Special and General Relativity (PHZ 4601/5606) Fall 2018 Solutions

Set 9

21. Radar Distance.

Let the coordinate times for light-signals from A to B and B to A be $\triangle t_{A\to B}$ and $\triangle t_{B\to A}$, respectively. The coordinate round-trip time $\triangle t$ for a radio echo is the same at A and B: $\triangle t = \triangle t_{A\to B} + \triangle t_{B\to A}$. But the radar distance is determined with standard clocks: Radar distance measured at A: $L_A = (c/2)\,\triangle\tau_A = (c/2)\,\exp(\Phi_A/c^2)\,\triangle t$ and, similarly, $L_B = (c/2)\,\triangle\tau_B = (c/2)\,\exp(\Phi_B/c^2)\,\triangle t$. Therefore,

$$\frac{L_A}{L_B} = \frac{\exp(\Phi_A/c^2)}{\exp(\Phi_B/c^2)}\,.$$