

General Relativity Animations

Spacetime Curvature

By Mark Egdall 6/15/ 09
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4. Animation on Spacetime Curvature:

What is it that reaches out from the Sun some 93 million miles to hold the Earth in its orbit?

4. Animation on Spacetime Curvature:

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Spacetime Curvature

What is Gravity?

According to General Relativity:

- gravity is spacetime curvature, and
- spacetime curvature has energy!

Thus spacetime curvature causes spacetime curvature

- The spacetime curvature at the surface of the Sun causes spacetime curvature just a little bit further out, and so on.

What is Gravity?

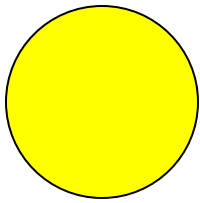
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- gravity is spacetime curvature, and
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→ **Spacetime curvature spreads out in a sphere as it travels from the Sun to the Earth. So it weakens as the surface of a sphere or as the *radius squared*. (Just as Newton theorized.)**



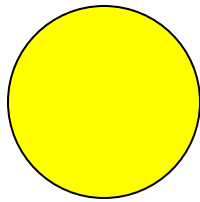
Sun



Earth

Not to scale

Spacetime curvature transmitting from Sun's surface into space



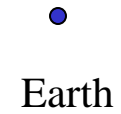
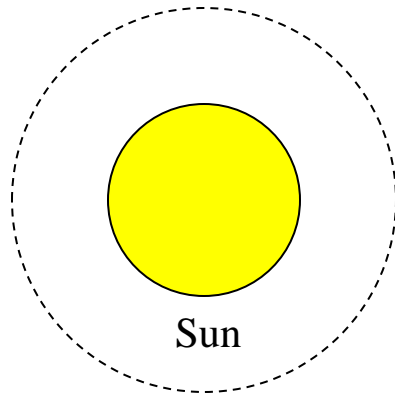
Sun



Earth

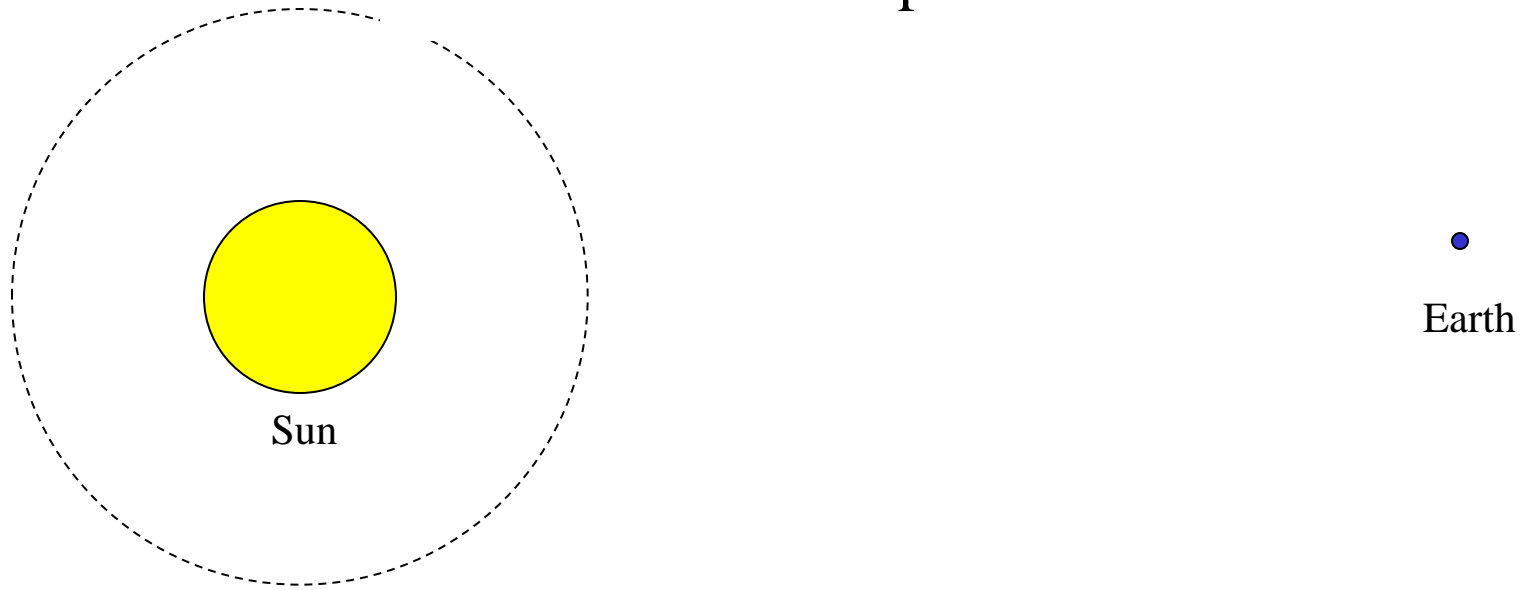
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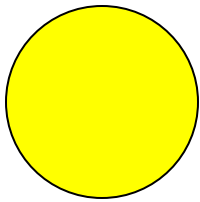
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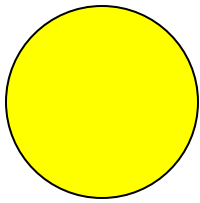
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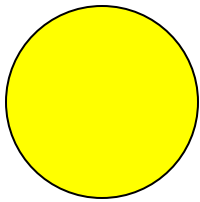
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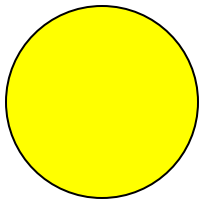
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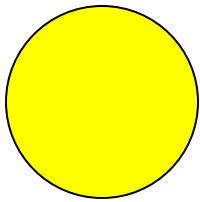
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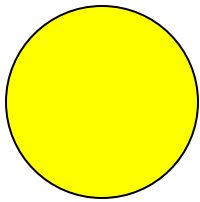
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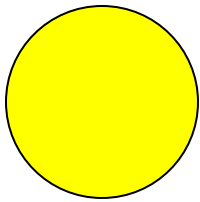
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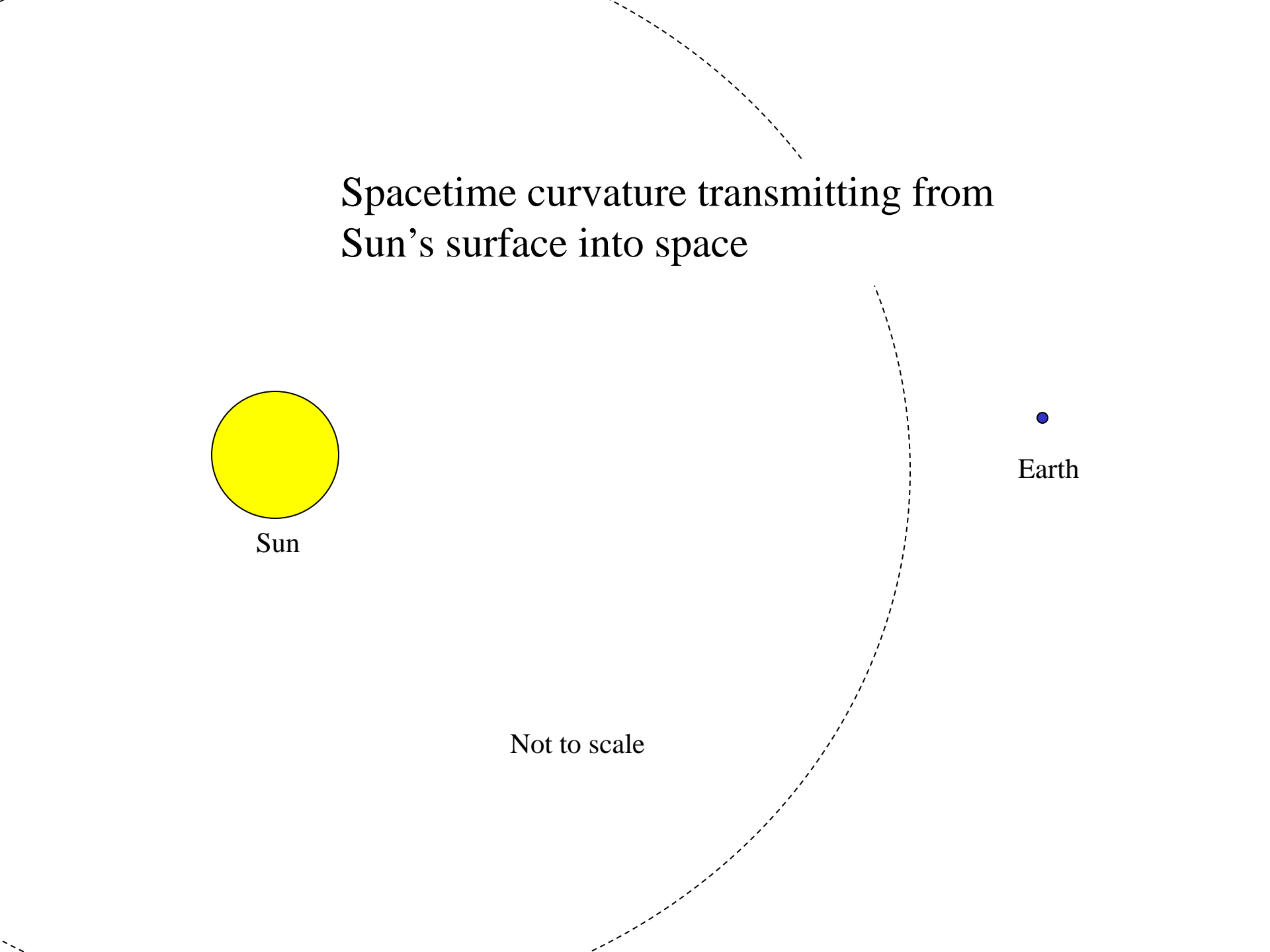


Sun

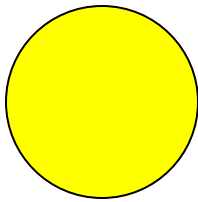


Earth

Not to scale



Spacetime curvature transmitting from
Sun's surface into space



Sun

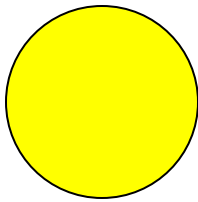


Earth

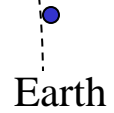
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Spacetime curvature transmitting from
Sun's surface into space

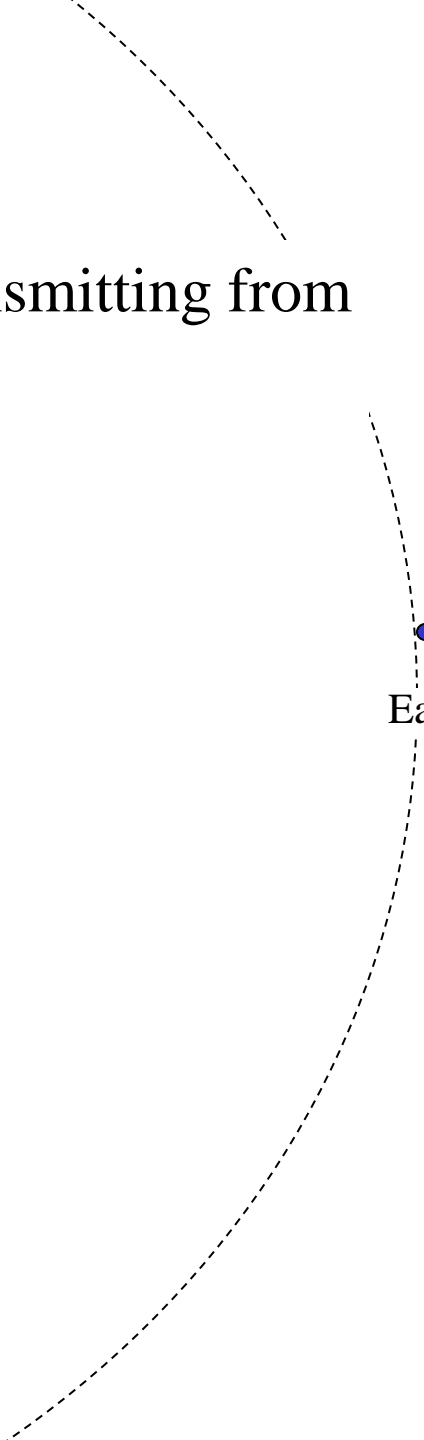


Sun

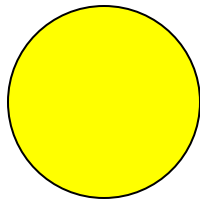


Earth

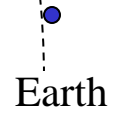
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The Sun's spacetime curvature
reaches Earth and holds it in its orbit



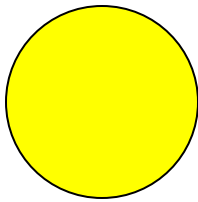
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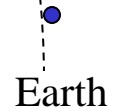
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Not to scale

Because it has spread out spherically,
spacetime curvature has weakened by the
square of the distance, r from Earth to Sun



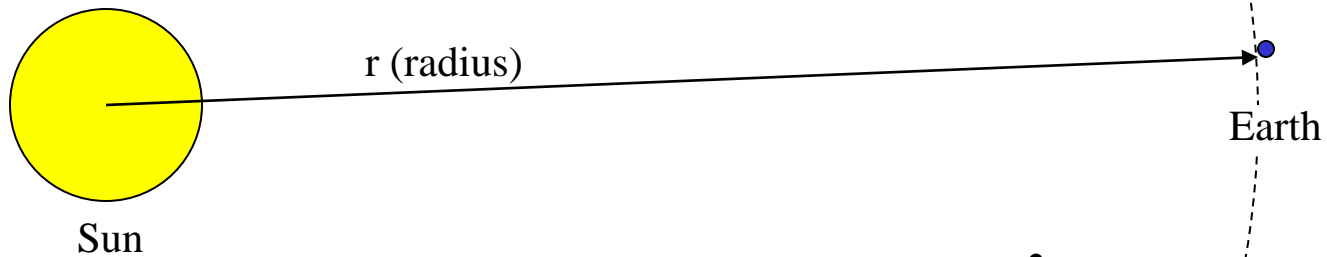
Sun



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Not to scale

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Surface Area of a Sphere = $4 \pi r^2$
(r is radius of circle)

Not to scale

End of Animation