

انحراف گرانشی نور

استاد راهنما :

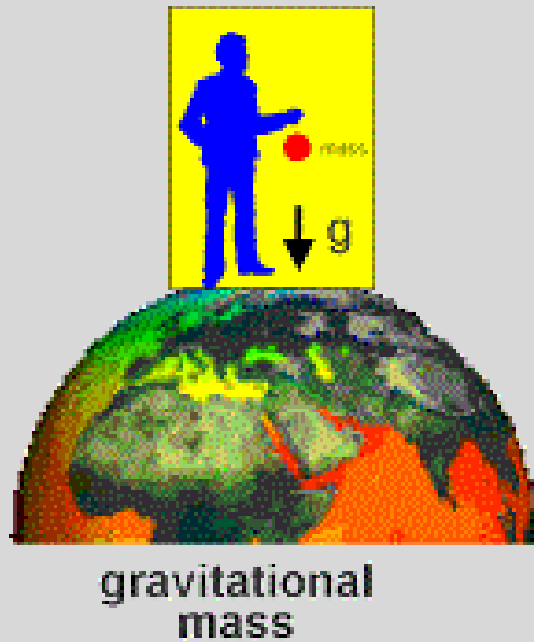
دکتر بهروز میرزا

ارائه دهندگان:

محمد مهدی جهان طلب و احمد حسینی

اصل هم ارزی

$$g = a$$



متریک فضا زمان تخت

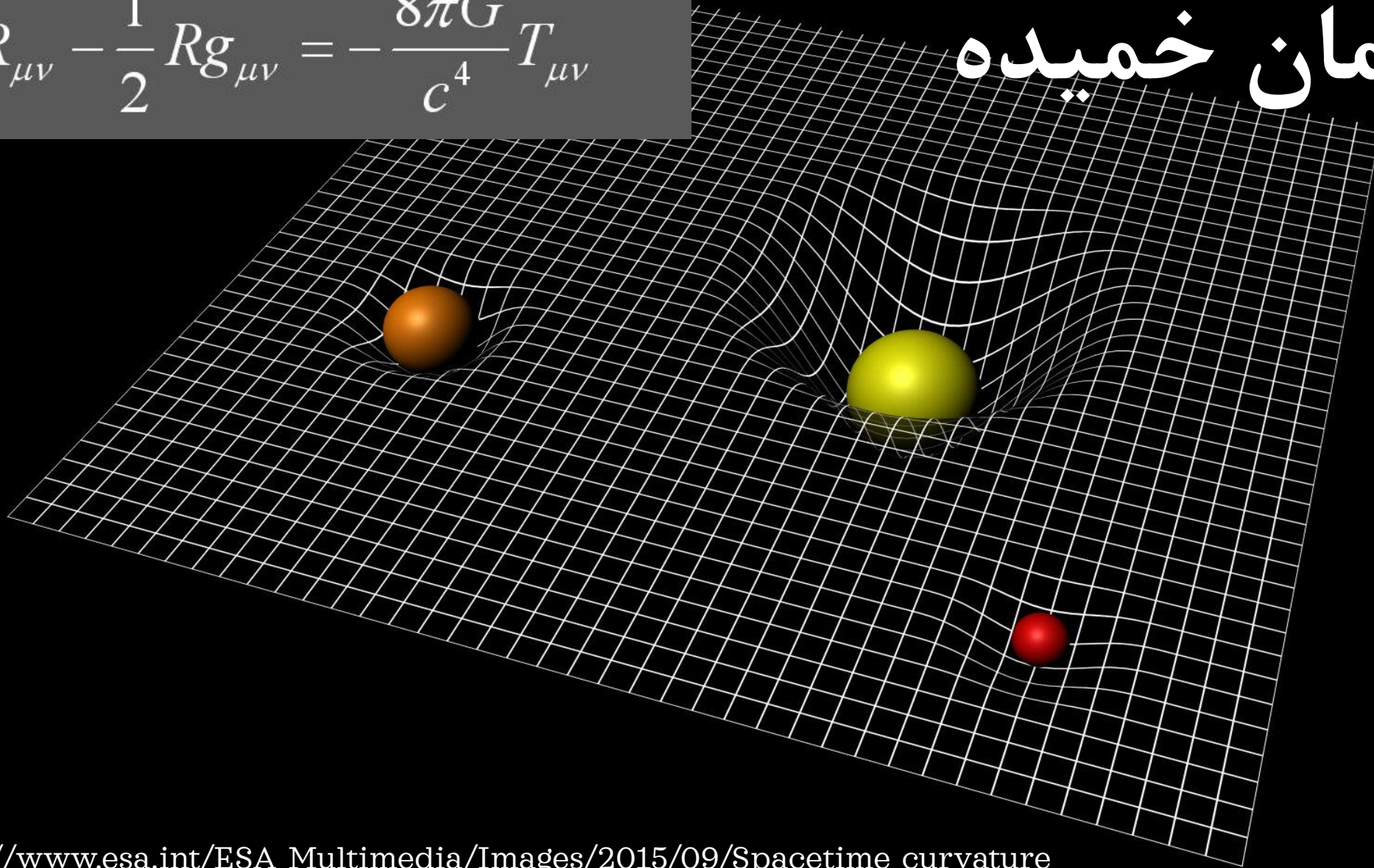
$$g_{\mu\nu} = \begin{pmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, ds^2 = -dt^2 + dx^2 + dy^2 + dz^2$$

©https://hepweb.ucsd.edu/ph110b/110b_notes/node74.html

©<https://www.bartleby.com/questions-and-answers/b-the-minkowski-metric-of-special-relativity-is-ds-dt-dx-dy-dz.-express-the-metric-and-its-inverse-i/5132afe4-5eb3-471c-ab26-d1c93d737f57>

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} = -\frac{8\pi G}{c^4} T_{\mu\nu}$$

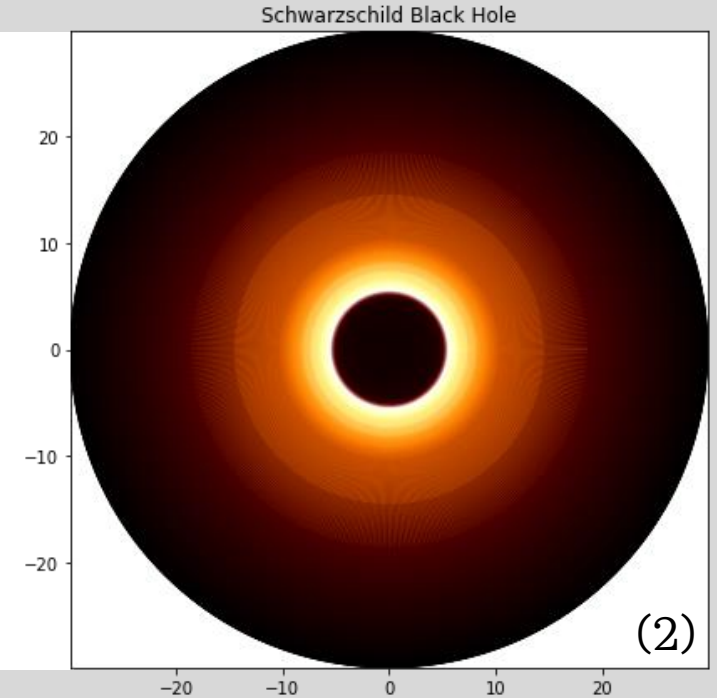
فضازمان خمیده



متریک شوارتزشیلد

$$g_{\mu\nu} = \begin{bmatrix} \left(1 - \frac{2GM}{rc^2}\right) & 0 & 0 & 0 \\ 0 & -\left(1 - \frac{2GM}{rc^2}\right)^{-1} & 0 & 0 \\ 0 & 0 & -r^2 & 0 \\ 0 & 0 & 0 & -r^2 \sin^2 \theta \end{bmatrix}$$

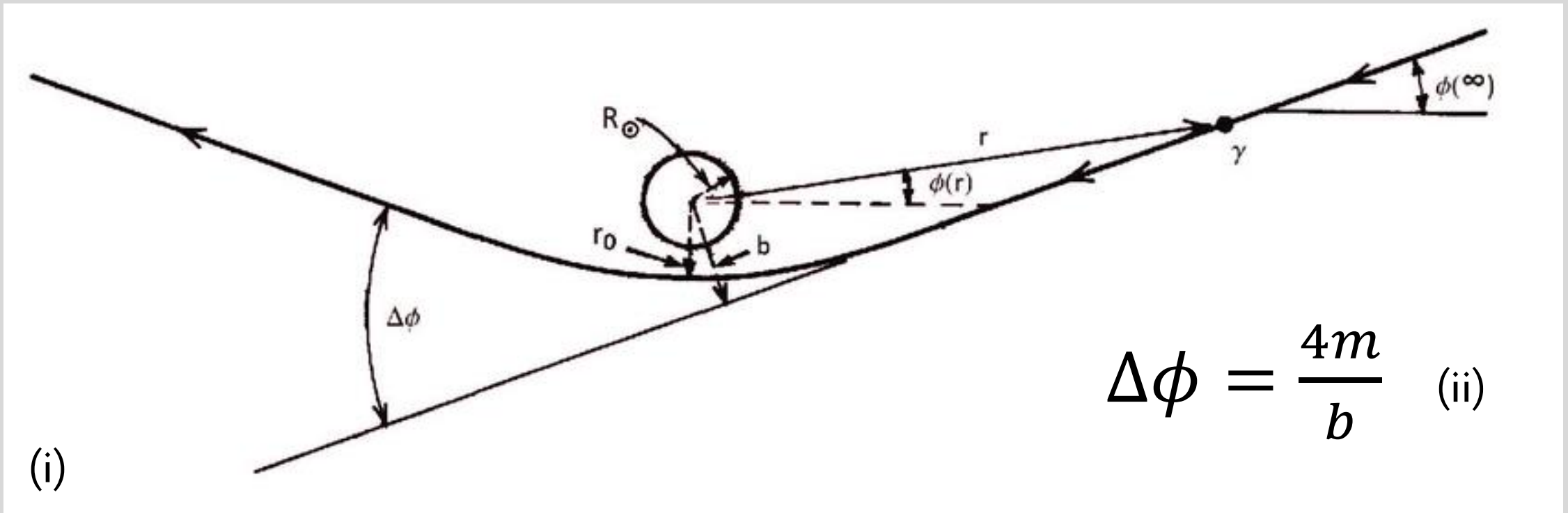
(1)



¹ ©<https://www.quora.com/How-could-Schwarzschild-assume-that-an-object-was-not-rotating>

² ©<https://docs.einsteinpy.org/en/latest/examples/Shadow%20cast%20by%20a%20thin%20emission%20disk%20around%20a%20Schwarzschild%20black%20hole.html>

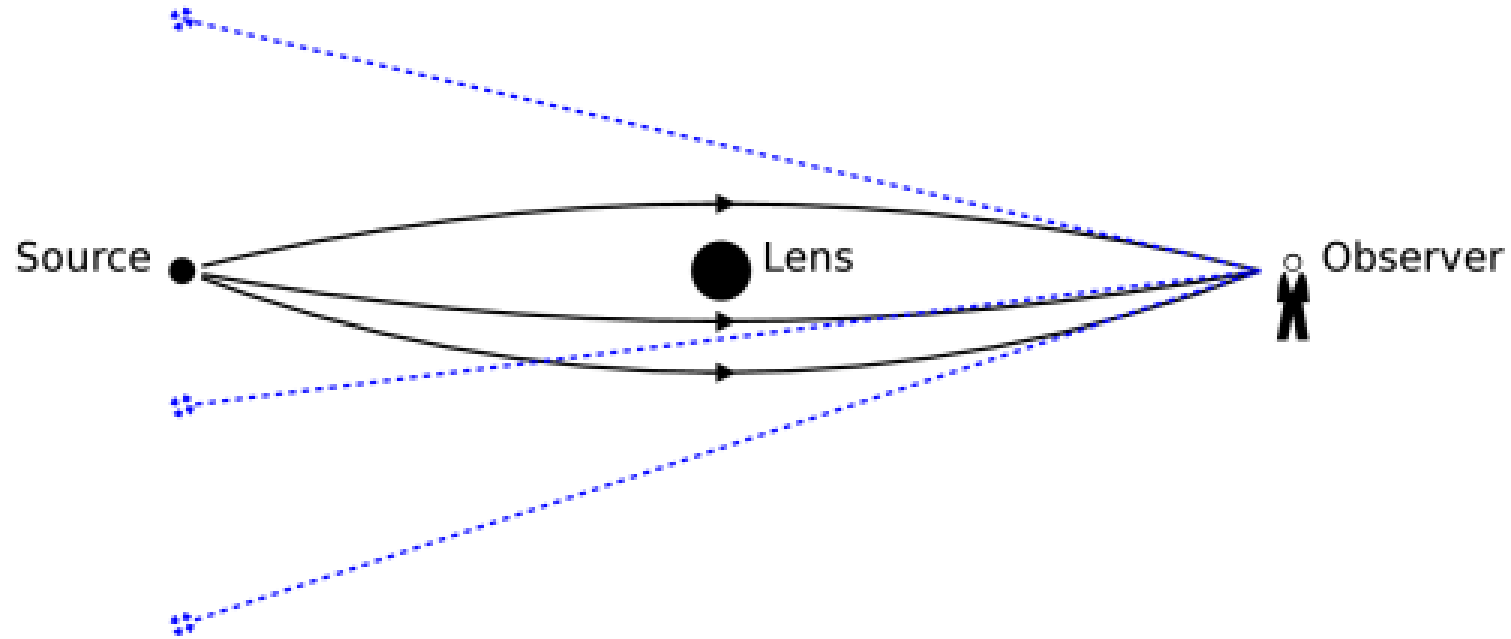
زاویه انحراف



ⁱ https://www.researchgate.net/figure/Deflection-of-light-by-the-Sun-refer-to-the-text_fig2_263582555

Mathematica محاسبه شده با استفاده از برنامه ⁱⁱ

ستارگان کجا هستند؟



©http://en.citizendium.org/wiki/gravitational_lens



سیاسی از توجه شما