# HENRIQUE LARA: NOTES FOR THE PHILOSOPHY OF PHYSICS – 10 (ADDENDA)

1. Through the development of his General Relativity Theory Einstein discovered a relationship between the *rate* at which time flows and the *manner* in which space is characterised: time passes more slowly when the force of a gravitational field, that is, the curvature of space-time, is greater. I propose that we seek to obtain something similar using the concept of *temperature*.

2. In my view, this may be understood by reference to Einstein's theory, as compared with the traditional (statistical) approach. For this to hold, we must be able to state: just as $t^*=f_1(d)$ in the General Theory of Relativity, so also $T= f_2(d)$ for the theory to be expounded, where $T$ is temperature, $t^*$ the velocity of the passage of time and $d$ is length.

3. We must therefore characterise processes of diffusion of heat in order to make them compatible with a thermodynamic *interpretation* of the Theory of General Relativity. In order to do this, we must seek a *system of equivalences* between thermal aspects and pliable aspects of reality by elucidating the *meaning* of the above-mentioned relationship between temperature and the passage of time in the Theory of Relativity.

4. Here we have two *clocks* that need to be *standardised*: processes of diffusion of heat and so-called gravitational processes (the trajectories of bodies in motion in a field of gravity) represent the passage of time in two distinct ways. The *criterion* that enables their comparison – through the clarification of the equivalence posited – enables us to understand time as the *unifying bridge* linking the two theoretical frameworks of Physics.

5. *Thermometers* and *rulers, diffusion of heat* and *trajectories of bodies in motion, thermal energy* and *kinetic energy*, etc. characterise in a range of ways the object that Physics seeks to describe using the heuristic principle – the method – that lies in its origin. "Time" is, as mentioned above, the name that may be assigned to the *problem* that must be solved in order to establish a degree of coherence in Physics.

6. In order to establish the above relationship between $T$ and $t^*$, that is, between $f_2 (d)$ and $f_1 (d)$, we propose to define $T$ as previously stated, on the basis of the value of a constant $K_n= Td^2$, to be determined. Thus, it follows that: $T= f_0 (t^*) = f_0 [ f_1 (d) ] = f_2 (d) = K_n /d^2$. But we have also seen that the constant $K_n= Td^2$ enables the following equation to be formulated: $S{\cdot}M{\cdot}K_n = H^2$, where $S$ is *entropy*, $M$ is *mass* and $H$ is *action*.

7. Using the Boltzman formula for entropy, we obtain: $K_n (k \log \Omega) M =H^2$, which gives: $\log \Omega = H^2/M K_n k$. If we replace $H$ with Einstein's formula for action, we are able to establish, by this means, a method for *quantifying space-time*, which also means for us: a method for the *geometrisation of heat diffusion processes*.

8. If $K_n= Td^2= Td^3 / d = K/d$, where $K=(G / k) (h / c)^2$, with $h$ expressing an action and $G$, $k$ and $c$ being the other three fundamental constants of Physics. If we consider that $G$ can be expressed as $G = c^2 (d_0 / m_0)$, it follows that $\log \Omega = H^2(d_0 / m_0) (1 / Kk)$, for $d = d_0$ and $M = m_0$, of known quotient $d_0 / m_0 = G / c^2$. And, for $\log \Omega = 1$, we obtain $H^2= h^2$. That is: $h$, Planck's constant, can be understood as the *lower limit* of Einstein's action, its smallest part. Thus, in *Quantum Mechanics* we have an expression for the unification of the different branches of Physics, which, when rendered explicit, displays a degree of fundamental simplicity.