Appendix M to:
A Theoretical Investigation to the Physical Constraints for Light Velocity in Empty Euclidian Space and first Consequences for Long-distance Physics.
Referred equations: (29), (31), (34)

Derivation of the function Θ( ) for force-free moving system transformation

Equation (29):

$$(29)\quad \frac{1}{\Theta(T_{or},v_{or};d_x,0)}\frac{\partial\Theta}{\partial x}(T_{or},v_{or};d_x,0) = -\frac{d_x + v\big(T_x(d_x)\big)\,T_x(d_x)}{\gamma^2 - d_x\,\{\,d_x + v\big(T_x(d_x)\big)\,T_x(d_x)\,\}}$$

is general for any moving system but will be worked out specifically for the situation of a force-free movement; adapted from equation (34):

$$(\text{M.1})\qquad d_x = d(T_x) = v_{or}\,T_{or}\left(1-\frac{T_{or}}{T_x}\right)$$

and its first derivative:

$$(\text{M.2})\qquad v(T_x) = \left(\frac{d}{dT}d\right)(T_x) = v_{or}\,T_{or}\frac{T_{or}}{T_x^{\,2}}$$

It is easily seen that:

$$(\text{M.3})\qquad d_x + v(T_x)\,T_x = v_{or}\,T_{or}$$

This result goes into equation (29):

$$(\text{M.4})\qquad \frac{1}{\Theta(T_{or},v_{or};d_x,0)}\frac{\partial\Theta}{\partial x}(T_{or},v_{or};d_x,0) = -\frac{v_{or}\,T_{or}}{\gamma^2 - d_x\,v_{or}\,T_{or}}$$

which is straightforwardly solved as:

$$(31)\quad \Theta(T_{or},v_{or};d_x,0) = \Theta(T_{or},v_{or};0,0)\left(1-\frac{d_x\,v_{or}\,T_{or}}{\gamma^2}\right)$$
