

PHYS 480/581 General Relativity

Extra Problems #1

Question 1.

Use the Equivalence Principle to compute the deflection angle δ that a light ray from a distant star experiences as it passes near the Sun. Assume that the light ray barely grazes the surface of the Sun. This can be done by calculating the net y -direction velocity component v_y acquired by the light ray as it passes close to the Sun, assuming that its total speed remains c (the speed of light). The deflection angle is then $\sin \delta = v_y/c$. Show that $\delta \simeq 0.87$ arcsec. You may use the fact that $GM_{\odot}/c^2 = 1477.1$ m and that $R_{\odot} \simeq 7 \times 10^5$ km. This answer is actually off by a factor of 2 compared to the correct result obtained using the machinery of GR. Which aspect of the equivalence principle is not respected in the above calculation?

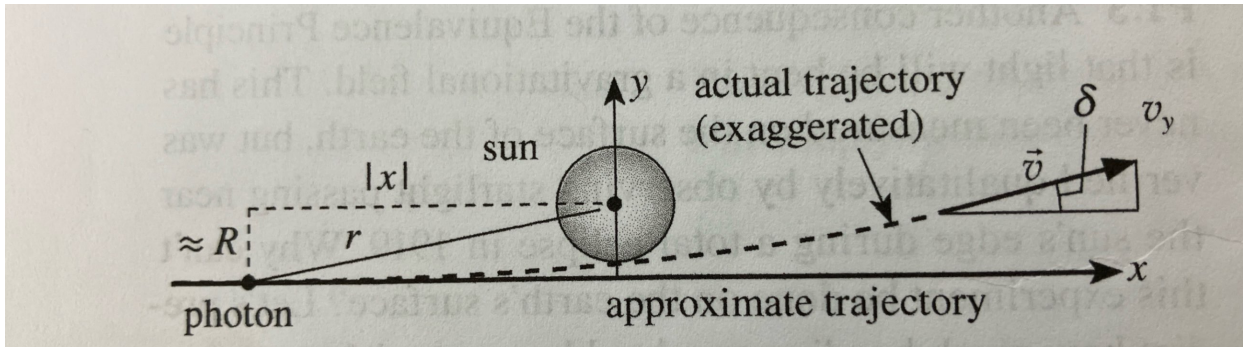


Figure 1: Deflection experienced by a light ray as it passes near the Sun.