theory (parabolic differential equation), allowing infinite speed of thermal energy propagation (i.e., a change of temperature at one location is felt at infinity instantaneously), is challenged by Hyperbolic Heat Conduction Model, Relativistic Heat Conduction Theory, and Thermomass Theory, the latter also based on Einstein mass-energy equivalence with 'thermon' quasi-particle leading to inertia of heat transfer.

Thermal conduction is due to chaotic thermal electron-shell collisions and may be enhanced by free-electrons or crystal-lattice structure vibration (phonons), both phenomena due to underlining photon propagation (similar to electro-chemical phenomena and AC electrical current). This is in-effect experimentally confirmed in nuclear reaction processes: If a nuclear reaction is carried out in a "sealed" box, then energy or rest mass will be conserved within the box until transferred through the wall. However, after the energy/heat is transferred through the wall to the surroundings (and the box is cooled to its initial temperature and pressure), then its inherited rest mass is reduced and all energy transferred (by heat conduction through the wall) will increase the surroundings' rest mass by the same amount. Similarly, the mechanical work transfer is due to electron-shell directional pushing/twisting as the most efficient ("focused") energy transfer (i.e., mechanical super conductor). If it is fully investigated and understood, it has potential for development of hybrid synthetic-materials with superior thermal conductivity like diamond, for critical and new application.

This treatise may contribute to further understanding and generalization of electro-magnetic phenomena, including heat-conduction and mechanical energy transfer, and thus "fill the remaining gap" since all other phenomena, excluding gravitational and nuclear interactions, are due to the electromagnetic force interactions, namely all electro-chemical and thermo-mechanical phenomena, the latter as reasoned here. Based on simple, phenomenological, cause-and-effect conservation concepts and the mass-energy equivalence law, it is deduced here that conduction heat transfer and work transfer within material systems are photonic, i.e., electromagnetic in nature. The hypotheses posed here, some thought-provoking, have additional objective to initiate further discussion with constructive criticism, and future research and applications, related to the conclusions deduced and open questions posed.

Holistic Reasoning and Generalization of the Second Law of Energy Degradation and Entropy Generation

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Even today, the *Second Law of Thermodynamics* remains obscure, due to the lack of its holistic and subtle comprehension, and it continues to attract new efforts at clarification, including this one. The theory of classical Thermodynamics was originally based on thermal and mechanical energy transformations, but it has been expended to all different types of work and heat interactions and thus effectively became Thermo(*multi*)dynamics, the general energy science, considered by some to be "the *Mather of all sciences*."

Any change/process is caused/requires mass-energy flux exchange, i.e., it is a forced displacement of non-uniform mass-energy in space, ultimately resulting in equilibrium. Therefore, the force concept is the cause-and-effect force-flux phenomena. In that regard the *Newton's Laws* of motion and forces, which overlap each other, are special cases of more general Thermodynamic Laws, the latter have much wider, including philosophical significance and implication, than their simple expressions based on the experimental observations – they are *The Fundamental Laws of Nature*: *The Zeroth* (equilibrium existentialism), *The First* (conservational transformationalism), *The Second* (forced-directional, irreversible transformationalism), and *The Third* (unattainability of emptiness). They are defining and unifying our comprehension of all existence and transformations in the *Universe*.

The second law of Thermodynamics is among the most fundamental principles of engineering, science and nature. Since its discovery about one-and-a-half century ago, its status is generally considered supreme. However, the Second Law has come under unprecedented scrutiny during the last couple of decades by research groups worldwide. It caused some proponents of the Law to unnecessarily take defensive by restricting its validity to the isolated systems and global physical processes.

It is reasoned and deduced here that the Second Law is universally valid for all space and time scales, and without exceptions. During forced interactions (thus all processes) the momentum and energy are conserved at local scale and therefore at any integral space and time scales. However the momentum and energy are spatially redistributed in time and directionally equi-partitioned into 'randomized' thermal energy (dissipated via heat) giving rise to *irreversible generation* of thermal energy per absolute temperature, known as *entropy*. In reality entropy is always generated (in part or in whole) within locality of system structure, while otherwise and in limit it is conserved during reversible processes (without energy dissipation), but it cannot be destroyed since it will imply creation of non-equilibrium from nowhere or from within an equilibrium alone (without required non-equilibrium forcing).

The Second Law is often challenged in biology, life and social sciences, including evolution and information sciences, all with history rich in confusion. Organization/creation of technical (man-made) and natural (including life) structures and thus 'creation of local non-equilibrium' is possible and is always happening in many processes while entropy is generated (never destroyed), using another functional structures (channeling/filtering, pumping, with tools, hardware/software templates, information-knowledge-"intelligent" templates, DNAs, etc.). However, the mass-energy flow/transfer within those structures will always and everywhere dissipate energy and generate entropy (*according to the 2nd Law!*), i.e. on the expense of internal and/or surrounding/boundary systems' non-equilibrium. It may appear that the created non-equilibrium structures are self-organizing from nowhere, from within an equilibrium (thus *violating the 2nd Law*), due to the lack of proper observations and 'accounting' of all mass-energy flows, the latter maybe in 'stealth' form or undetected rate at our state of technology and comprehension (as the science history has though us many times). *The miracles are until we comprehend and explain them!*

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Invitation letter

More at: <http://goo.gl/6PnqR>

Moran <mrwang@mail.tsinghua.edu.cn> **Mon, Jul 11, 2011 at 7:58 PM**
To: "Prof. M. Kostic" <kostic@niu.edu>
Cc: demgzy <demgzy@mail.tsinghua.edu.cn>

Dear Prof. Kostic

The International Forum on Frontier Theories of Thermal Science (IFTS) will be held on December 19-20, 2011

at Tsinghua University in Beijing, China. This forum is open to worldwide but the speakers are invited only.

I am proud of inviting you to attend this forum on behalf of the forum president, Prof. X. Zhang.

Based on your historical contributions to this field, we are sincerely inviting you to present a keynote

On Thermo-mechanical transfer by photon and applications.

Attached please find the formal invitation letter of the forum. If you have any questions or suggestions,

please do not hesitate to contact us via emails: Moran Wang: moralwang@gmail.com or Xing Zhang: x-zhang@tsinghua.edu.cn.

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From: milivojek@gmail.com [mailto:milivojek@gmail.com] **On Behalf Of** Prof. M. Kostic
Sent: Friday, March 04, 2011 10:46 AM
To: Moran Wang
Cc: demgzy