

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

*Based on atomic electron-shell interactions and the Einstein mass-energy equivalence, during “**believed-massless**” heat conduction or mechanical work transfer, there **has to be electromagnetic**, i.e., **photon mass-energy propagation** (since they are not gravitational and not nuclear interactions) through involved material structures, from a mass-energy source to a sink system. Otherwise, the mass-energy equivalence and Physics law of forced interactions will be violated!*



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NORTHERN ILLINOIS
UNIVERSITY
1 8 9 5 - 1 9 9 5



Prof. M. Kotic
Mechanical Engineering
NORTHERN ILLINOIS UNIVERSITY

It is my great pleasure and honor to visit China and Tsinghua University ...

Thank you for invitation and opportunity to meet with and learn from a distinguished International scientists, and to present my new concept-theories (the first time formally here).



From NIU (my photo ... almost 14 hrs. flight more than 14 yrs. old!)

... to visit Great People of the Great Wall in China and distinguished colleagues at Tsinghua University

The hypotheses posed here, some thought-provoking, have **additional objective to initiate further discussion with constructive criticism**, and future research and applications in existing critical areas as well as emerging and novel applications, related to the conclusions deduced and open questions posed.

What is Energy ?



If one could expel all energy out of a physical system ...
... then empty, nothing will be left ...

... so **ENERGY** is **EVERYTHING** ... $E=mc^2$

$$m_{ph} = E_{ph}/c^2 = (h \cdot \nu)/c^2$$

Mass (m) is bind-energy within (E), they have a holistic meaning of “*mass-energy*”

The Nature of Heat and Work?

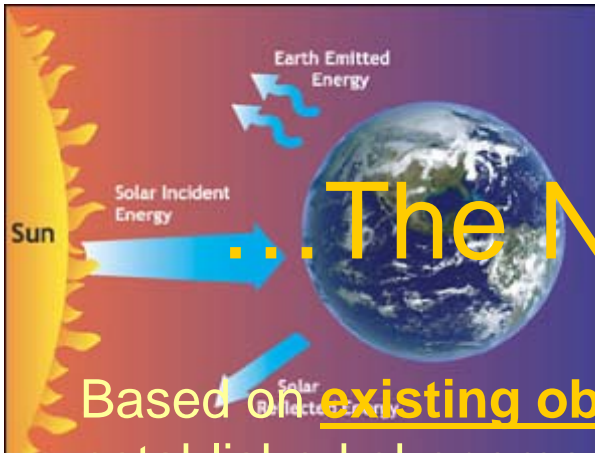
It has **NOT been explicitly established** what are the underlying, fundamental mass-energy carriers for conduction heat or mechanical work transfer within material systems...

... but are both widely considered to be “massless.”

Heat-Conduction Theories ...

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
(based on Einstein mass-energy equivalence with '*thermon*' quasi-particle leading to inertia of heat transfer)



...The Nature of Heat and Work !

Based on existing observations of electron-shell interactions and well-established phenomena and theories, including Einstein's mass-energy equivalence and thermal radiation (and for the same reason), it is deduced here that during **thermal heat conduction** or **mechanical energy transfer** (as vividly observed in *fractoluminescence* and *triboluminescence* phenomena), there must be underlying electromagnetic transfer, i.e. photon "diffusive re-emission and propagation" on short distance within a material structure ("on-contact" photon re-emission and propagation, or 'internal' thermal radiation), as well as corresponding mass-energy transfer carried by photons from a mass-energy source to a sink system (similar as from Sun to Earth).

Otherwise, the mass-energy equivalence and Physics law of forced interactions will be violated!



Objectives ...Up-Down View

- The objective here is to express a *phenomenological-thermodynamicist*, an up-down thought-reasoning view as complement to (and independent from) the *quantum-mechanicist*, down-up modeling view

After all, the thought-reasoning experiments are necessary for concepts beyond reach of reliable experimental observations

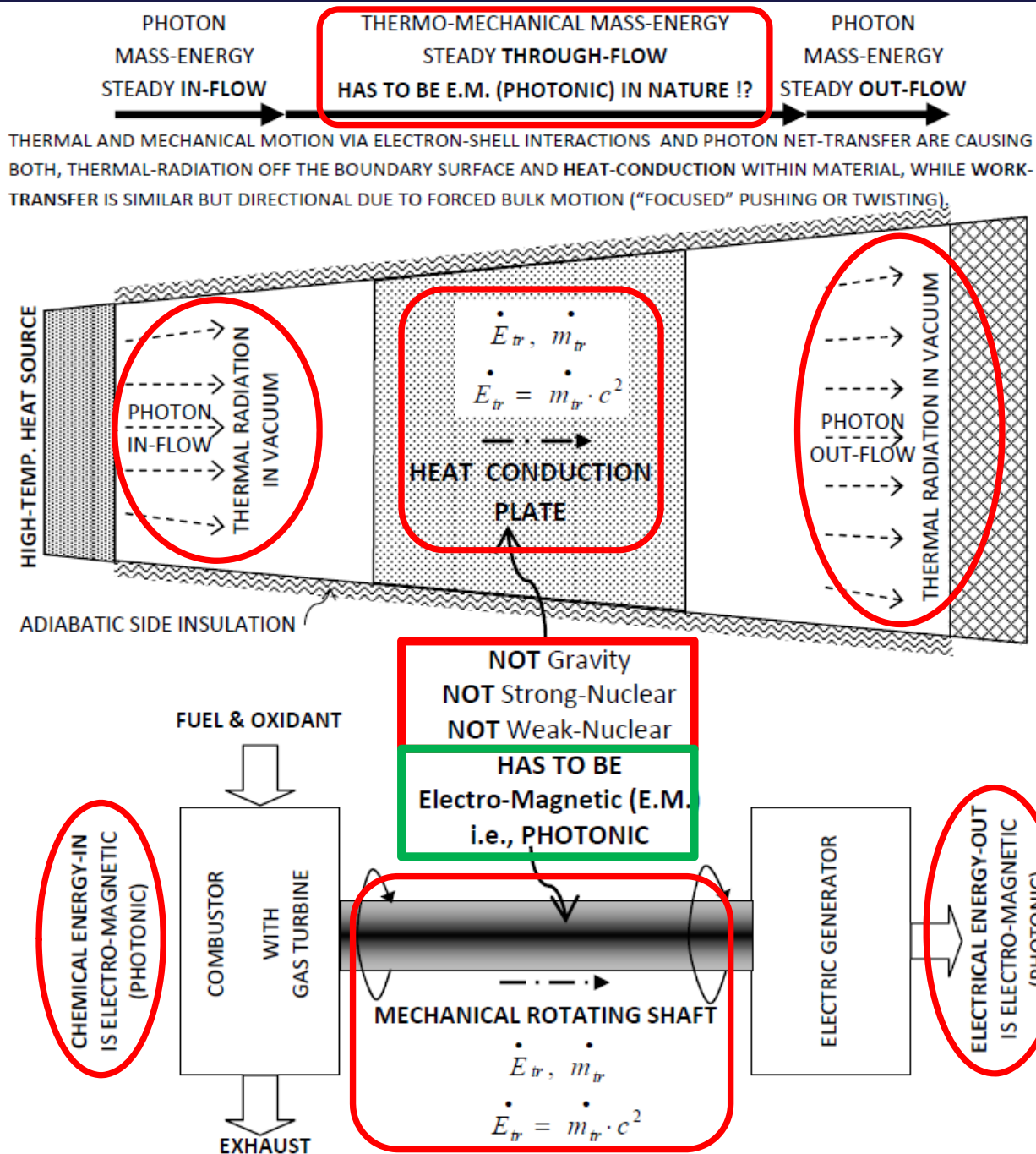


Fig.1: Electromagnetic Nature of Thermo-Mechanical Mass-Energy Transfer Due to Photon Diffusive Re-Emission and Propagation: Steady-state, mass-energy transfer is depicted through heat conduction plate (right-above) and rotating shaft (right-below). Energy transfer (i.e., Einstein's mass-energy equivalency transfer, $\dot{E}_{tran} = \dot{m}_{tran}c^2$) has to be electromagnetic by photon transfer, either as photon electromagnetic waves on-long range through space/vacuum ($\dot{Q}_{rad} = \dot{m}_{rad}c^2$), or photon "on-contact" transfer within material structures, e.g., through heat conduction plate (rt.-above) and turbine shaft work (rt.- below). Otherwise, Einstein's mass-energy equivalency and the fundamental force/interactions in Physics will be violated.

Underlying phenomena ...!

- **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 or DC/AC current, etc.).
- **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 applications.

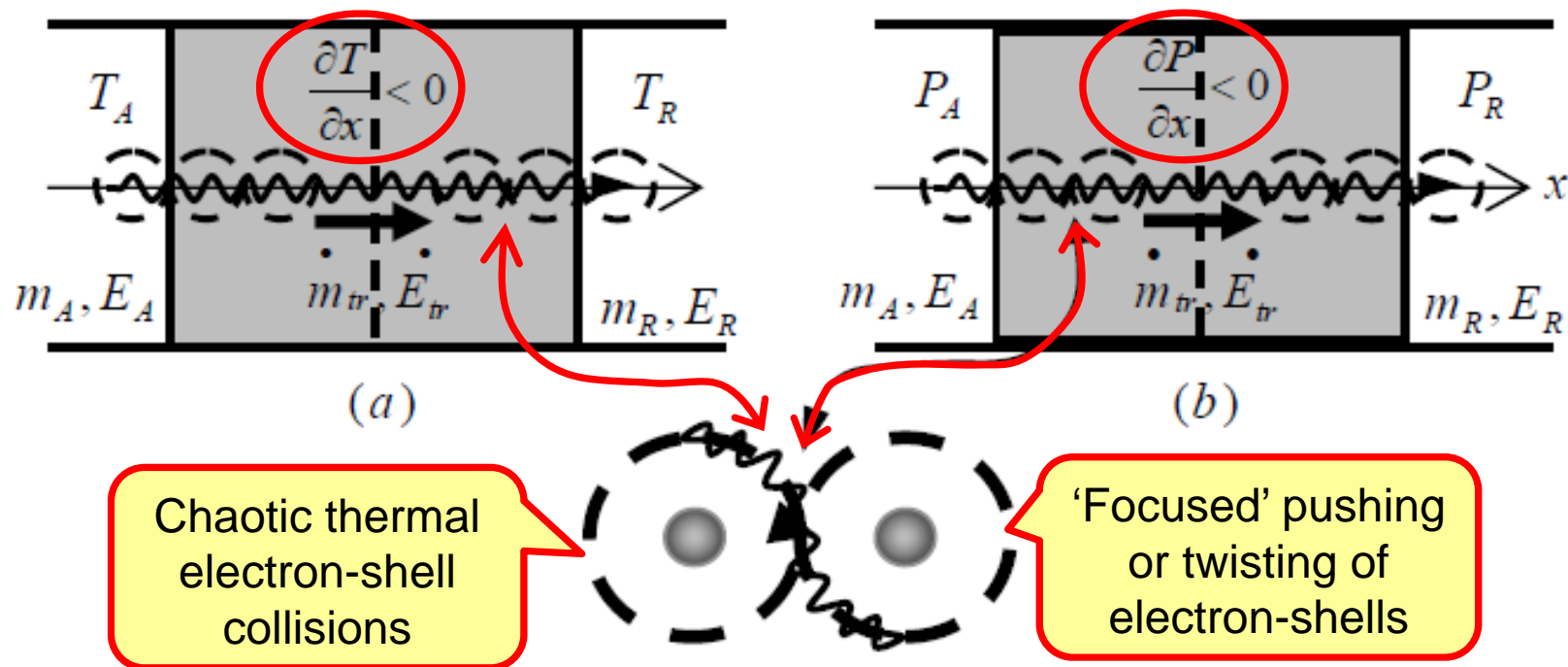


Fig. 2. Thermo-mechanical energy transfer by photon “on-contact propagation.” (a) Heat transfer by propagating photons (due to chaotic thermal electron-shell collisions), in direction of decreasing temperature (opposite direction of temperature gradient), and (b) work transfer by propagating photons (due to electron-shell directional pushing/twisting as the most efficient “focused” energy transfer), in direction of decreasing “collective stress” (opposite direction of collective stress gradient); from Acting-source (A) to Reacting-resisting-sink (R) systems.

Heat is 'substance' after all ... (and Work)?

Lavoisier may be right, since this treatise reaffirms that '*caloric*' is a "transferred substance" after all, and it also supports mechanical *fractoluminescence* and *triboluminescence*, including the "*peeling sticky-tape X-ray phenomenon*."



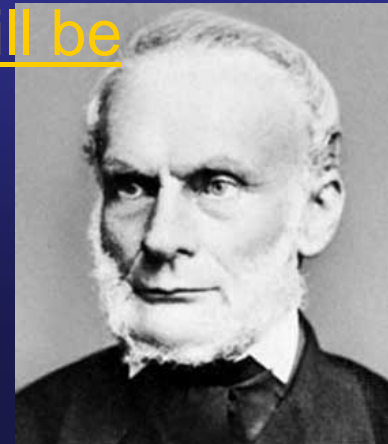
Published online 22 October
2008 | Nature |
doi:10.1038/news.2008.1185
News
Sticky tape generates X-rays



The Caloric Theory ...

Lavoisier and his followers reasoned ingeniously, long before the conservation of energy was established, that heat must be a conserved substance (*caloric*) contained in material systems which can be “poured” (transferred) within and between the systems.

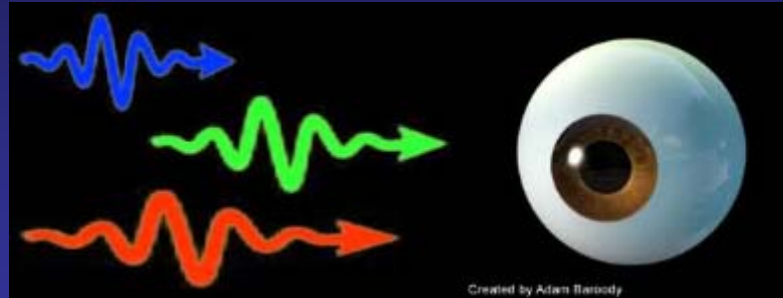
If conversion of all other energy types to heat is included (**thermal energy “generation” from all types of “phlogistons”**), i.e. conservation of energy in general, then caloric theory will be valid in general as stated by **Clausius**.



Physicists are “silent” ...

- The physicists and other scientists account for mass-energy equivalence for electro-magnetic radiation (including thermal), and binding electro-chemical and nuclear energy, but somehow, again, are “silent” (without giving a due justification) about thermal heat-conduction and mechanical work transfer through material structures when energy is transferred without (or beyond) any material particle diffusion.

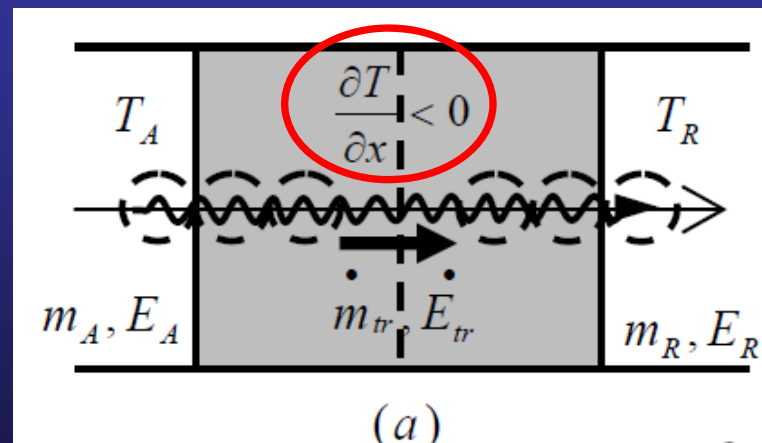
Photons are “poking” our eyes ...



- The photons have been giving us a lot of “signs” (almost “poking” our eyes) about their involvement in thermo-mechanical phenomena, but scientists have been somehow busy with studying other more “modern” concepts.

Heat Conduction ...

- When thermal energy is transferred (known as heat transfer), without material particle net-transfer, in direction of decreasing temperature gradient (known as heat conduction), see Figure 2(a), then more-energized particles (atoms or molecules) at higher temperature (T_A) will be interacting (colliding) with neighboring less-energized particles at lower temperature (T_R), thus transferring their electron-shell energy by re-emitting and propagating photons from one electron shell to another during the particle localized interactions.



... Heat Conduction

- Depending on material structure, the heat may be conducted by free-electrons (like in metals) or by “collective” mechanical vibration of solid crystalline structure (like in crystals), generated by thermal motion of atoms and molecules, known as thermal phonons (not elementary particles but quasi-particles); **however**, the both (thermal free-electron and thermal phonons) are due to photon “on-contact propagation” during atomic electron shell or free electron **thermal** interactions, resulting in photon net-propagation as underlying fundamental carriers of thermal energy transfer due to temperature gradient.

Experimental confirmation



- This is in-effect experimentally measured 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 (**by heat conduction**) 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 wall) will increase the surroundings’ rest mass by the same amount.

Ultimate fundamental energy carriers ...

- ... The energy carriers have to be the photons' propagation from the box to the surroundings, through the wall of the box. This experimentally “proves” that “massless” photons and “massless” heat exchange, transfer the invariant body-rest-mass through a wall from one body to another, during what is commonly regarded as “massless” heat exchange.
- **Therefore**, all thermal conduction energy transfers are “*thermo-luminescence-kind*” (visible or invisible), carried by the photon “on-contact” mass-energy re-emission and propagation, which may be considered as an “internal” thermal radiation.

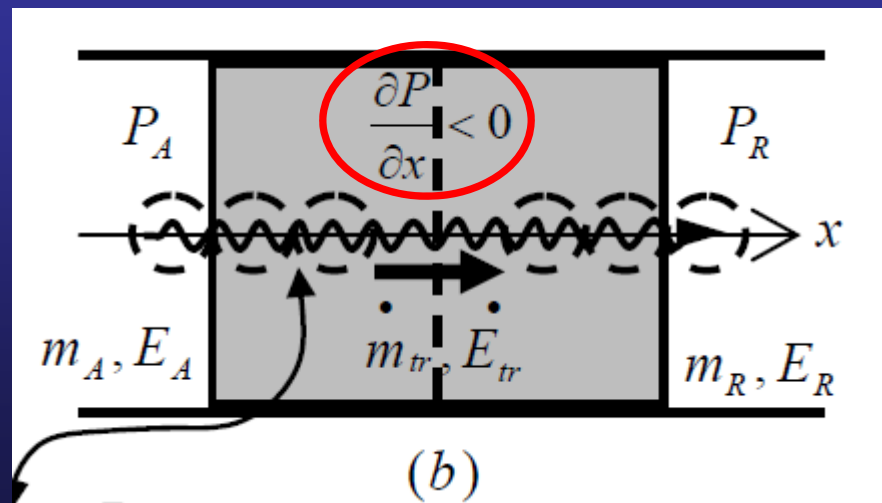
Ultimately all mass-energy forms converts to thermal energy ...

Heat transfer is Unique and Universal:

- ❖ Heat transfer is a spontaneous irreversible process where all organized (structural) energies are disorganized or dissipated as thermal energy with irreversible loss of energy potential (from high to low temperature) and overall entropy increase.
- ❖ **Thus, heat transfer and thermal energy are unique and universal manifestation of all natural and artificial (man-made) processes,**
- ... and thus ... are vital for more efficient cooling and heating in new and critical applications, including energy production and utilization, environmental control and cleanup, and bio-medical applications.

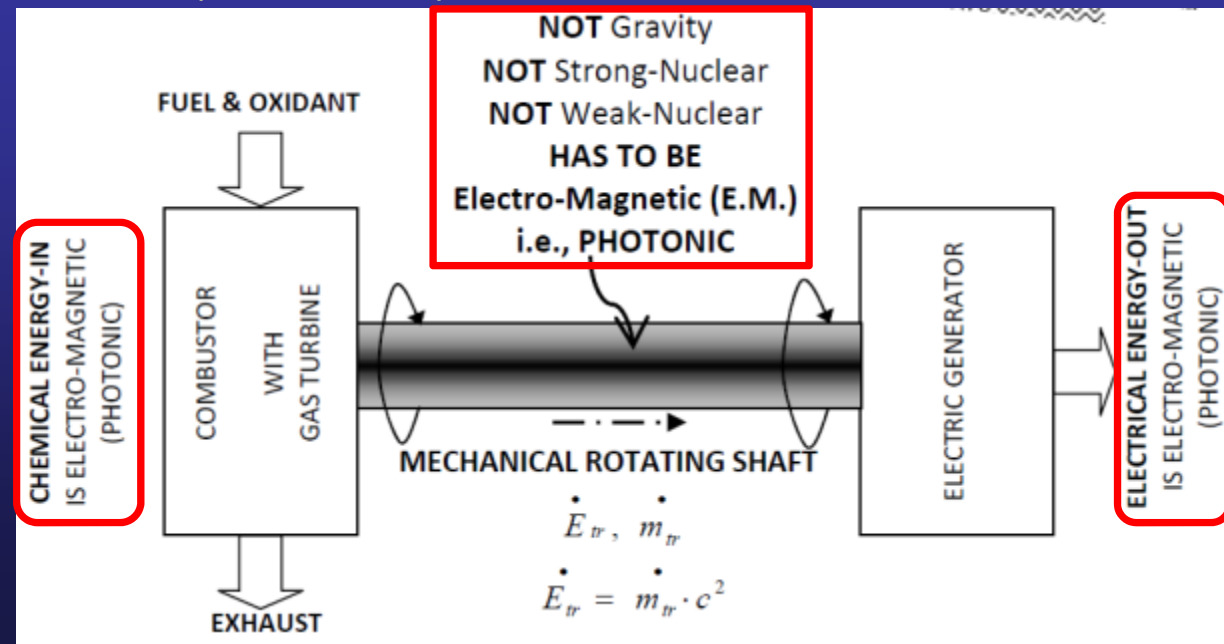
Mechanical Work Transfer ...

- During work transfer from one *acting* body, A (twisting or pushing in a certain direction) to another *reacting/resisting* body, R ; i.e., the particles (atoms and/or molecules) with more momentum at the contact interface (i.e. higher acting stresses, P_A) will be pushing the neighboring particles with less momentum (i.e. lower resisting stresses, P_R), thus transferring their electron shell momentum and energy in certain forced-displacement direction by 'orderly' photon propagation from one electron shell to another during the particle localized interactions and displacement in a certain direction, in addition to net-thermal energy transfer if any (the latter depending on temperature gradient).



... Mechanical Work Transfer ...

... Again, during any work transfer process there must be a net-propagation of photons (in addition to free electrons or other material particle motion, if any) and the equivalent mass will be transferred ($m_{tr}=E_{tr}/c^2$) from one material system to another, thus in the process effectively propagating the photon 'inertial' mass (total relativistic mass), in direction of decreasing stresses for fluids, or in direction of decreasing "collective stresses" (i.e. forces) for solids, even if it is too small to be measured.



Mechanical Superconductor

- For ideal elastic or perfectly rigid solid having a steady-state forced motion and transferring mechanical energy without its acceleration, the mechanical energy and commensurate mass-energy propagation of photons will not accumulate nor accelerate the body, but only passing through the body structure without any stress/force gradient through such intermediary, ideal solid body:
- It may be considered as *mechanical superconductor*.

The stress/force gradients ...

- However the stress/force gradient will exist **at the energy source** (where mechanical energy is generated), through imperfect intermediary bodies, **and energy sink** (where mechanical energy is dissipated), thus **effectively propagating photon mass-energy** (with relevant photon conversions and transformations through material structure, like frequency shifting and others if appropriate, from an energy source to the sink, by accelerating material structure of the mass-energy sink system (e.g., a resisting frictional load) on the expense of decelerating material structure of an acting source system).

Experimental Confirmation ...



As reasoned above, during mechanical work transfer, the photon mass-energy transfer is always encountered, but rarely observed since it is occurring orderly and locally (without trace/dissipation) within the material structure (often within virtually infinitesimal distance), except in certain **fractoluminescence** and **triboluminescence** processes, facilitated by material structure “visible” mechanical separation and especially if conducted in a vacuum, like the “peeling sticky-tape X-ray phenomenon.” Therefore, all mechanical energy transfers are “mecha-luminescence-kind” (visible or invisible), carried by the photon “on-contact” mass-energy propagation.



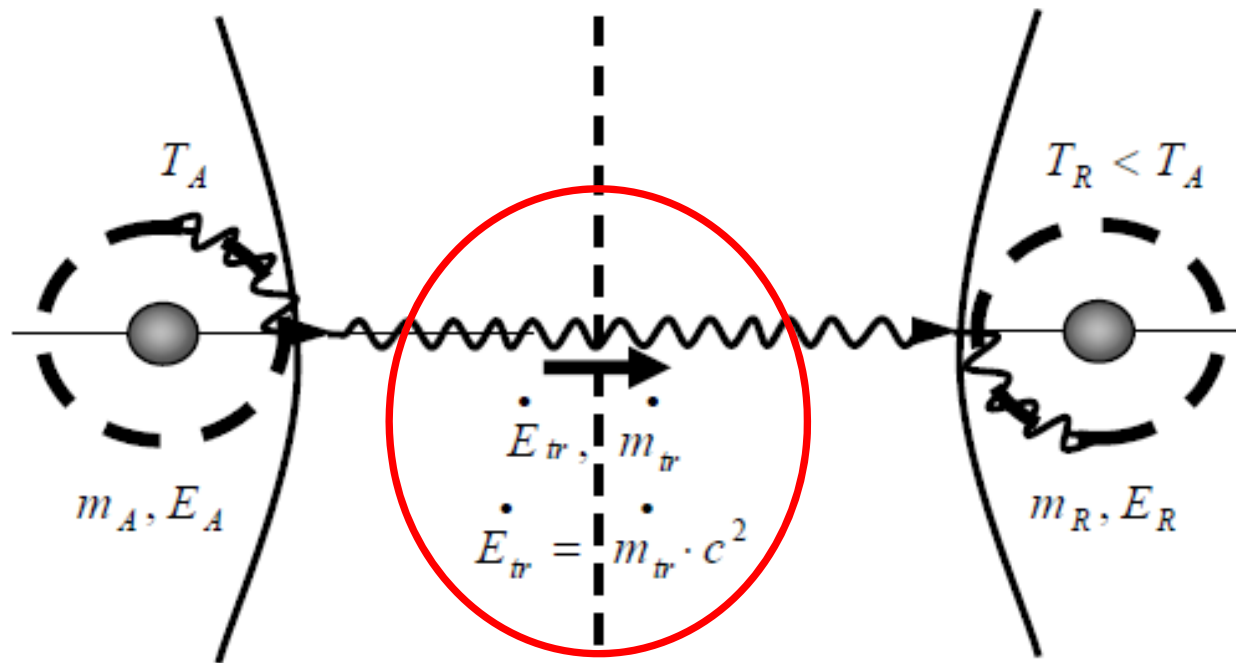


Fig. 3. Photon mass-energy transfer. Any energy transfer (other than gravity and nuclear interactions) must be photonic, accompanied by photon transfer either as electromagnetic waves on-long range through space, or “on-contact propagation” within material structures, or as diffusion or motion of material structures (including electrons), accompanied with underlining photon mass-energy exchange, thus unifying the mass and energy concepts and a notion of “massless photon” rest-mass transfer (as from the Sun to Earth).

Nature of a “Massless” Photon ?

... Questions arise about the nature of a “massless” photon and definition of its (relativistic) mass and “rest-mass transfer”: Since the photon is a ‘massless mass-energy carrier’ while in motion with the speed of light, and when it is captured (absorbed) within a material particle or a body at rest, i.e. when its energy is bound (“foiled”) within a body at rest (called here “body-rested photon mass-energy”), then the corresponding inertial mass increase of the material particle, could be defined as a photon inertial mass-energy (or “*body-rested* mass-energy” with regard to the body reference frame), also known as its relativistic mass, that is:

$$m_{ph} = E_{ph}/c^2 = (h \cdot \nu)/c^2$$

EM/Photon Mass-Energy Transfer From/To (Decel./Accel.) Massive Particles/Systems

- Energy transfer is a forced-displacement interaction between inertial material systems, in effect, accelerating the reacting, mass-energy sink-system (i.e. its structure) at the expense of decelerating an acting-source system structure, **by propagating (“pumping”) the photon mass-energy from the source to the sink system, as explained above for the thermo-mechanical energy transfer.**
- This is true in general, **even in steady-state processes**, the surrounding supporting system structure is reacting with its inertia as “frictional resistance load” and being accelerated (i.e. energized) all the time; otherwise without reacting (impeding) system, the potential-source system will not transfer any mass-energy and continue to be in its inertial motion (if any) with its “rested equilibrium” mass-energy structure.

Elementary particles and their interactions ?

... Elementary particles and their interactions (always new being discovered) have been, still are, and may always be the principal mysteries in nature.

... The electrons and nucleons “mysteriously” absorb (annihilate) and emit the photons, which are not conserved (thus not accounted for) but somehow “mysteriously” re-created with different frequencies and thus different mass-energies, posing several open questions, which will be subject of another discussion.

... Further Generalization of Electro-Magnetic Phenomena

This treatise may contribute to further 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.

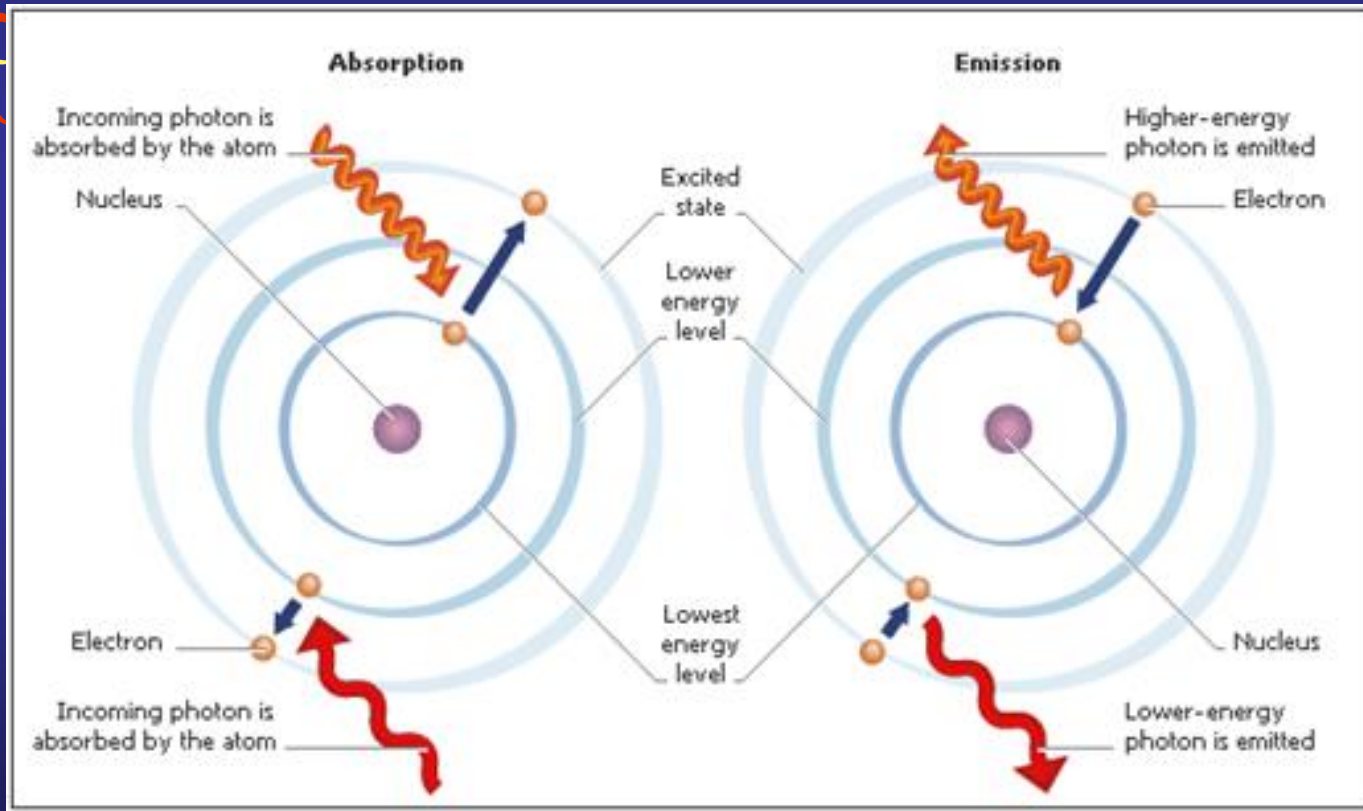
If we are unable to observe ...

- If we are unable to measure or comprehend something **it does not mean it does not exist**: it could be sensed or measured with more precise instruments or in a longer time scale, or in similar stronger processes.
- Some things/events may be 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 they are comprehended and understood!



Thank you! Any Question ?



Source: <http://www.energygroove.net/atoms.php>