

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

Milivoje M. Kostic

Department of Mechanical Engineering

NORTHERN ILLINOIS UNIVERSITY

DeKalb, IL 60115, USA

Web: www.kostic.niu.edu * E-mail: kostic@niu.edu

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 through 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 its 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 superconductor). If it is fully investigated and understood, it has potential for development of hybrid synthetic-materials with superior thermal conductivity like diamond, for many and unprecedented applications in existing critical areas as well as emerging and novel applications

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 mechanical 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.