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A non-equilibrium approach regarding hot metals

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This talk is focused on the discussion about the role of the generalized Fermi–Dirac Kappa Distribution which describes the electron population in pure metals. First, we present some experimental evidences and phenomenological facts – in such metals the Kappa parameter, which governs the distribution function, appears to vary linearly with the temperature. Taking this relationship into account, we reviewed the derivation of the generalized electrical conductivity. The relationship between the melting point of several pure metals and a material-dependent coefficient which can be obtained by analyzing the material's thermionic emission is shown. Also, we presented the transport coefficients for non-equilibrium hot metals, i.e., a new generalized thermal conductivity and a generalized Wiedemann-Franz Law, which are compared with experimental results. As a new property, these transport coefficients dropped when the metals achieved the solid–liquid phase transition. In addition, we also showed the impact of the temperature-dependent Kappa parameter on the thermionic emission law in metals. Moreover, we compared the Kappa distribution with the well-known expanded non-equilibrium function. This study leads to an analytical form of the Kappa parameter. The obtained expression shows the connection between the Kappa parameter and the factors causing the departure from equilibrium. We analyzed the behavior of this obtained equation and compared with the experimental one.

Biography

Juan-Luis Domenech-Garret is currently an Associate Professor (Permanent Staff) at the Technical University of Madrid. He is a Member of the Spanish Royal Society of Physics. He obtained his European-PhD from Valencia University (Spain) and CERN (Geneva-Switzerland) with a CERN-PhD thesis. He is a Member of the Plasma Laboratory of the Aeronautics and Space School–Technical University of Madrid. In previous years, he achieved academic positions in: Avila C University–Spain (Lecturer and Associate Professor), Lleida University–Spain (Lecturer and Associate Professor), and Technical University of Madrid (Lecturer).

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