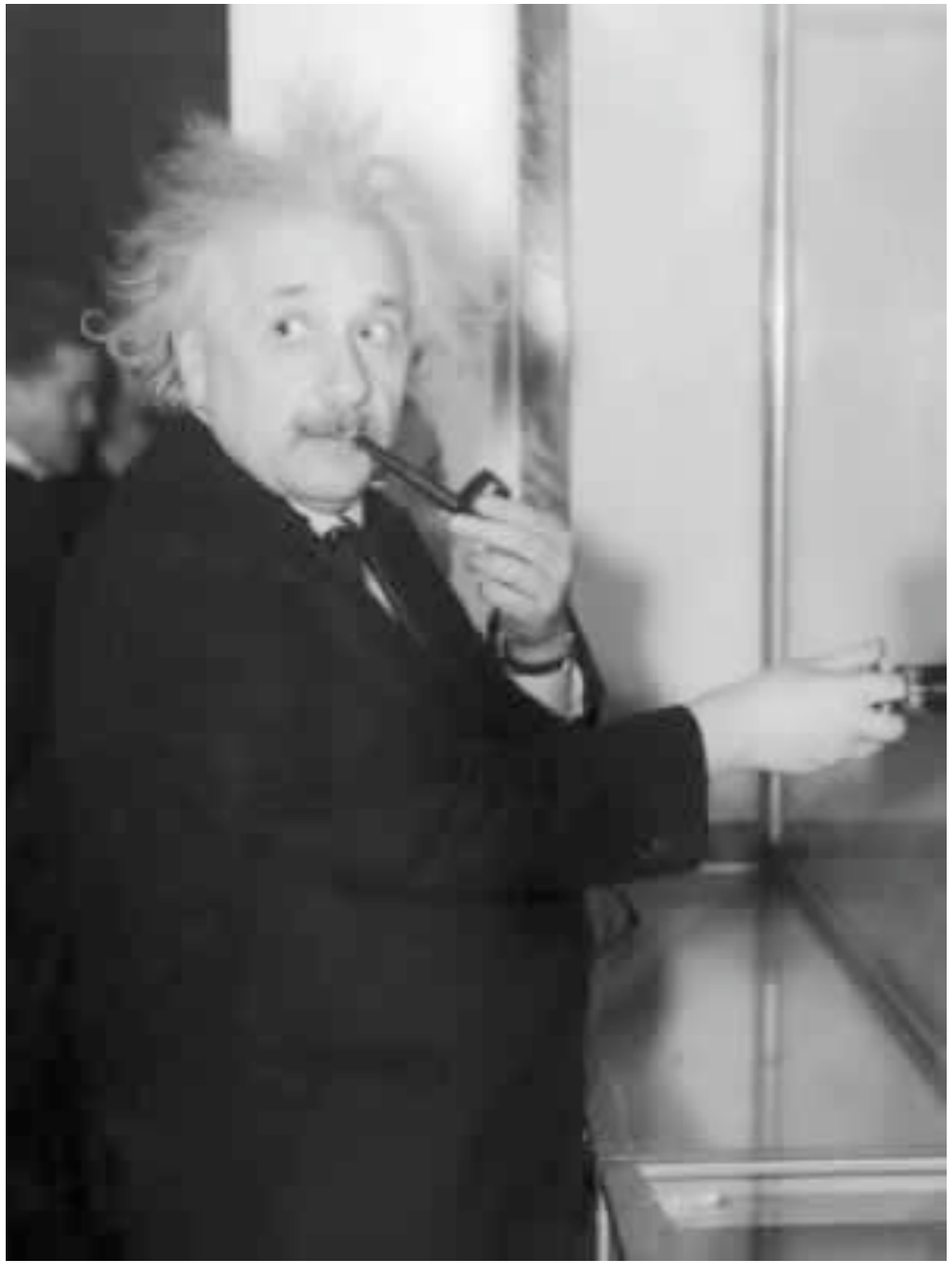
Not your Grandfather's Gravity!



John Ashmead

Free fall thru gravity

Free fall thru gravity

- Newton's Action at a distance

Free fall thru gravity

- Newton's Action at a distance
- Einstein's Gravity as curvature

Free fall thru gravity

- Newton's Action at a distance
- Einstein's Gravity as curvature
- Accelerating expansion of universe

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Free fall thru gravity

- Newton's Action at a distance
- Einstein's Gravity as curvature
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- OPERAs' superluminal neutrinos

Three cheers for the black death

Three cheers for the black death

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- Kicked off the industrial revolution

Three cheers for the black death

- Kicked off the industrial revolution
- Built up resistance to AIDS

Three cheers for the black death

- Kicked off the industrial revolution
- Built up resistance to AIDS
- Gave Newton time to discover gravity

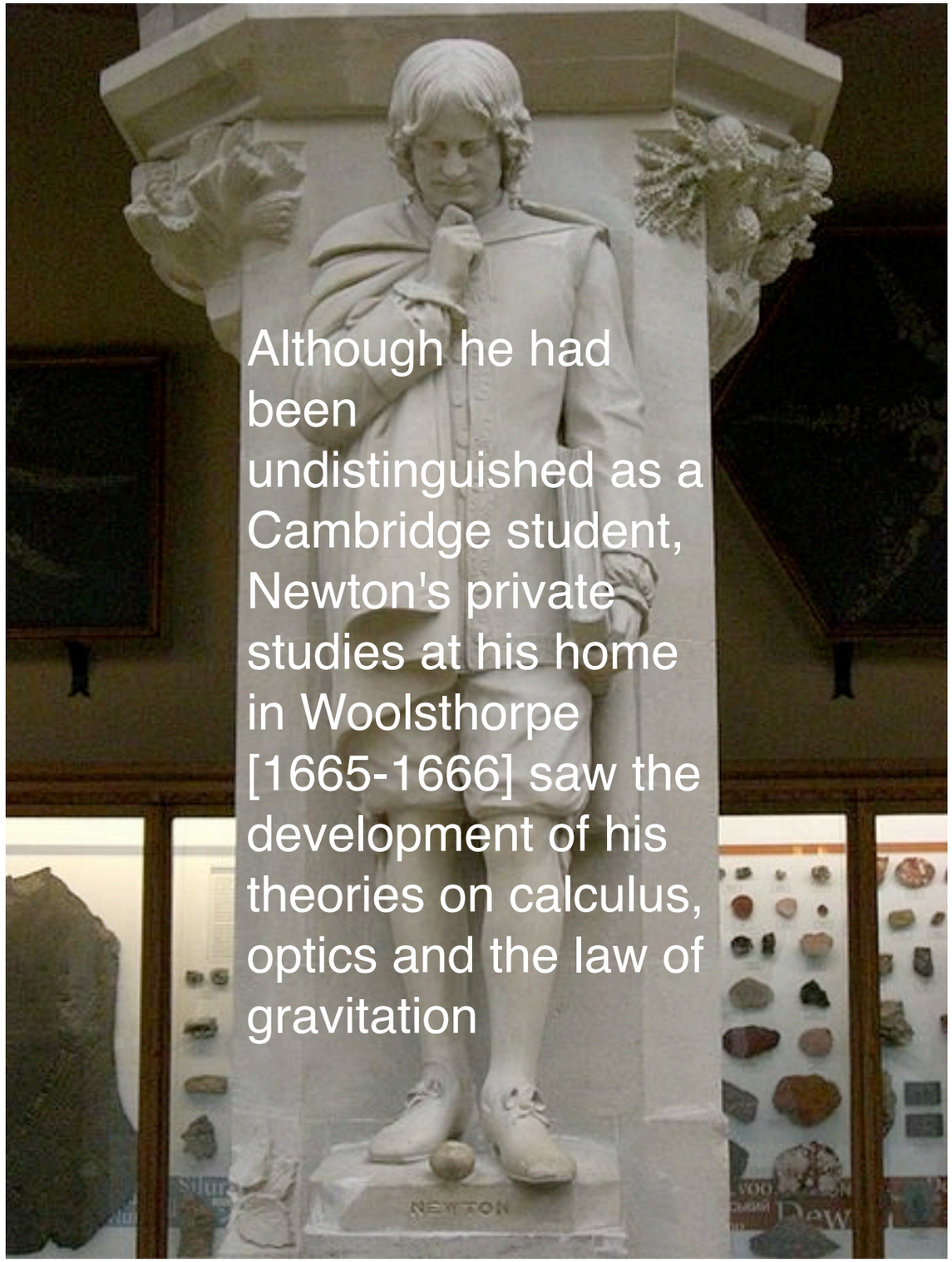
The Apple & the Moon

The Apple & the Moon

The Apple & the Moon

Why should that apple always descend perpendicularly to the ground…Assuredly the reason is, that the Earth draws it. There must be a drawing power in matter. And the sum of the drawing power in the matter of the Earth must be in the Earth's centre…Therefore the apple draws the Earth, as well as the Earth draws the apple.

The Apple & the Moon



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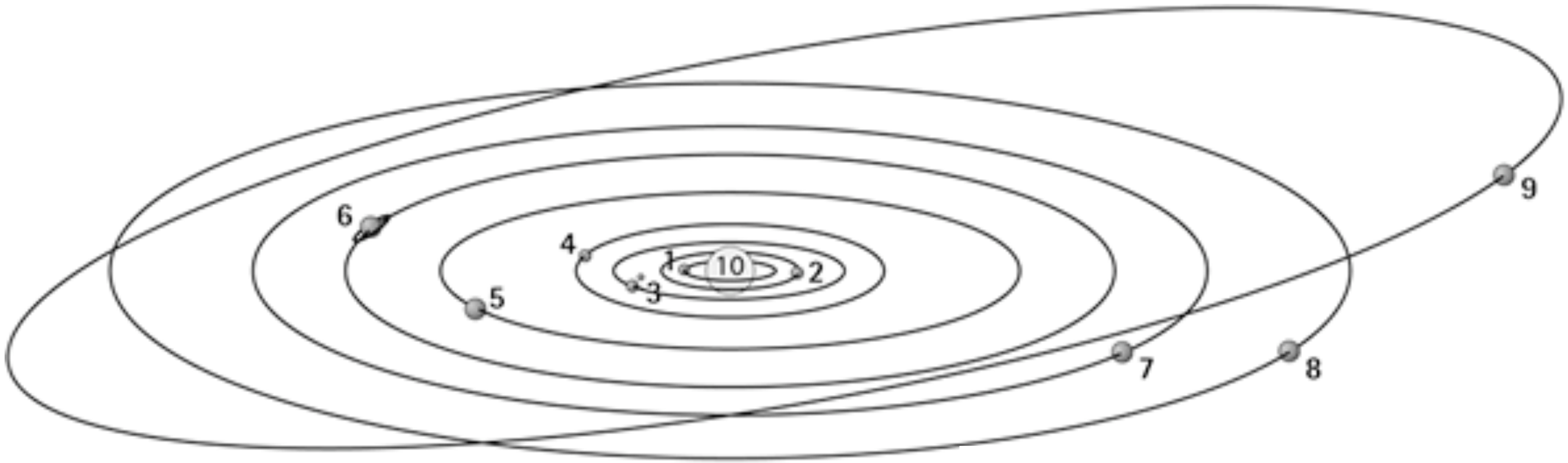
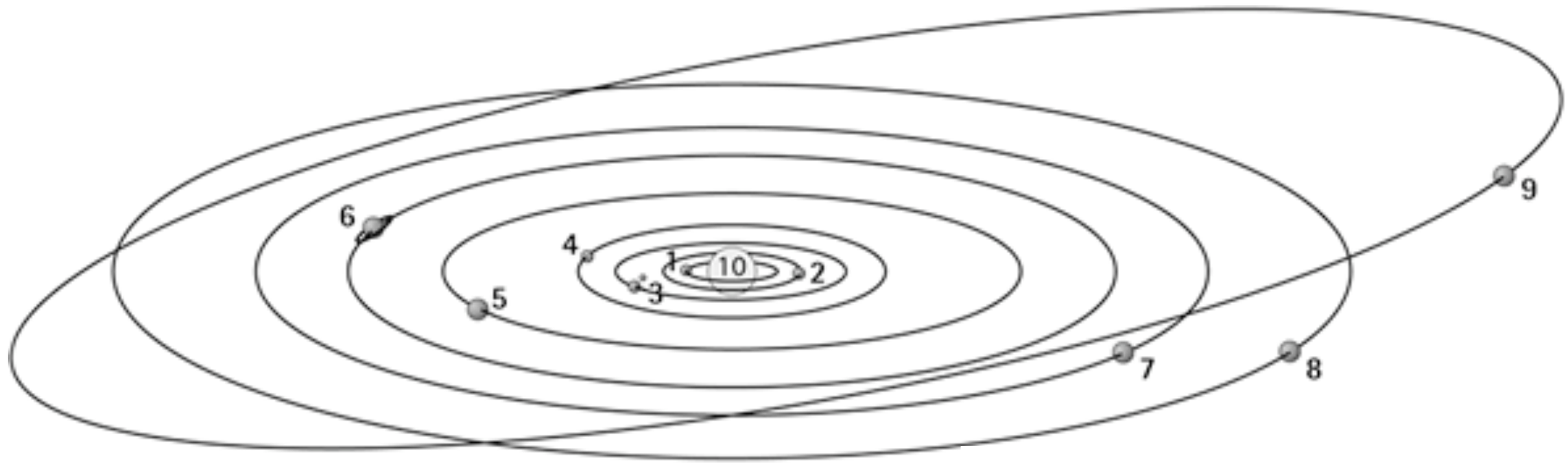
Endless ellipses most beautiful



1	Merkur	6	Saturn
2	Venus	7	Uranus
3	Erde	8	Neptun
4	Mars	9	Pluto
5	Jupiter	10	Sonne

Endless ellipses most beautiful



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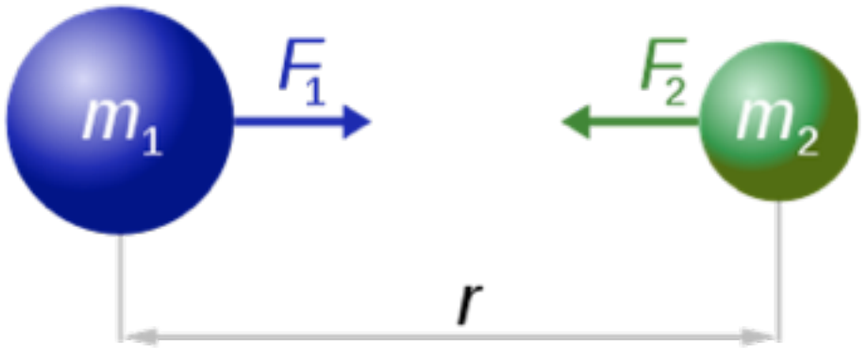

$$F_1 = F_2 = G\frac{m_1 \times m_2}{r^2}$$

Jupiter's Moons 16 ½ minutes off schedule

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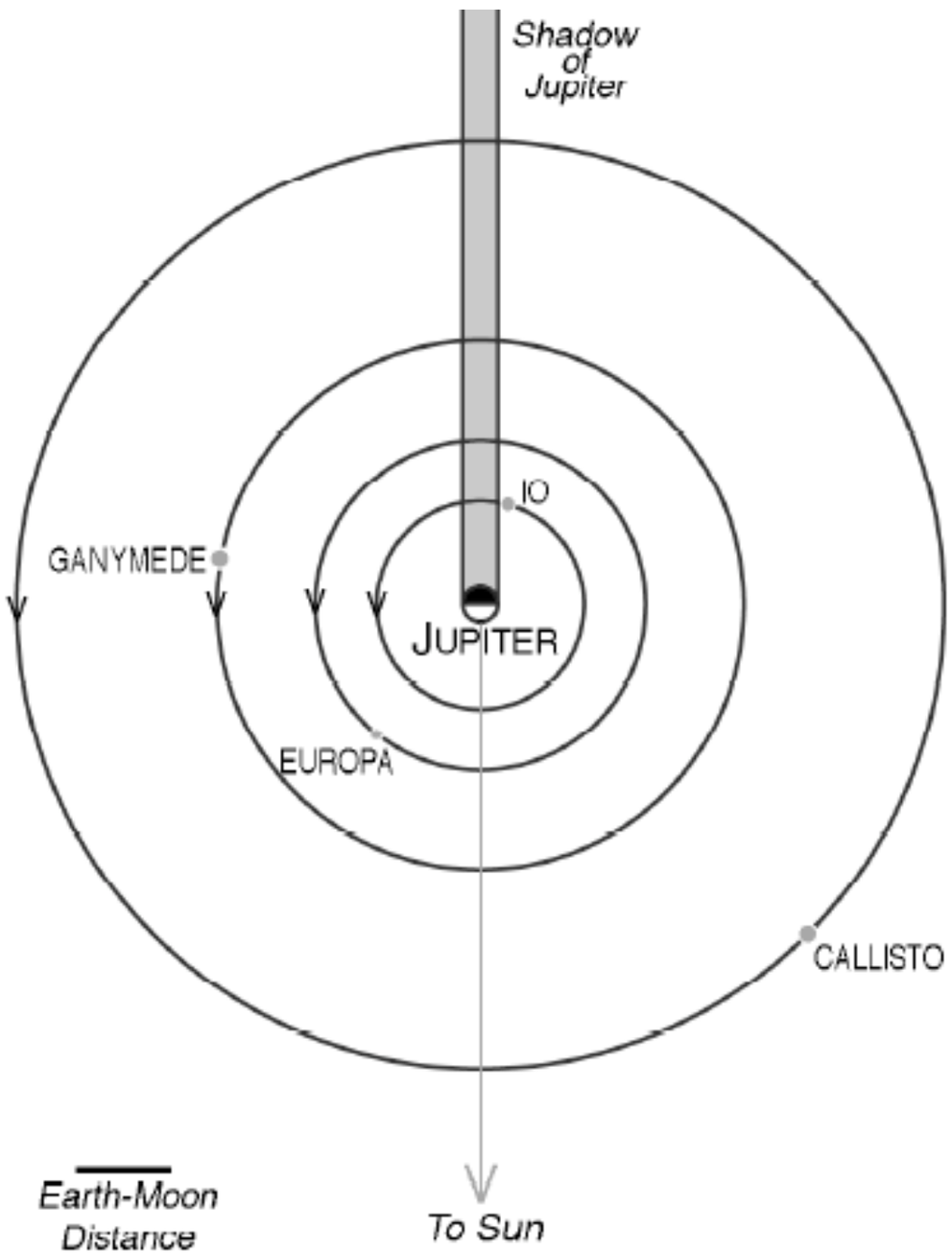

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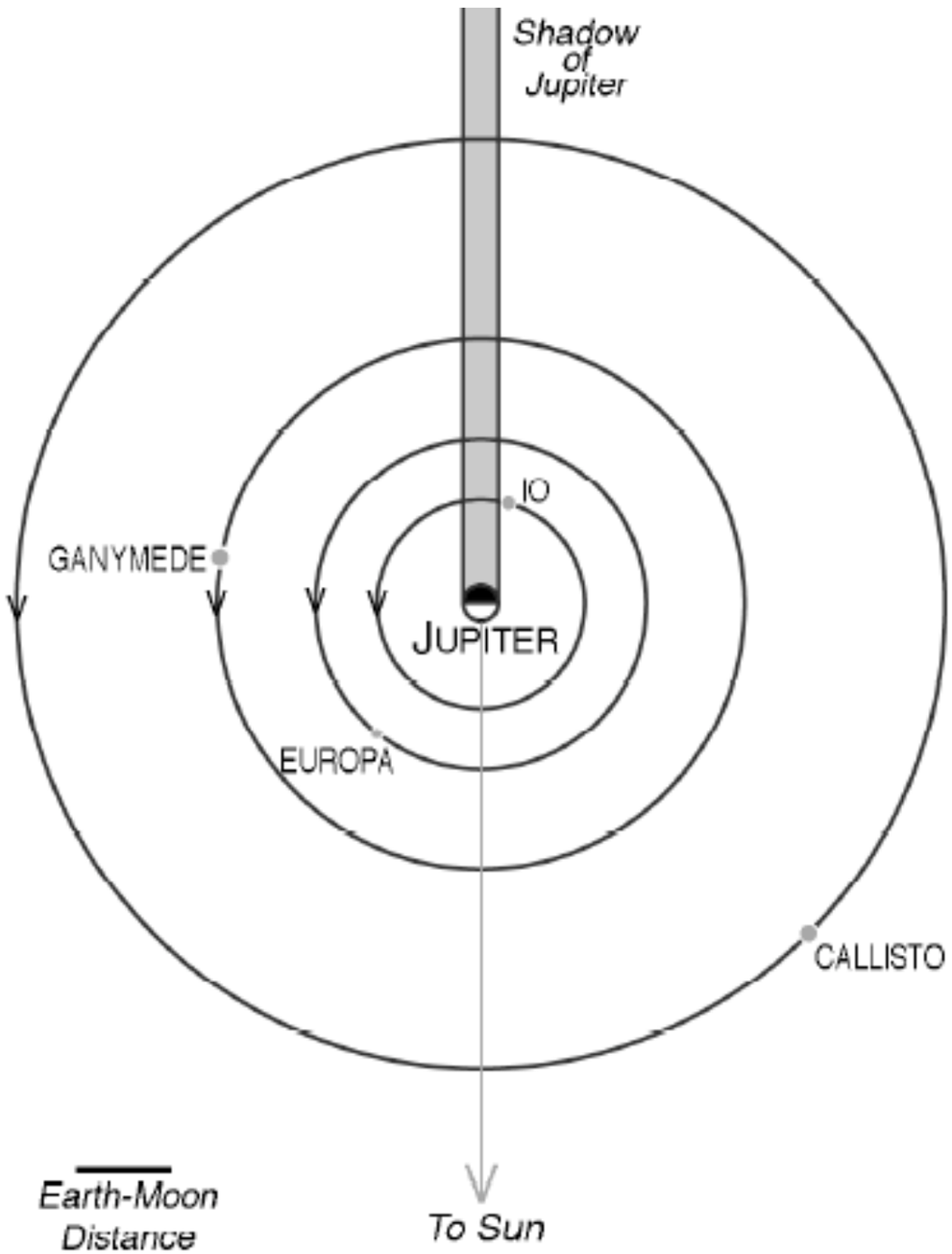

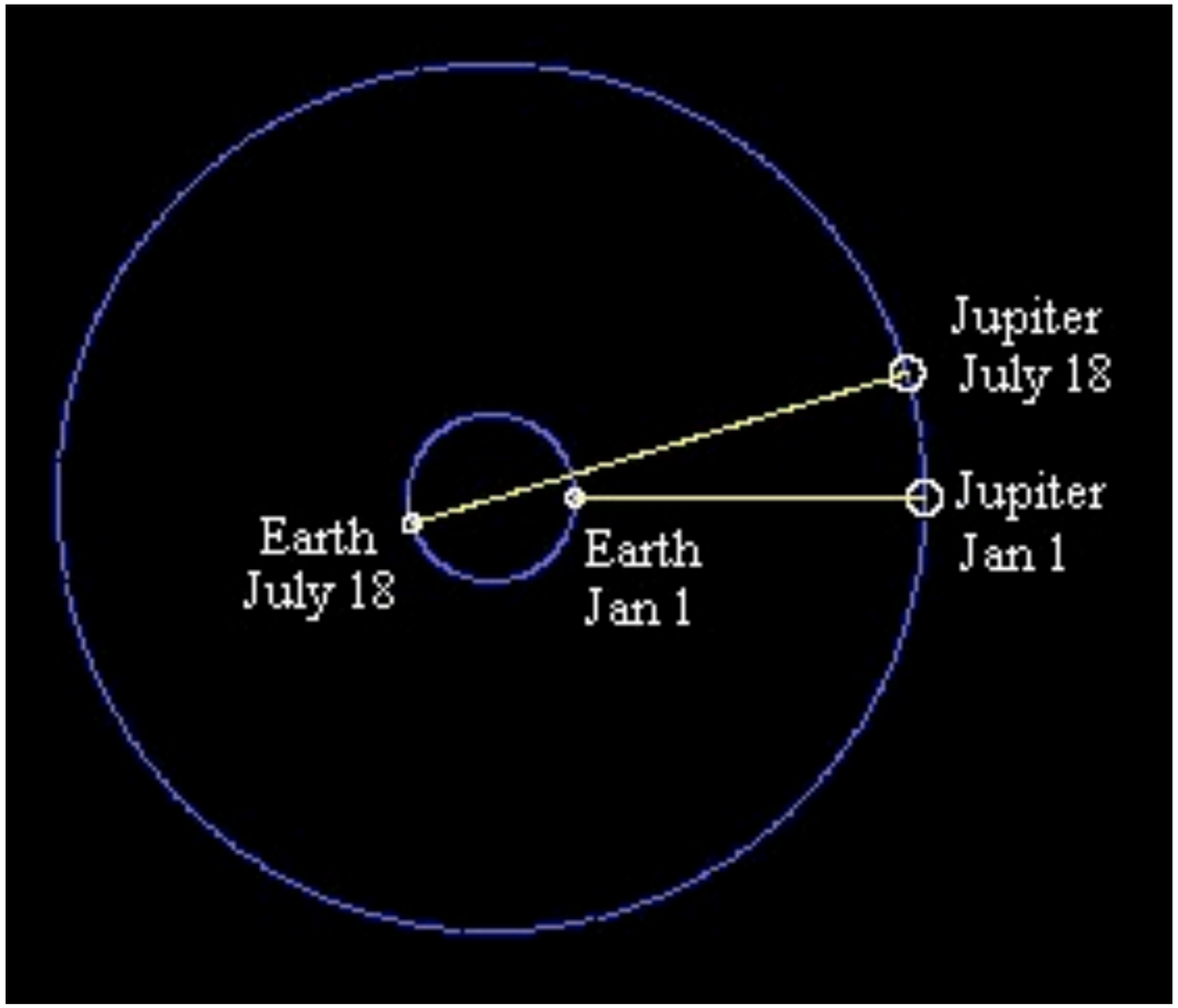

Not your grandfather's gravity

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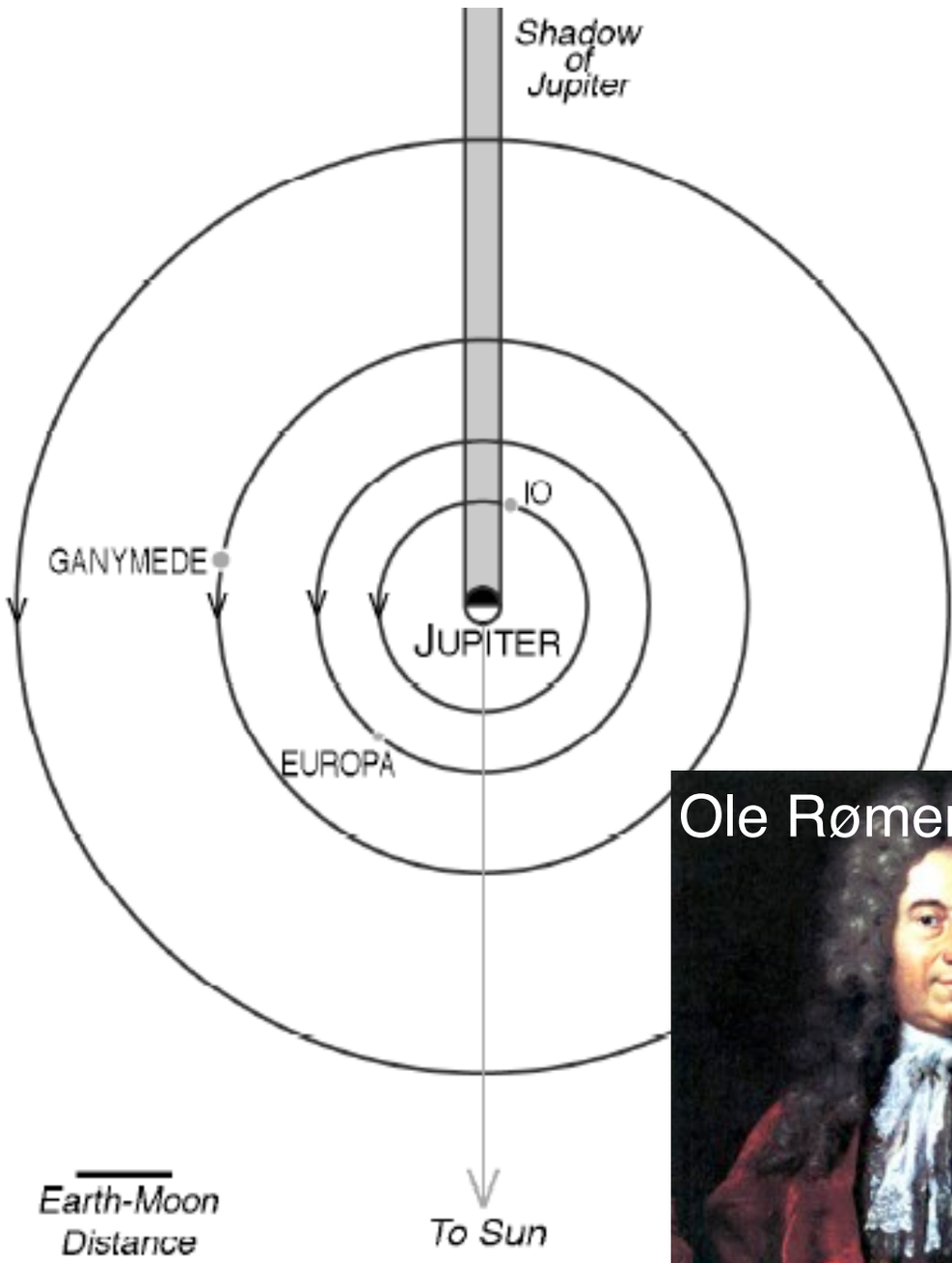
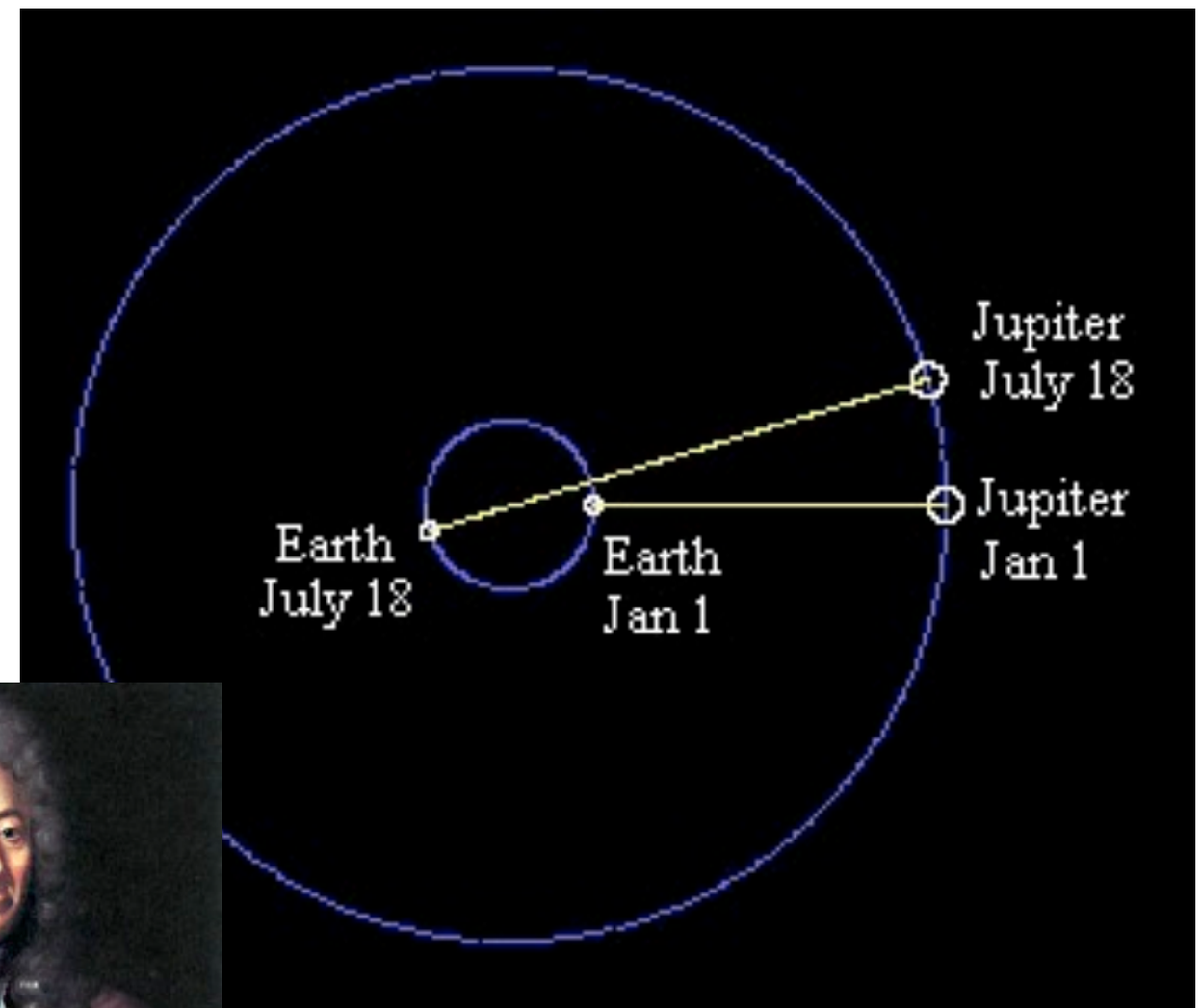
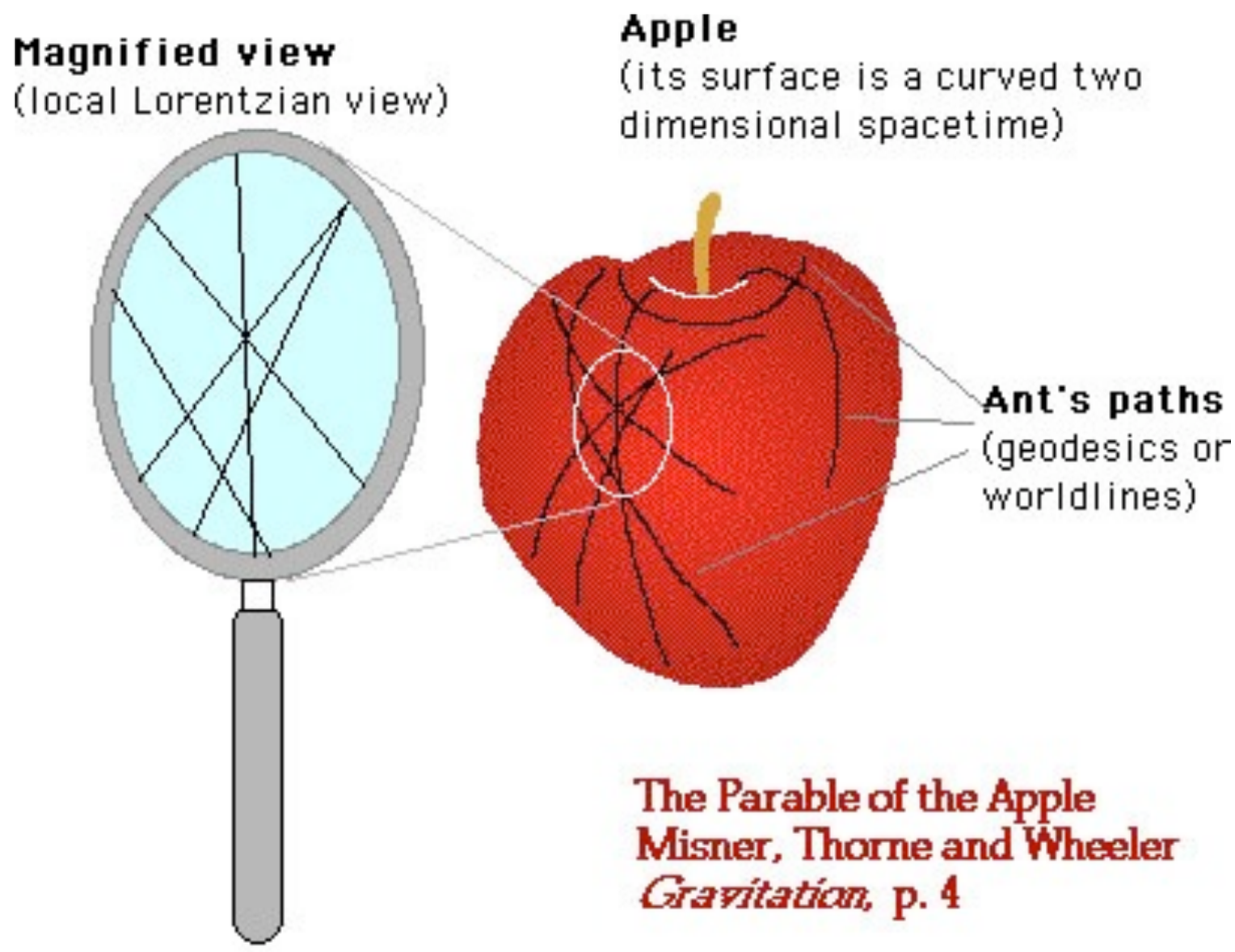




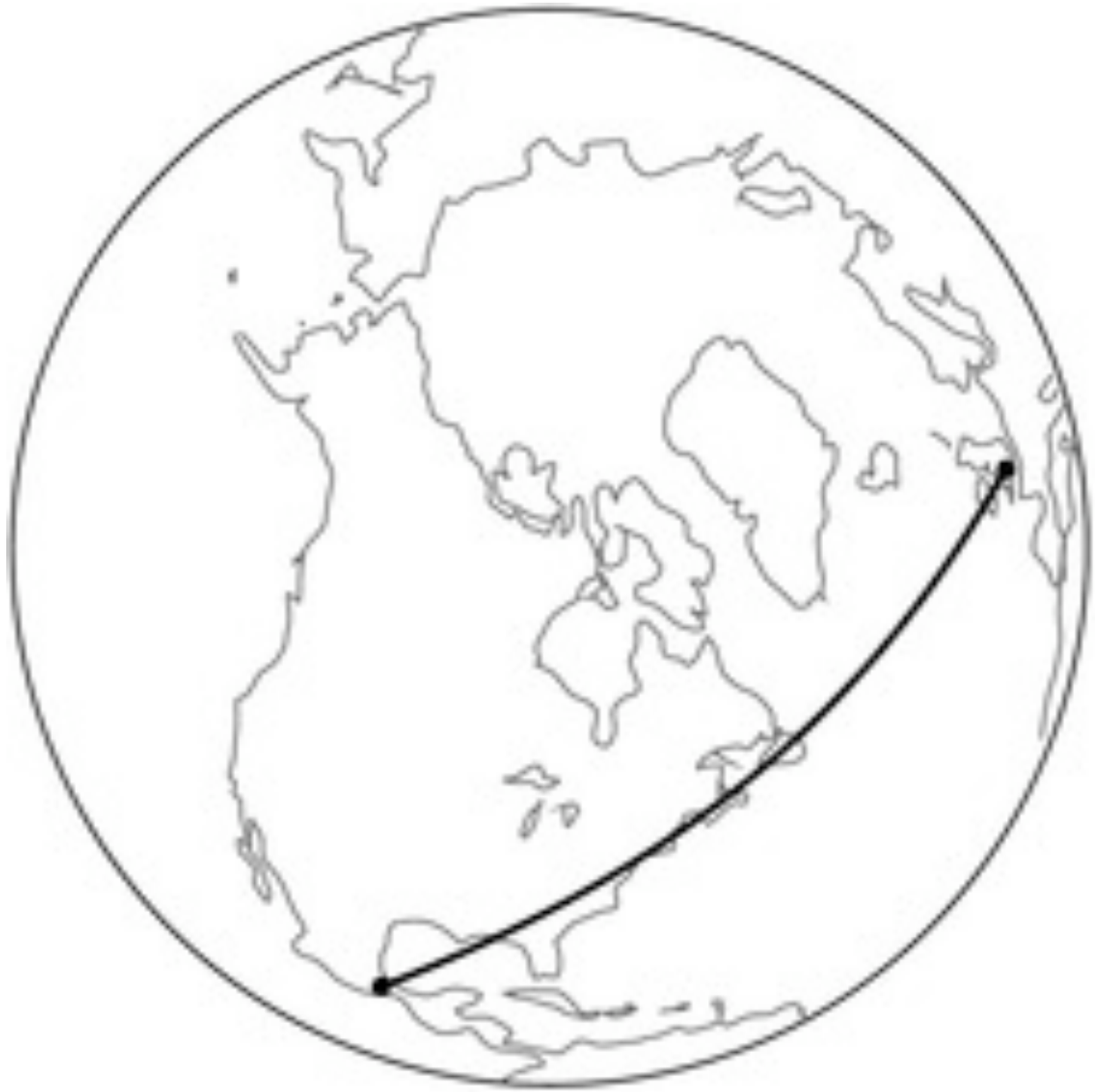
Of ants & apples

Of ants & apples



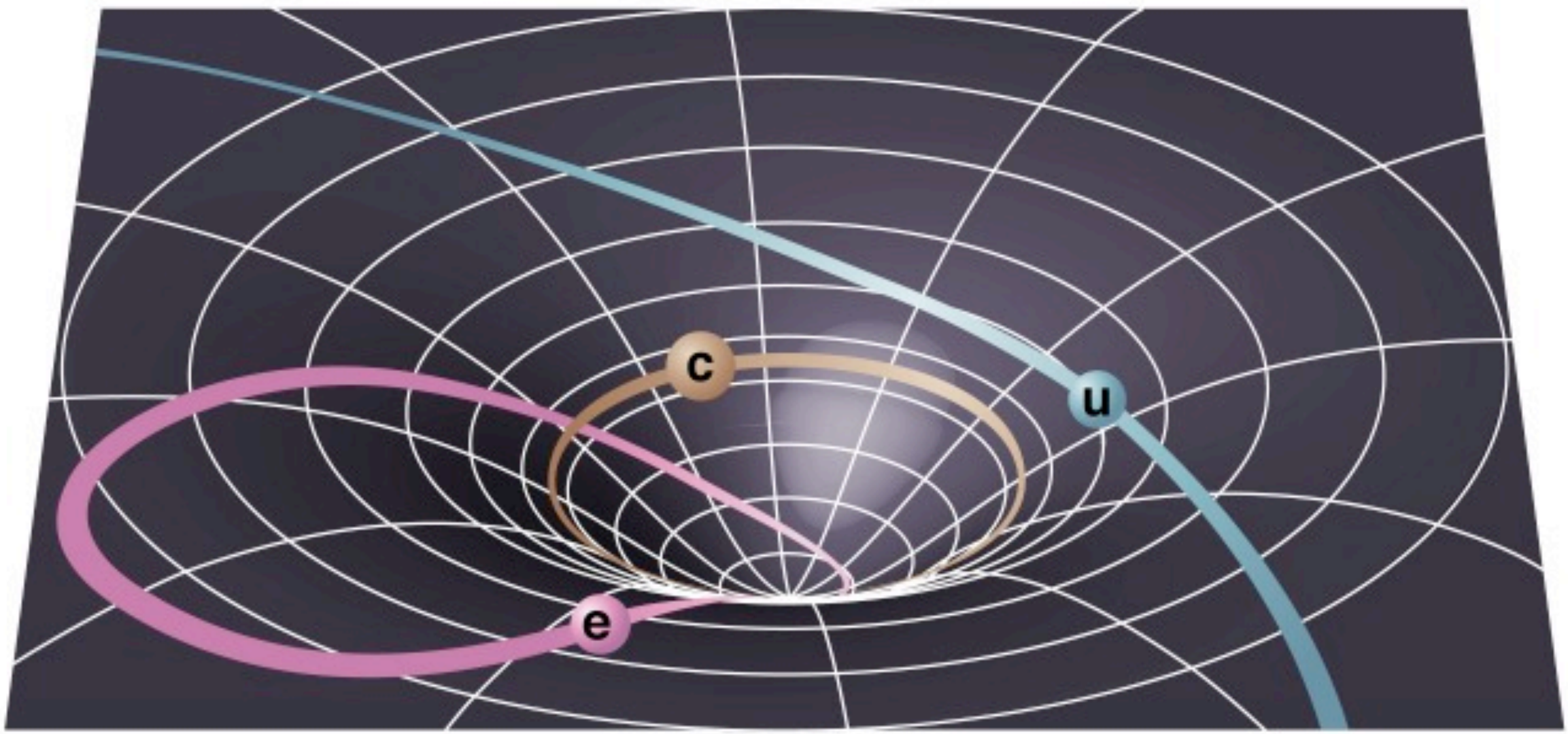
The Parable of the Apple
Misner, Thorne and Wheeler
Gravitation, p. 4

Of ants & apples



The Trampoline

c circular orbit
e elliptical orbit
u unbound orbit



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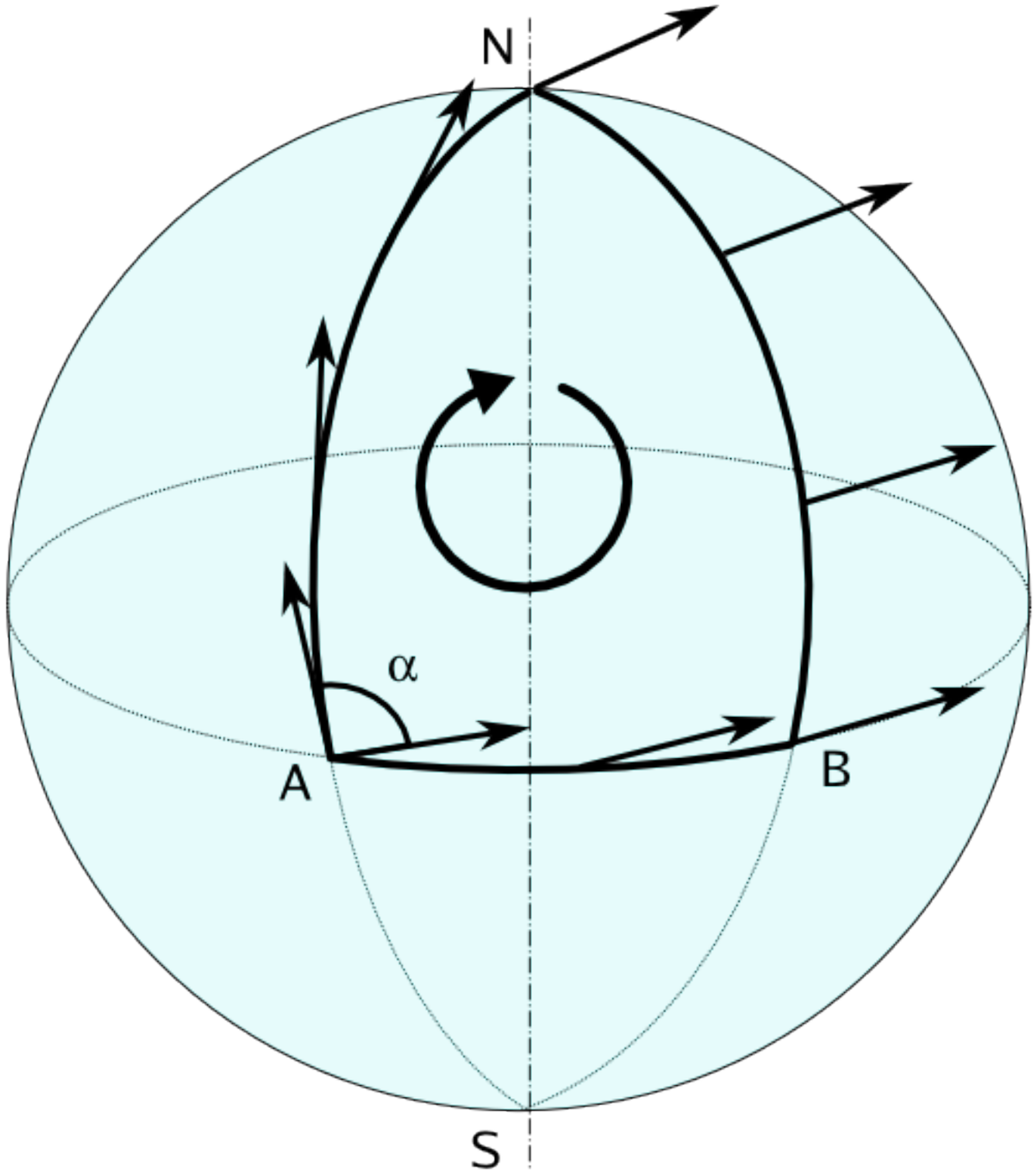
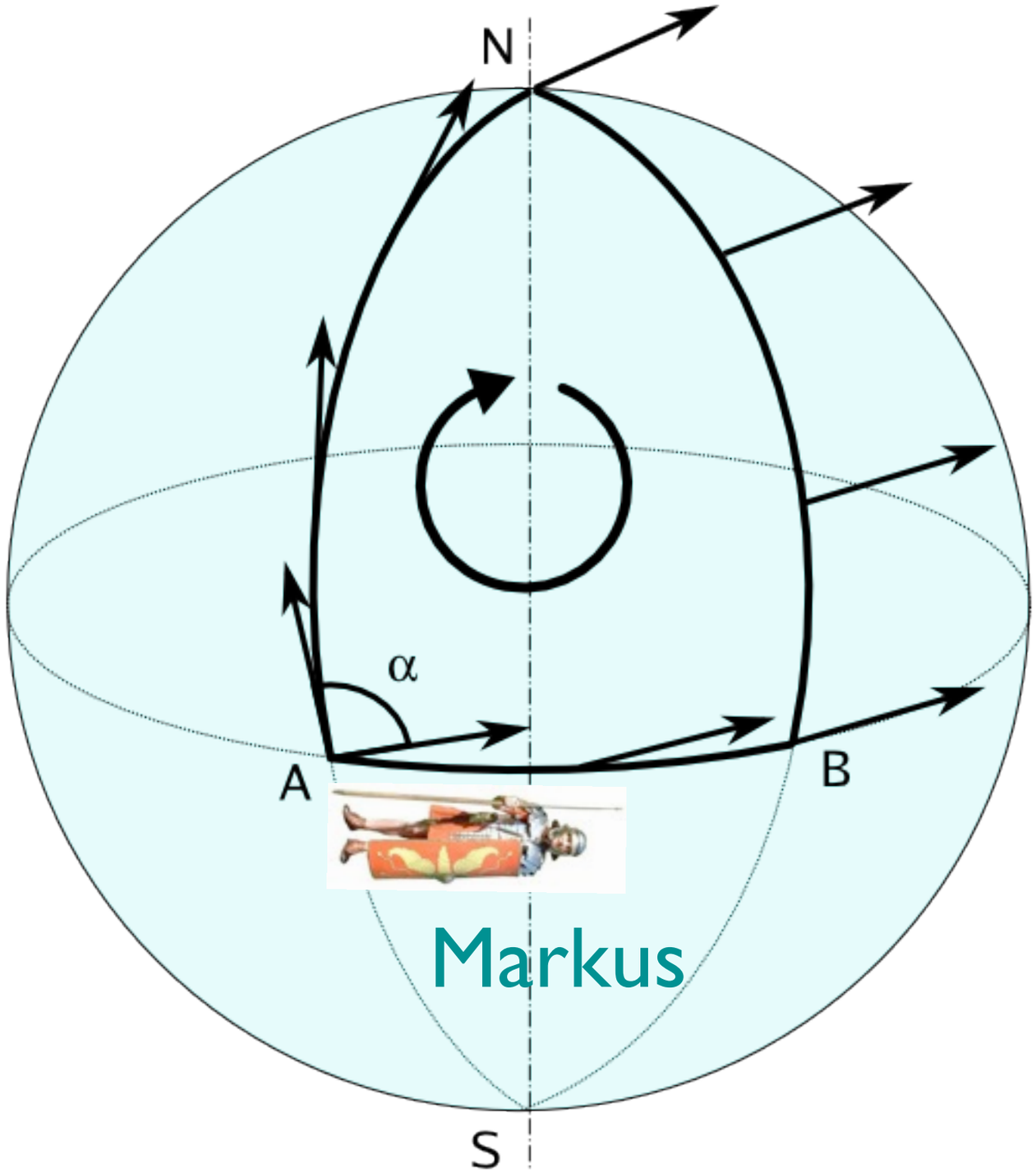
Spear points & curvature



Spear points & curvature



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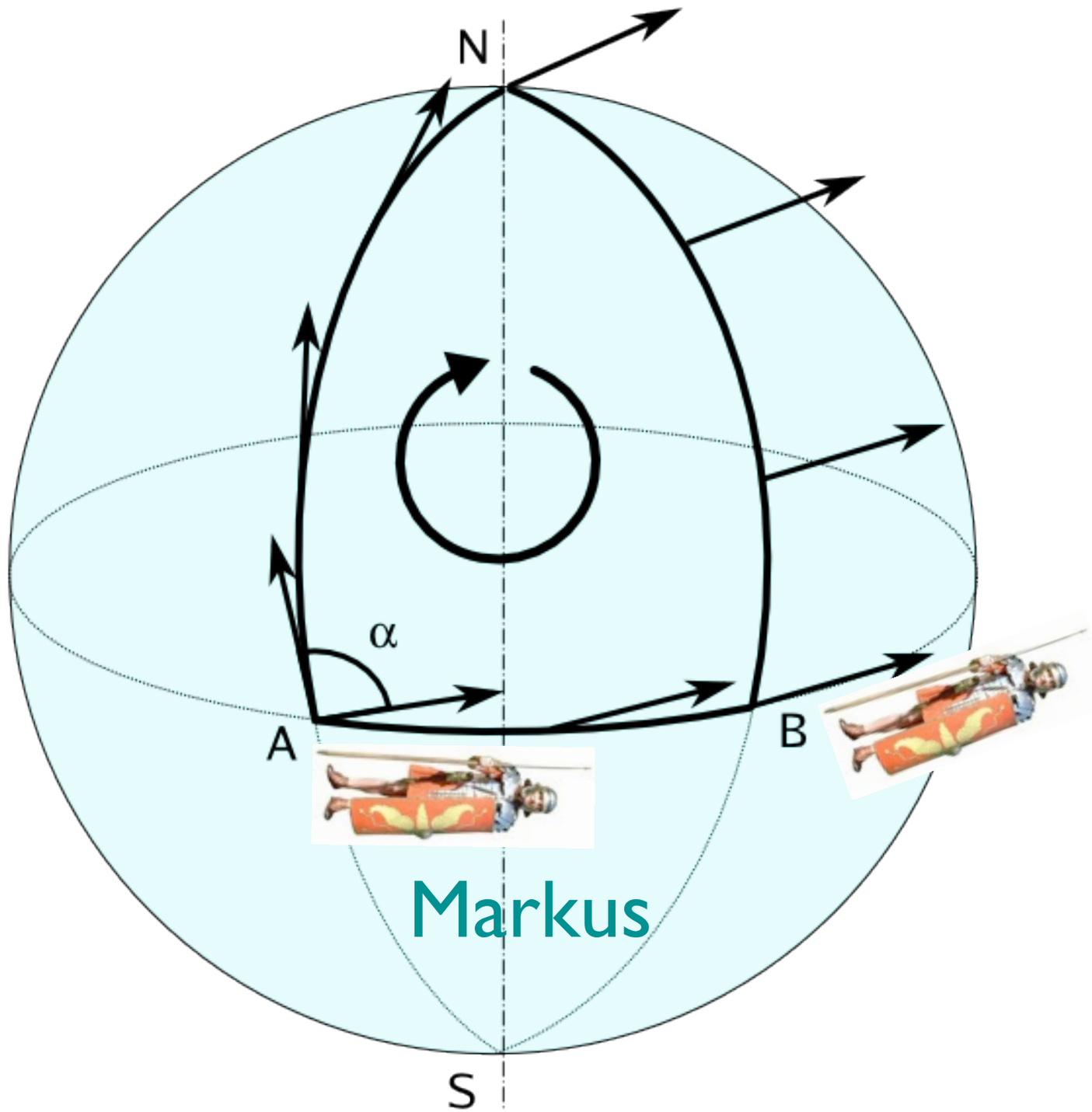

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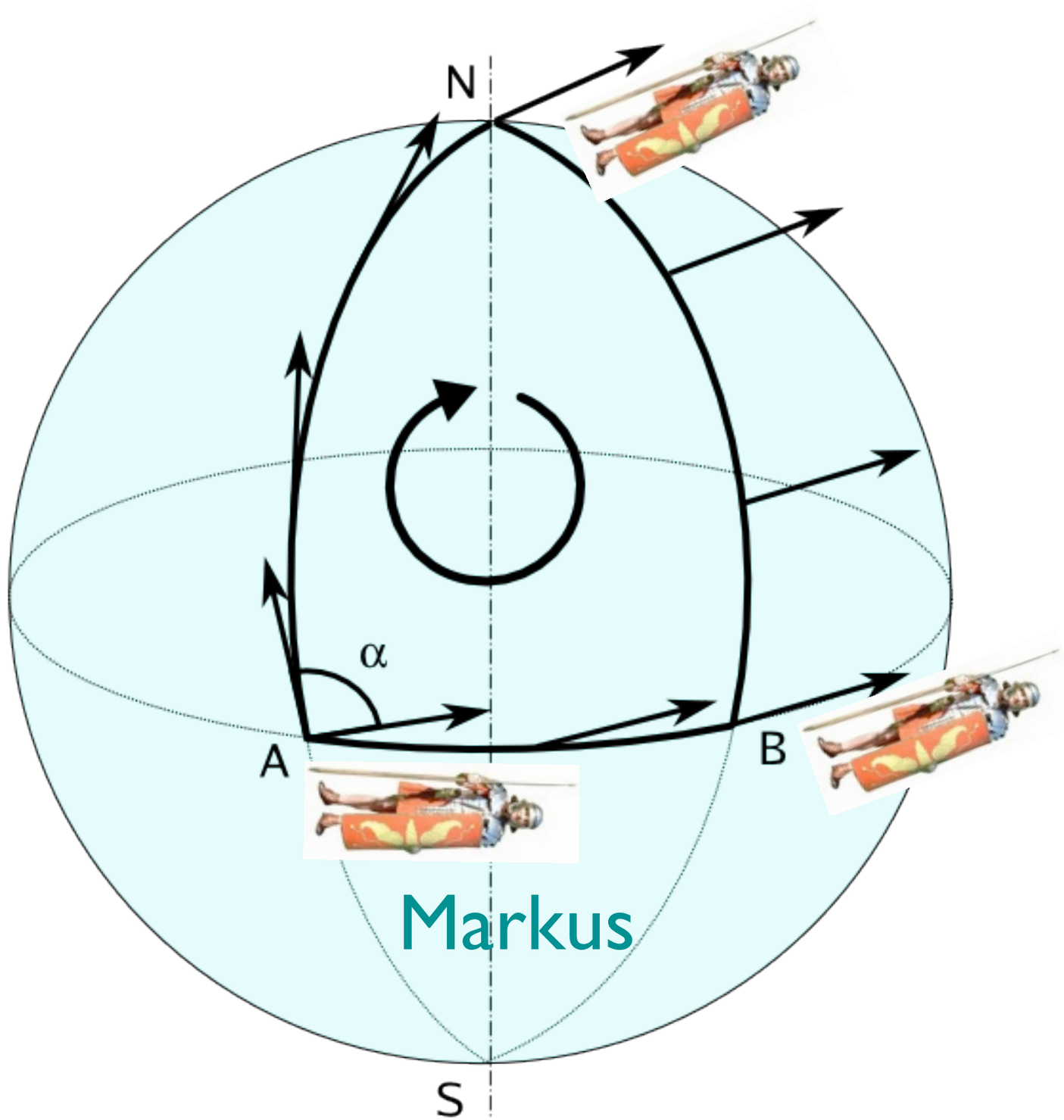

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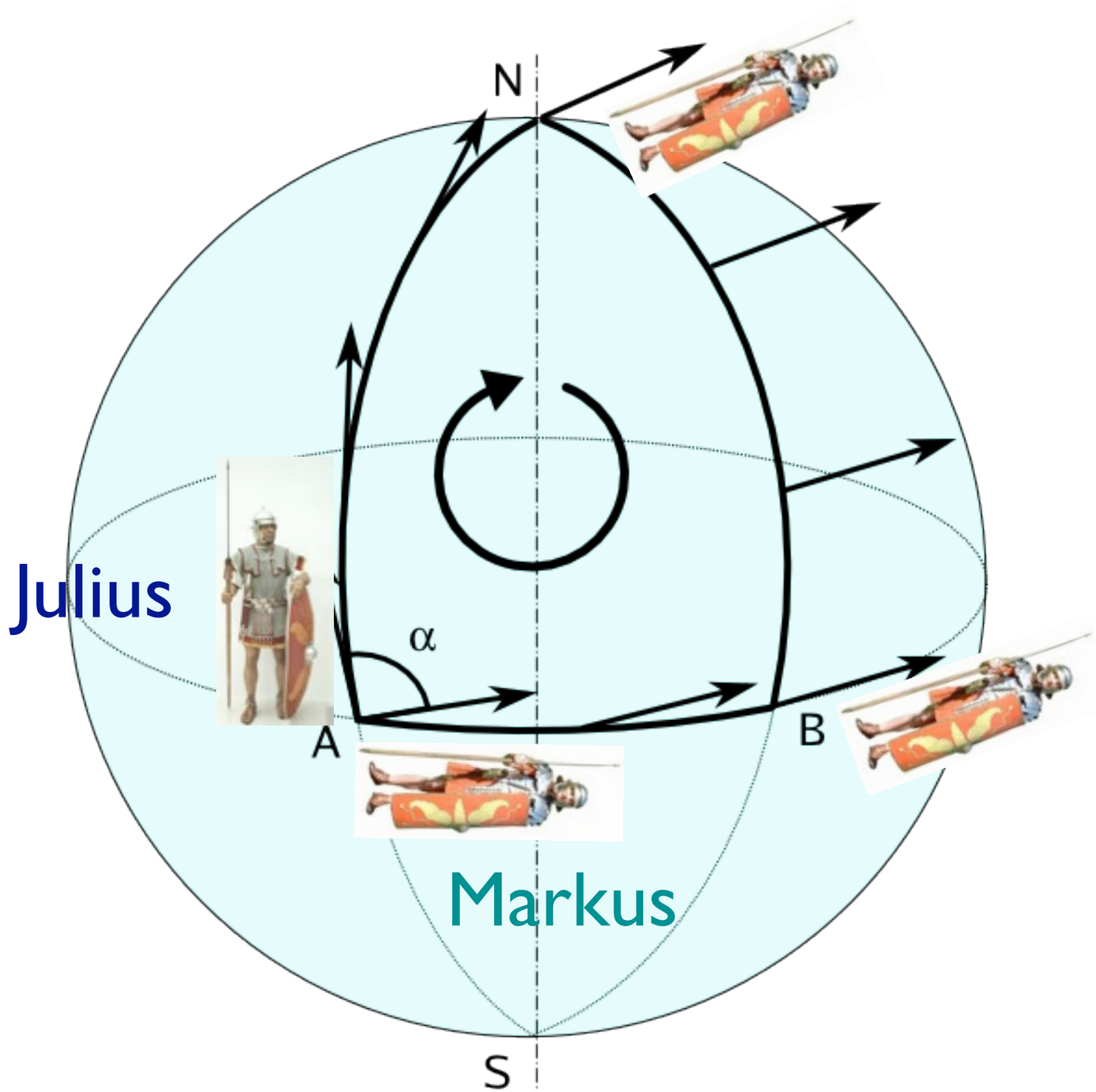

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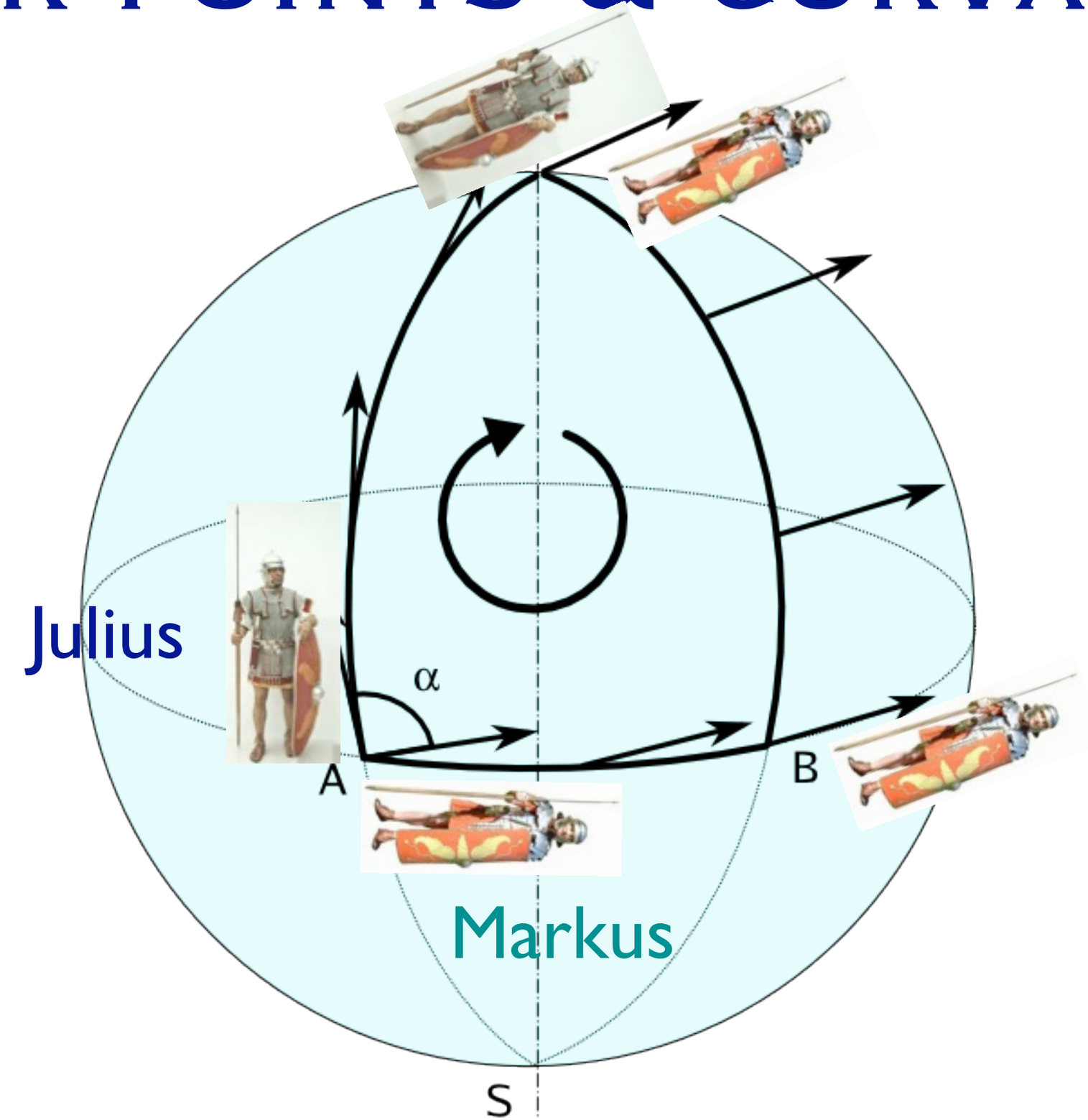
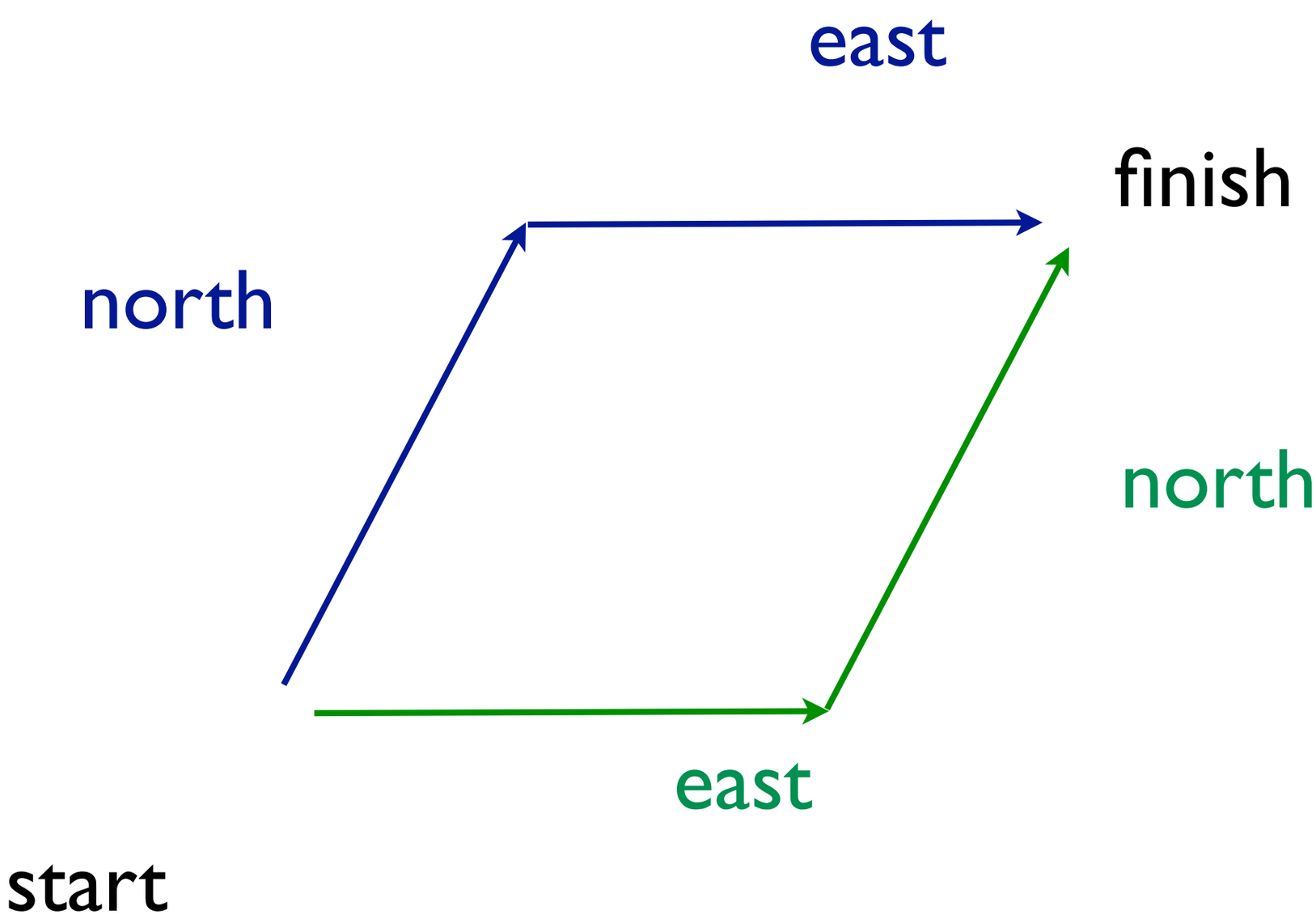


Riemann Curvature Tensor



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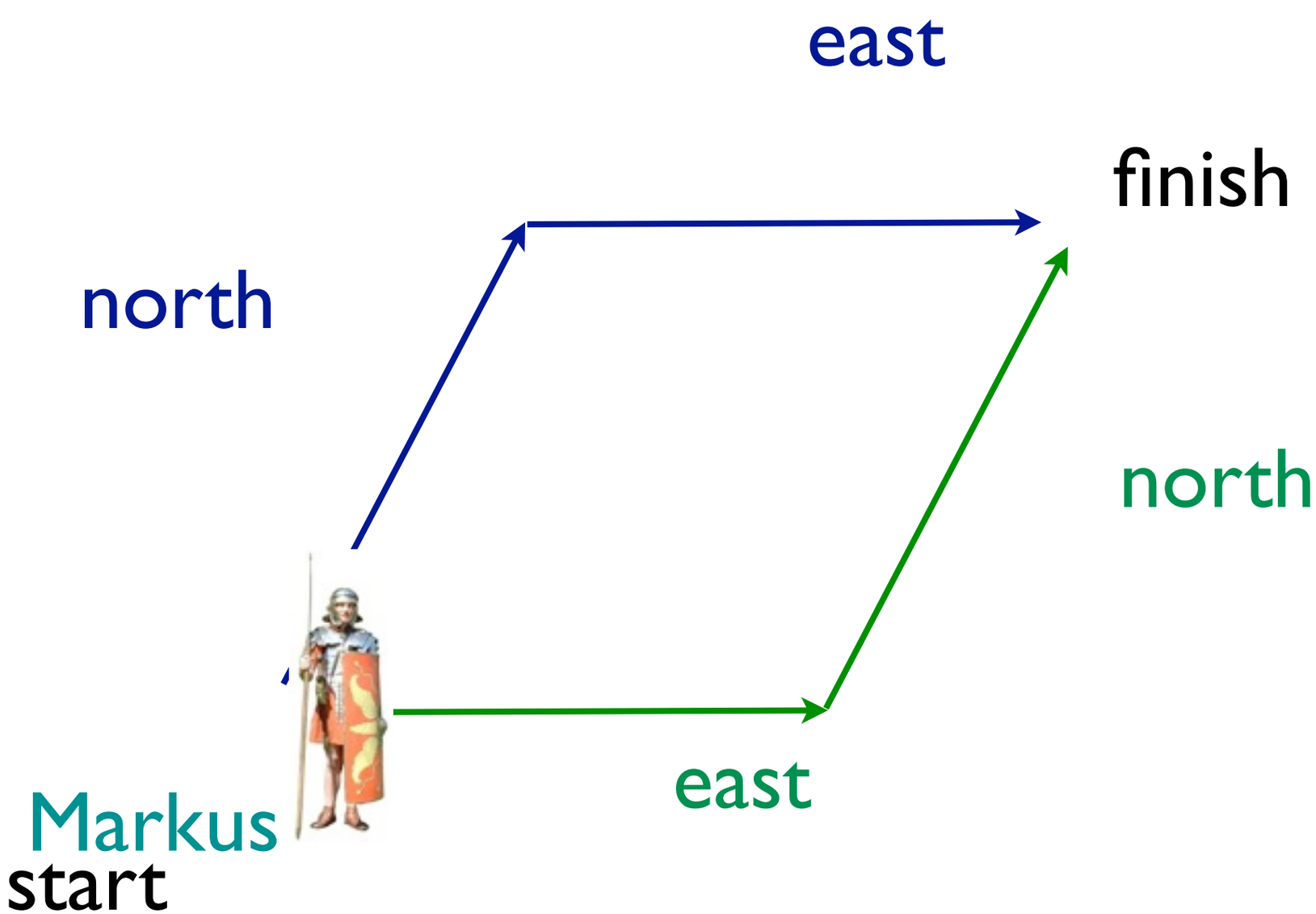

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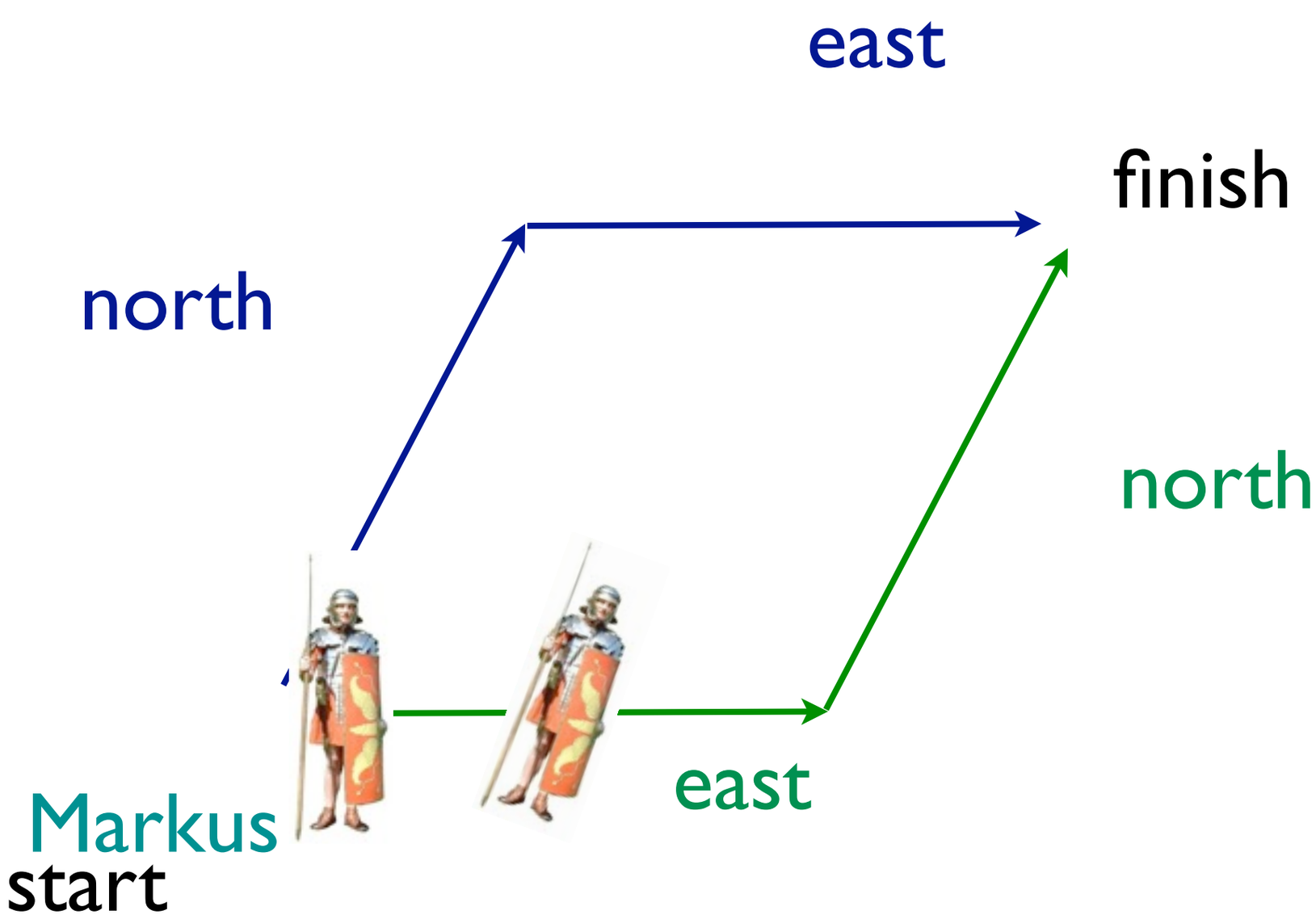

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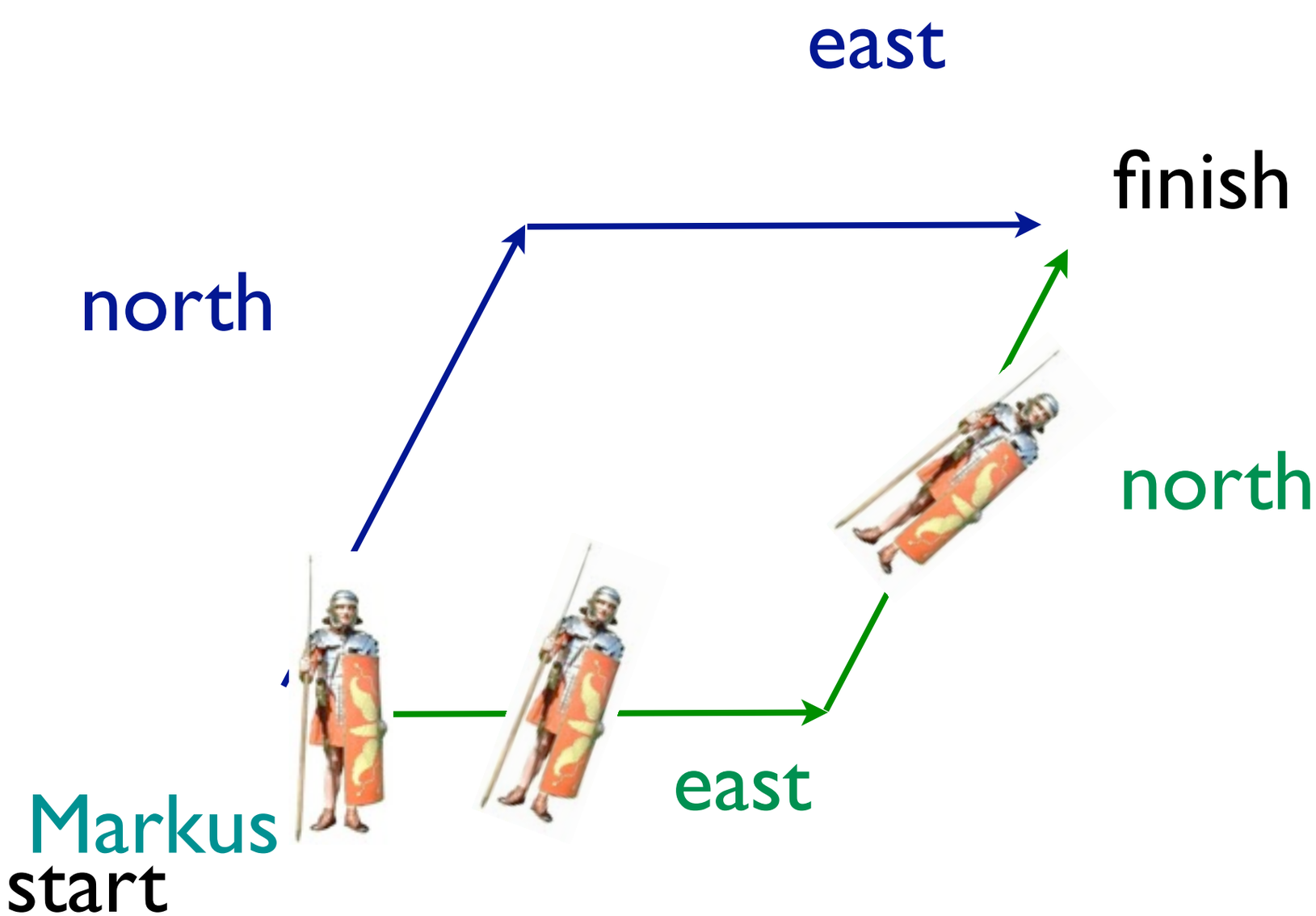

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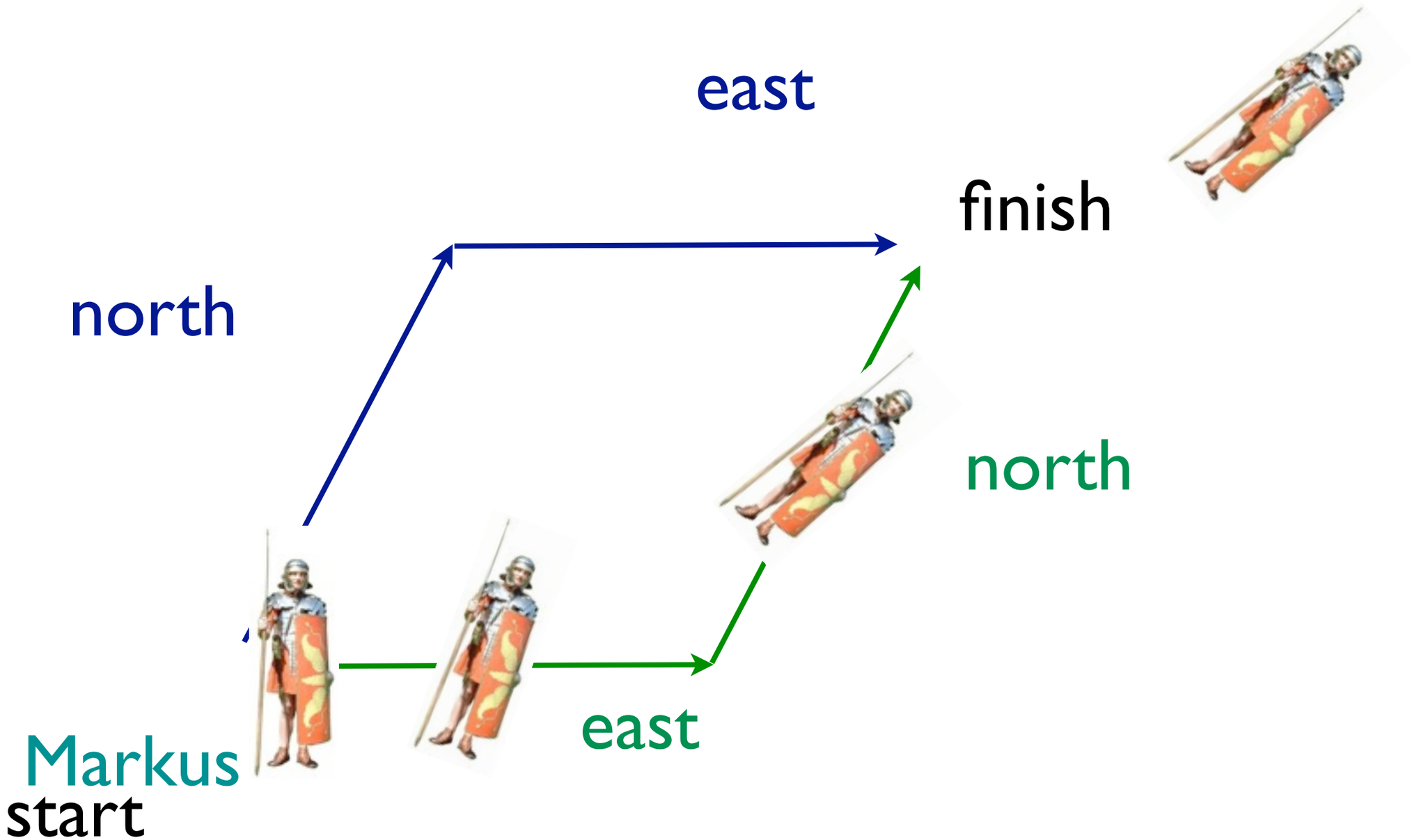

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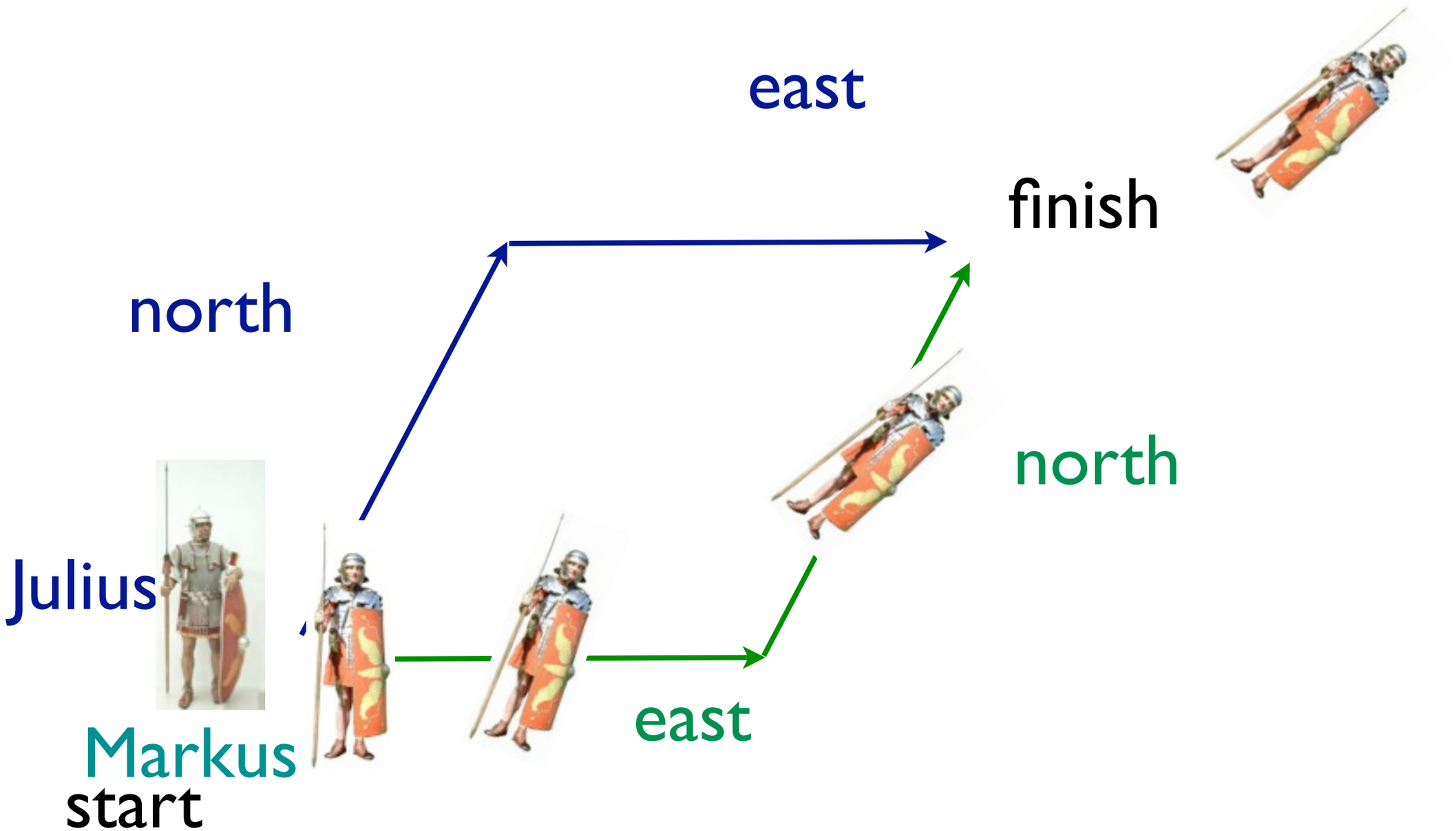

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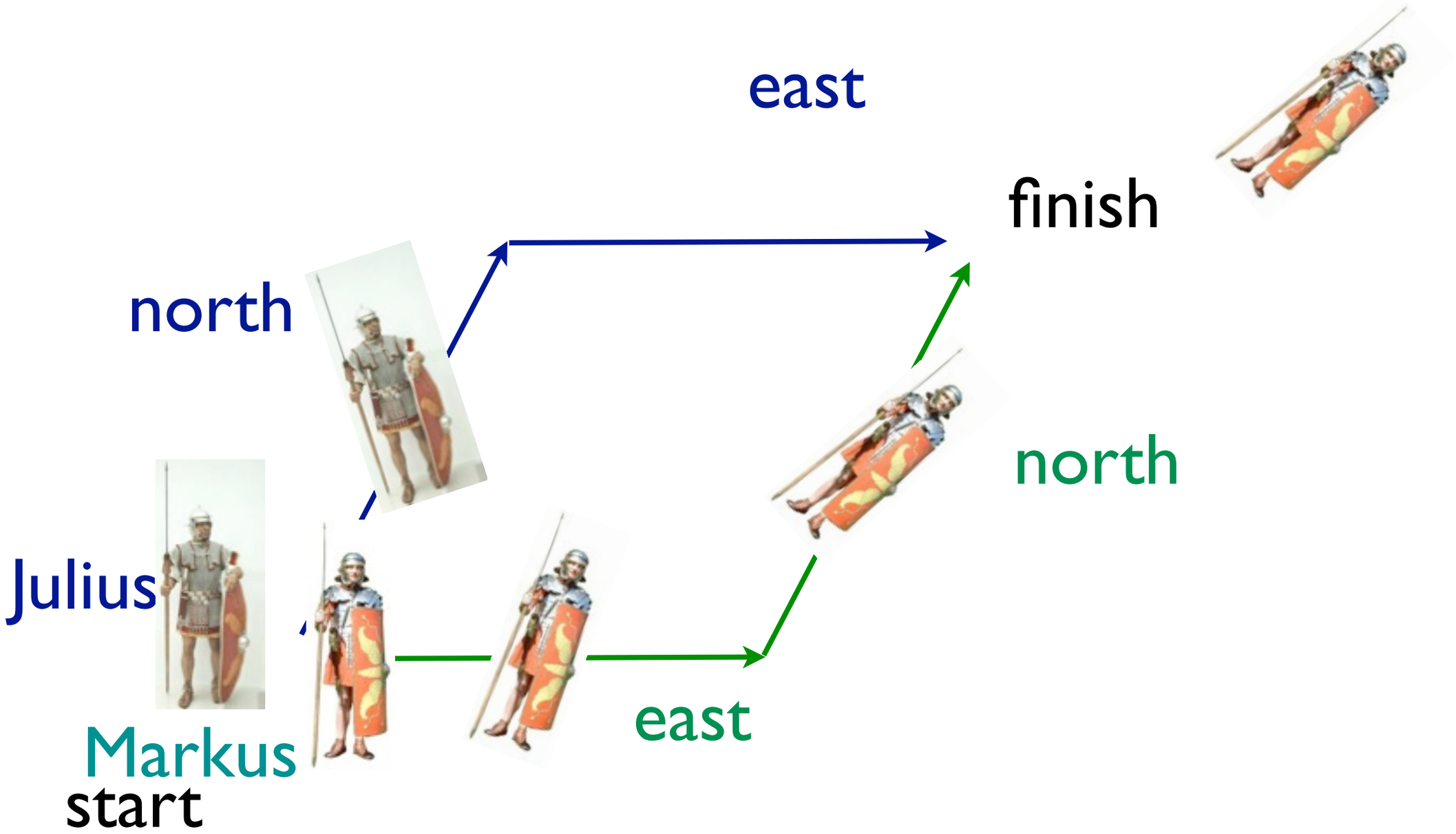

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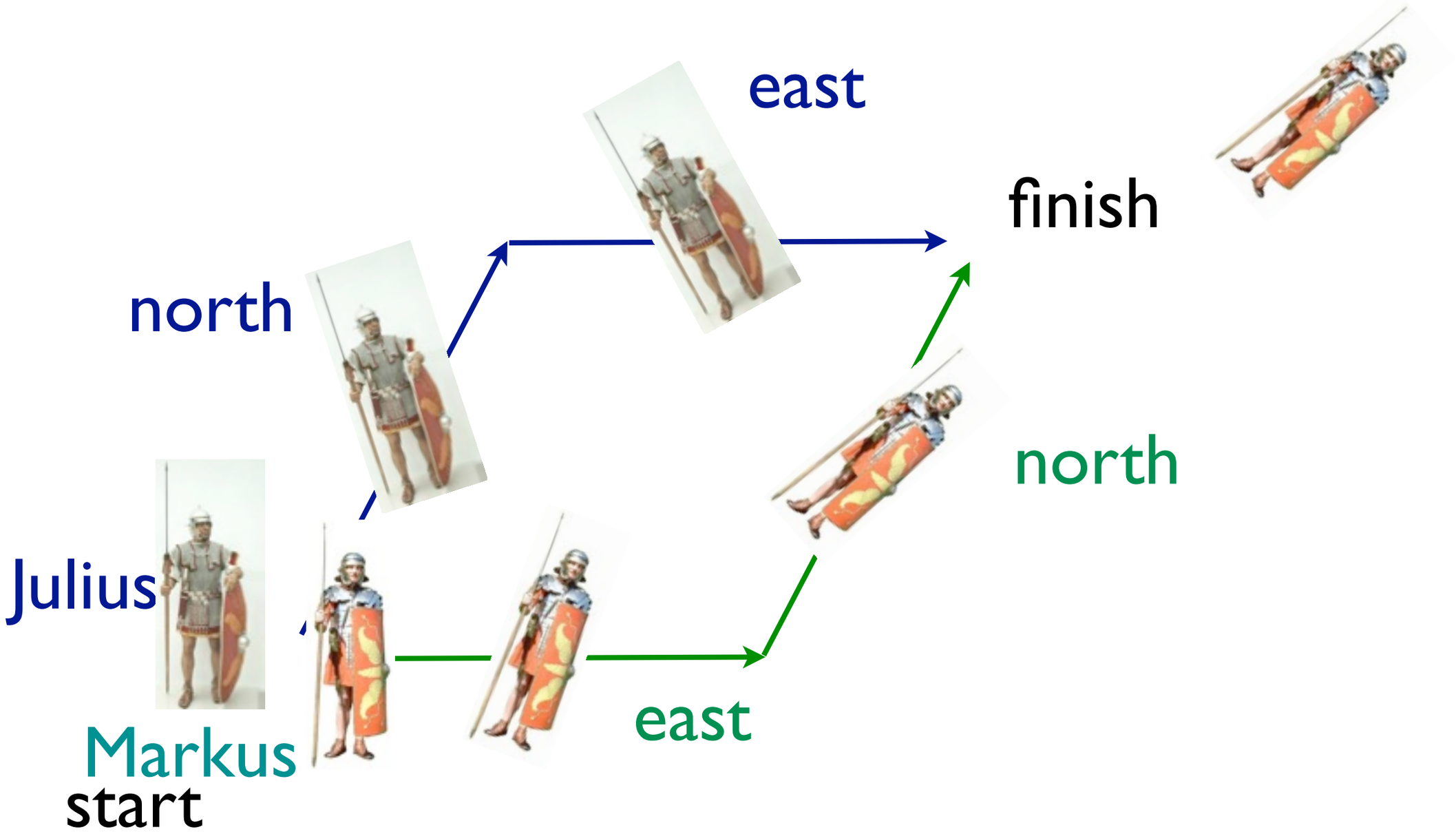

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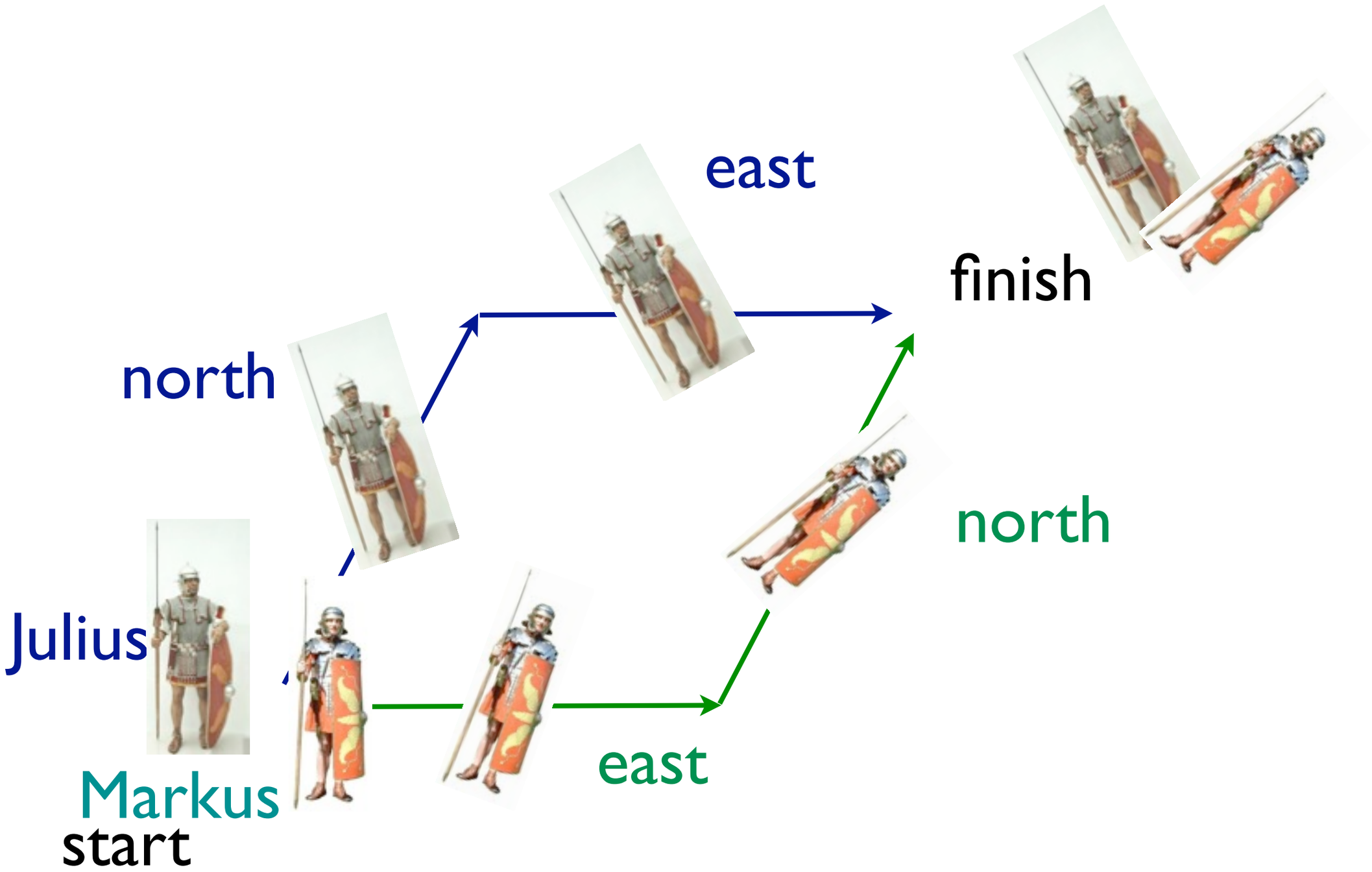

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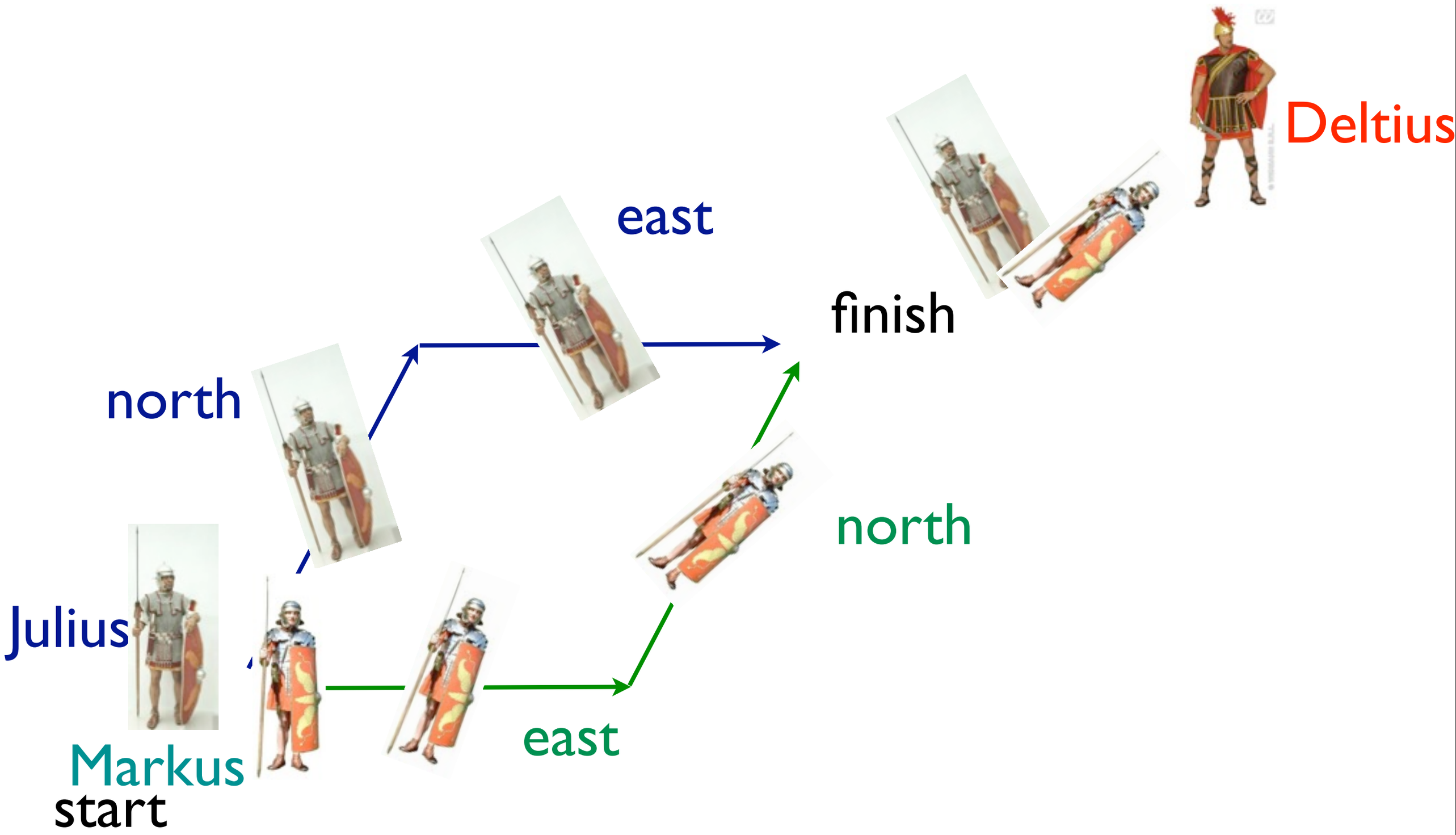

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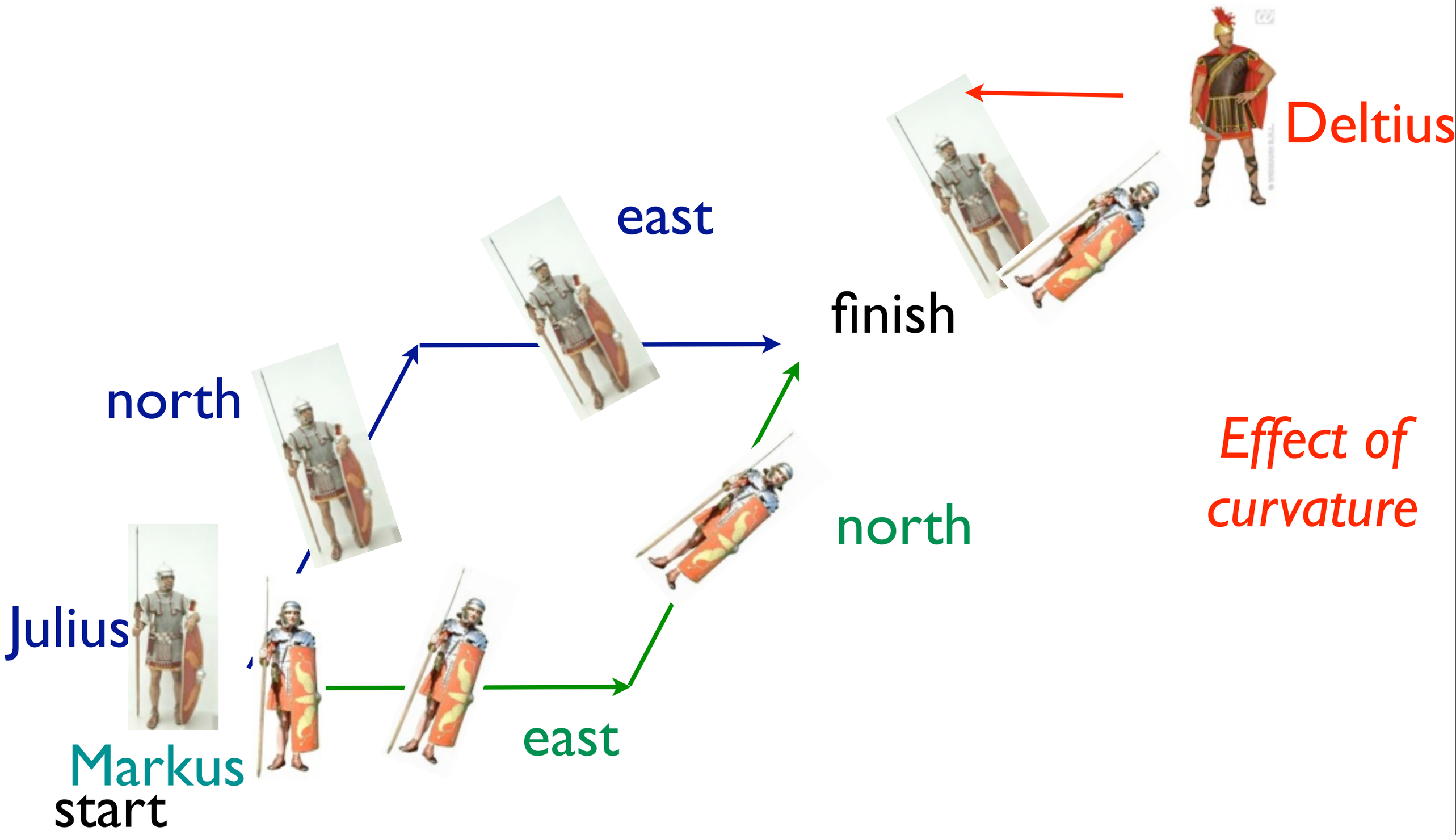
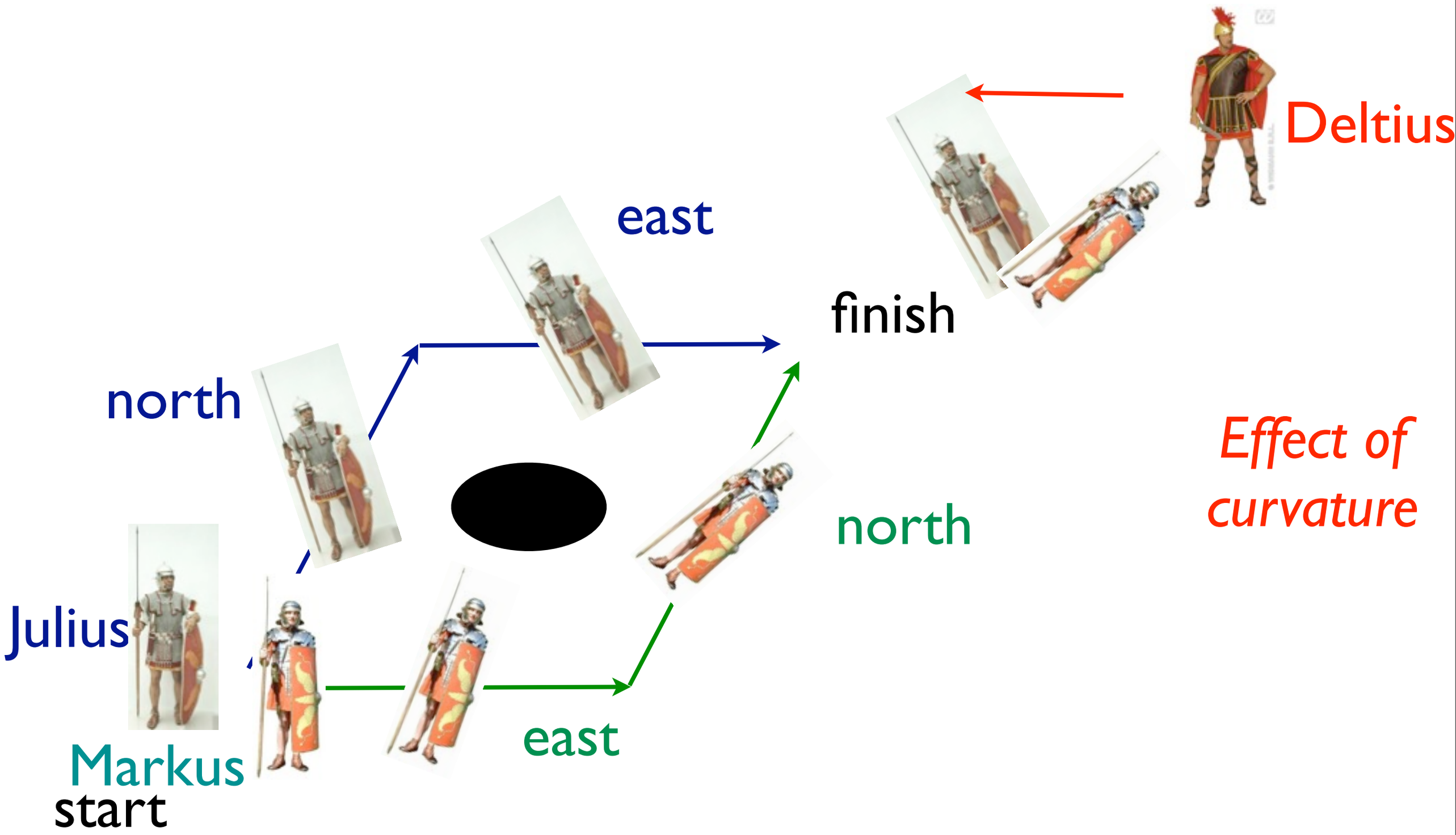


Riemann Curvature Tensor



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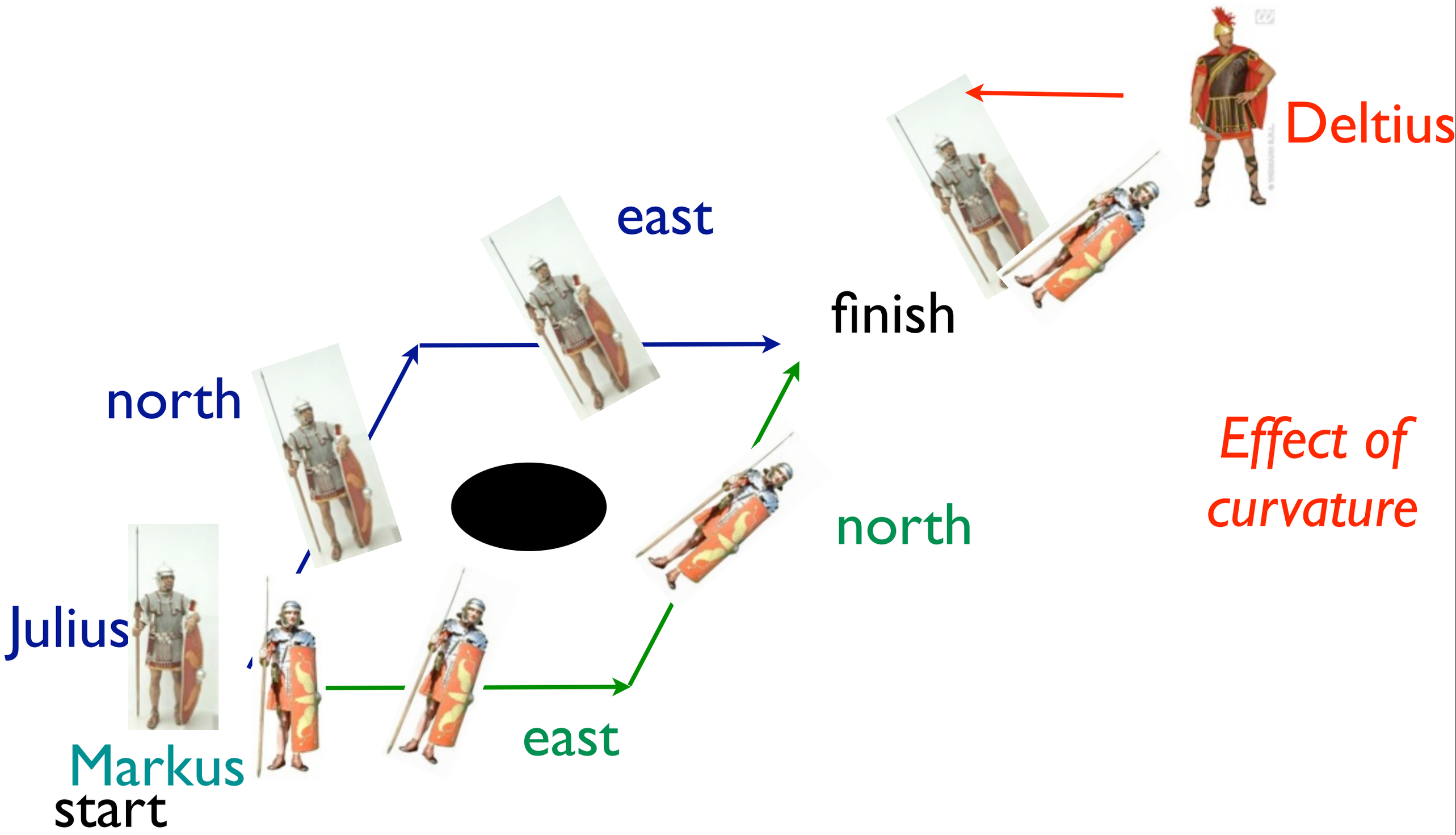

$$deltius = \left(\nabla(east)\nabla(north) - \nabla(north)\nabla(east)\right)uprightius$$

Einstein's field equation

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$$x^d = R^d_{abc} x^c$$

Einstein's field equation

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$$T^{(fluid)}_{\mu\nu} = \begin{pmatrix} \rho & 0 & 0 & 0 \\ 0 & p & 0 & 0 \\ 0 & 0 & p & 0 \\ 0 & 0 & 0 & p \end{pmatrix}$$

Einstein's field equation

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

Einstein's field equation

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$$T_{\mu\nu}^{(fluid)} = \begin{pmatrix} \rho & 0 & 0 & 0 \\ 0 & p & 0 & 0 \\ 0 & 0 & p & 0 \\ 0 & 0 & 0 & p \end{pmatrix}$$

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

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Important bit

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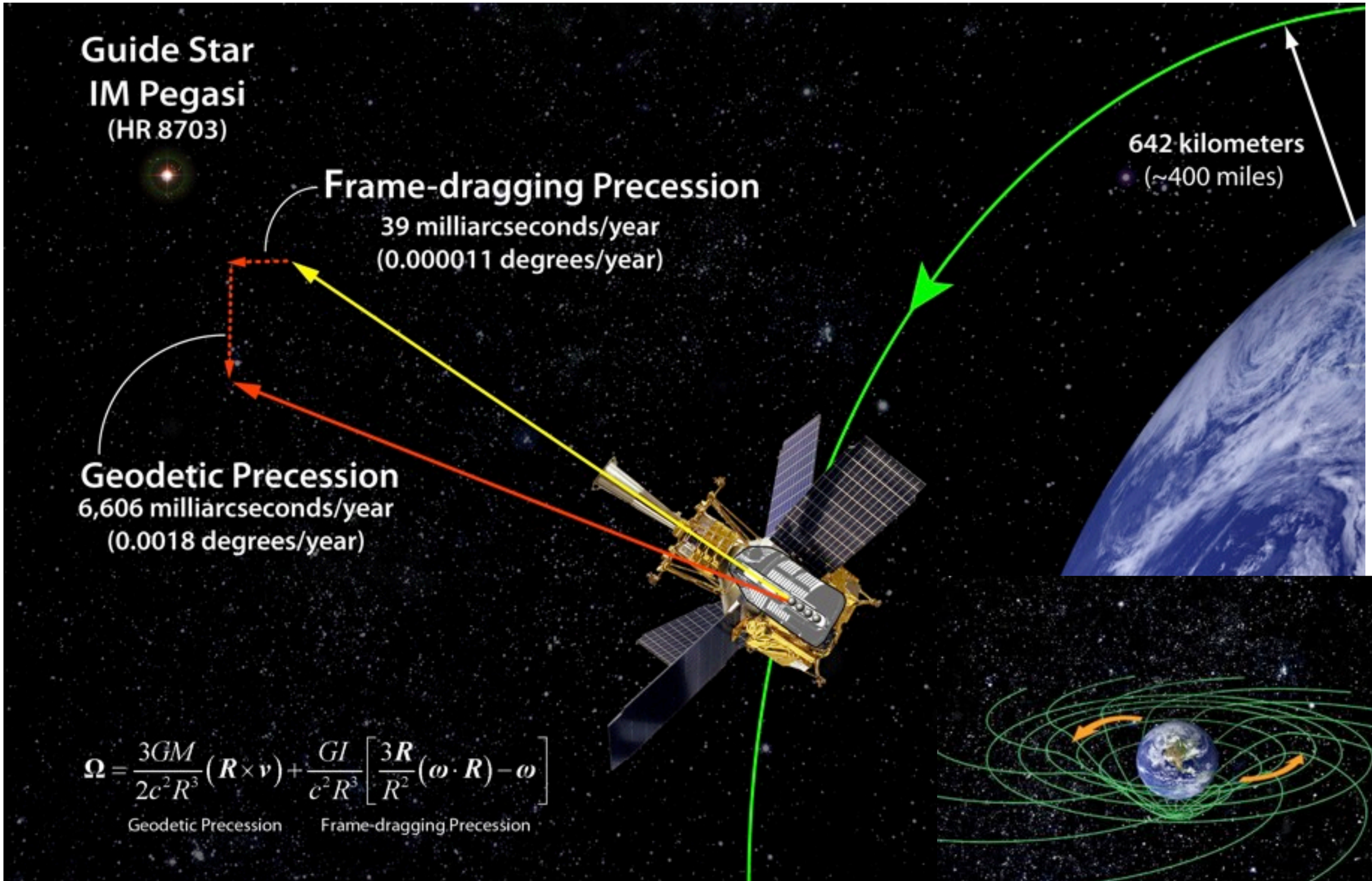
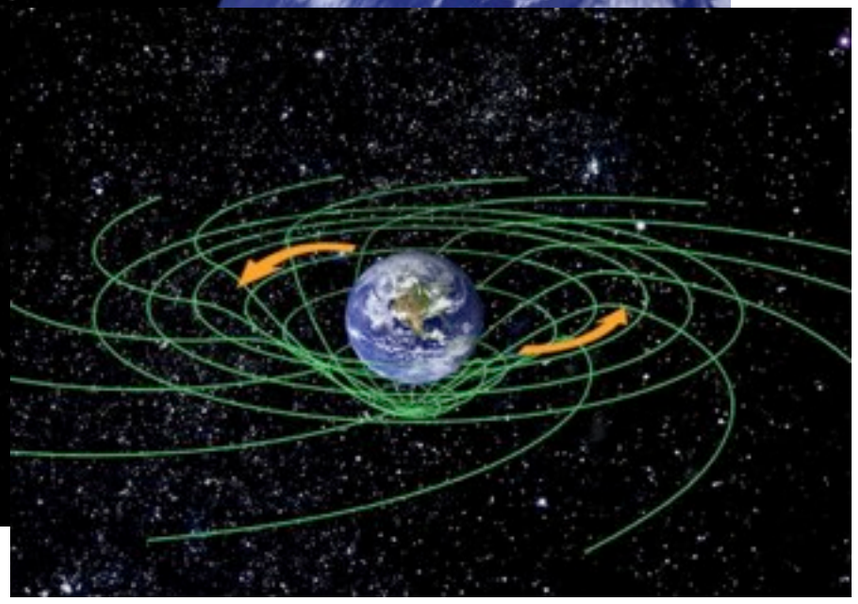
Suspicious bit

Frame dragging





Not your grandfather's gravity

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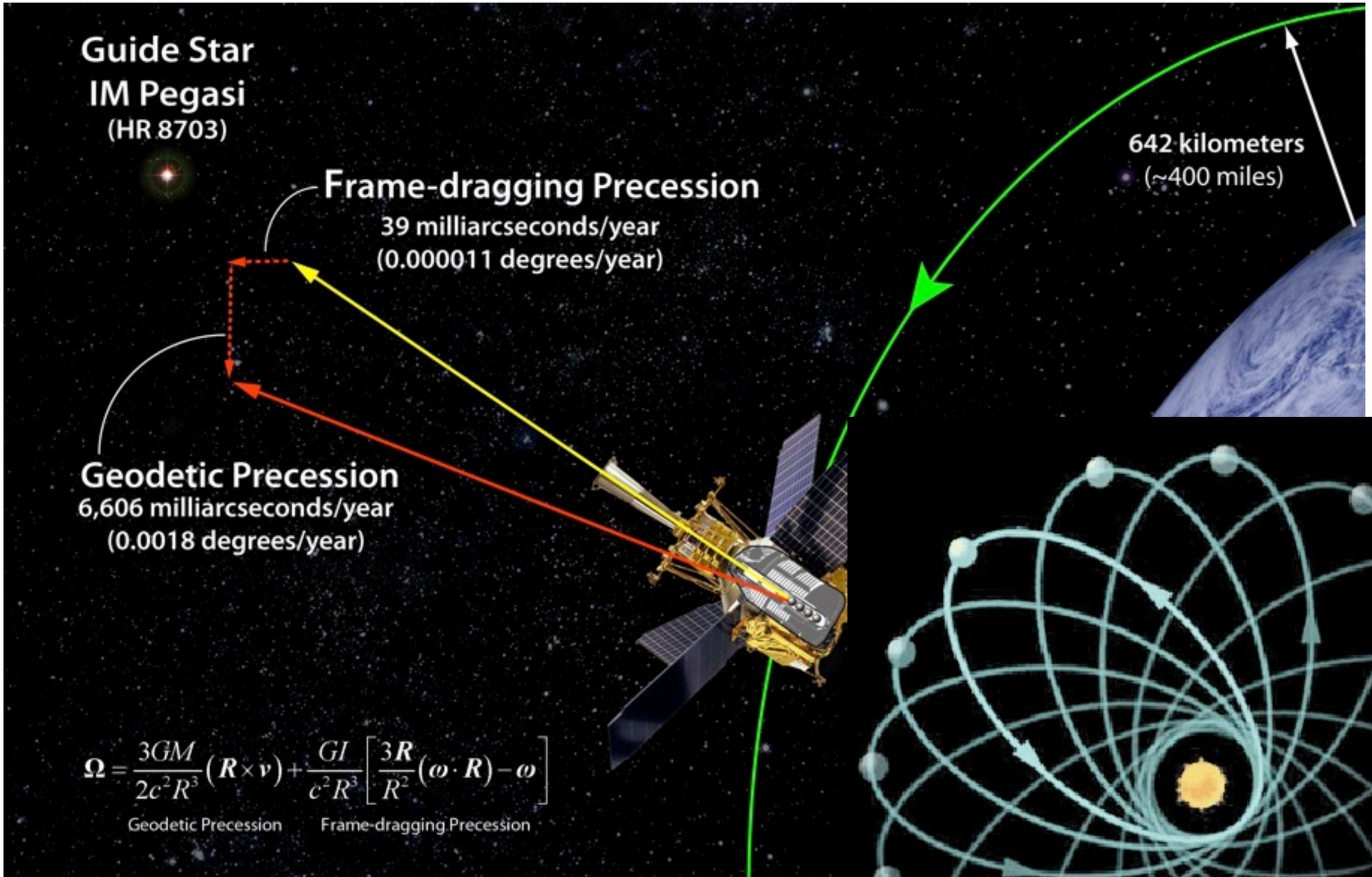
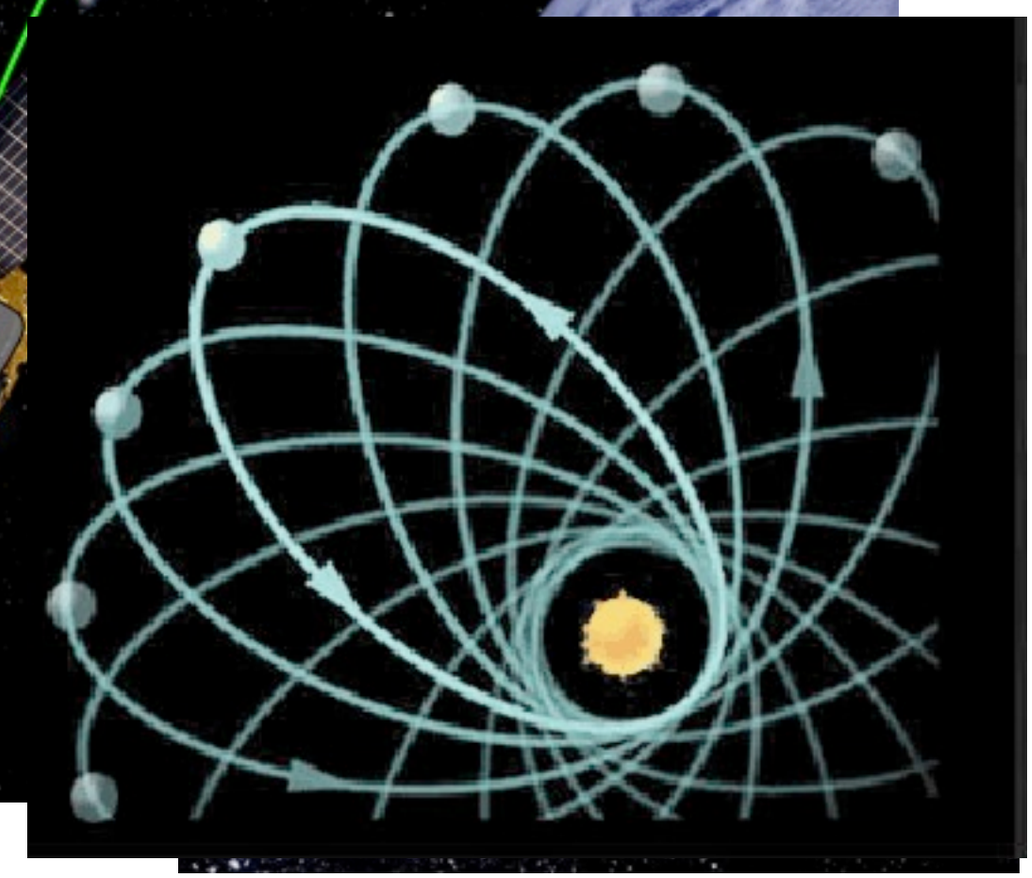
Frame dragging





Not your grandfather's gravity

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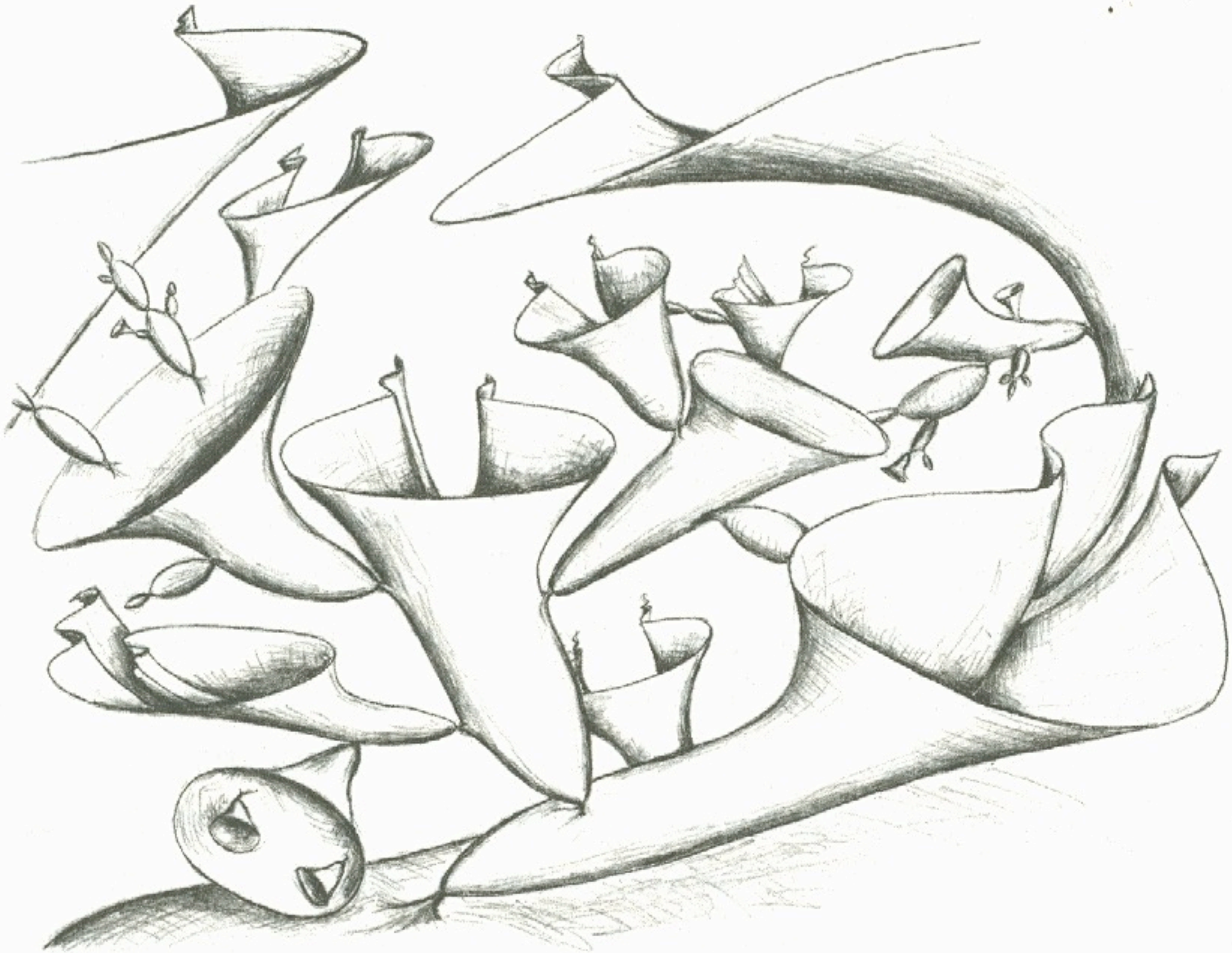
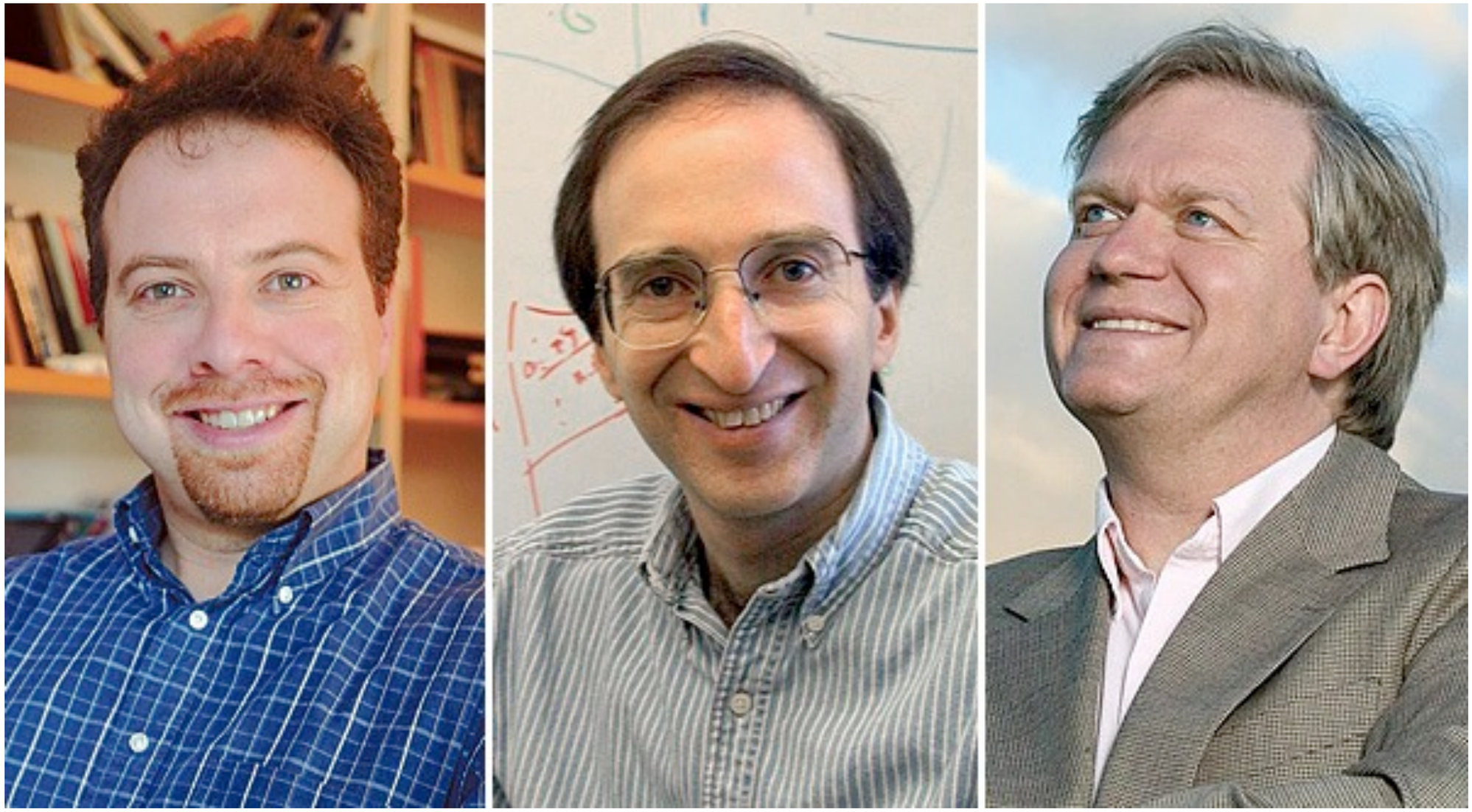
Black holes & white holes

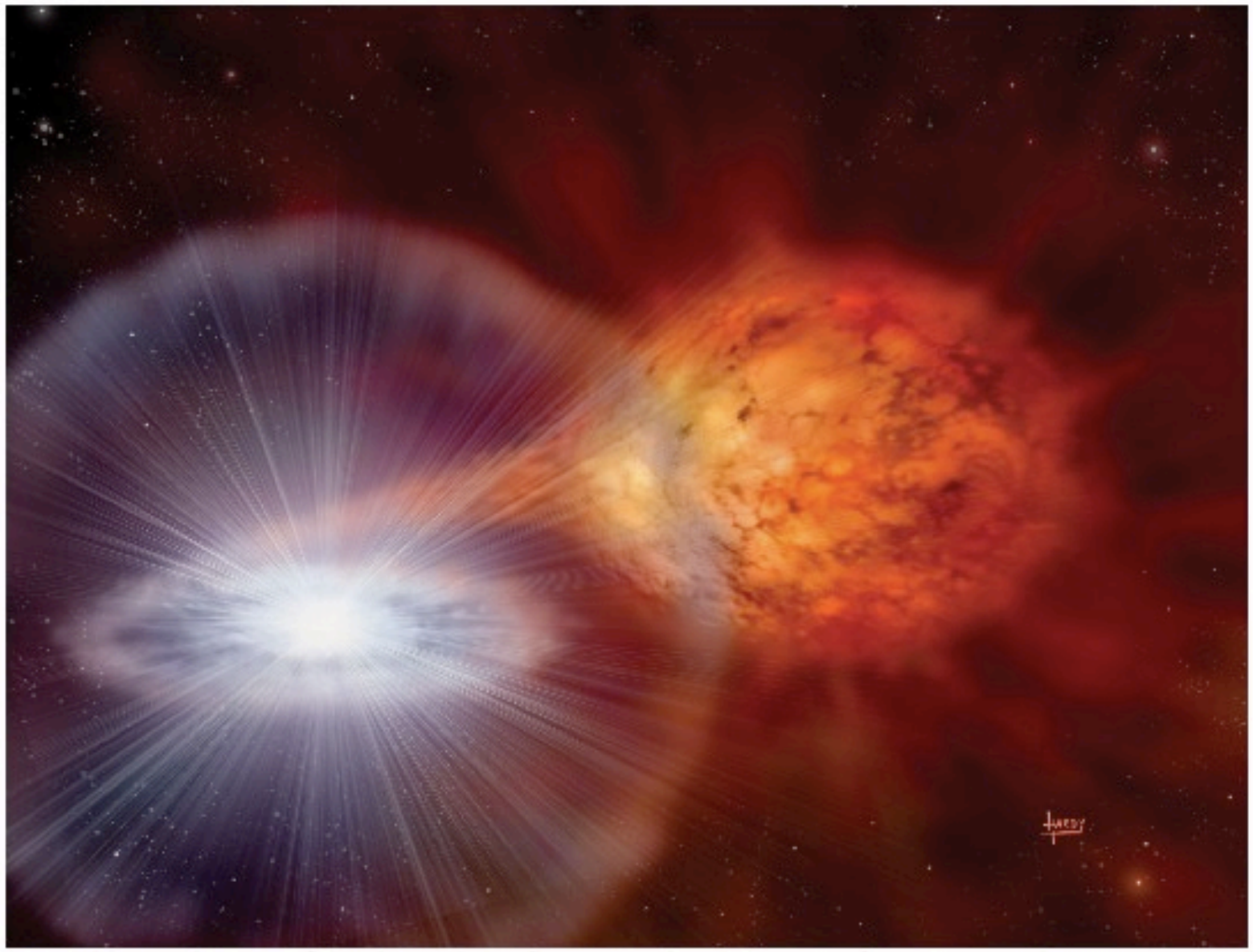


October 4th, 2011



Riess, Perlmutter, & Schmidt get 2011 Nobel in physics for discovery of expansion of universe & dark energy

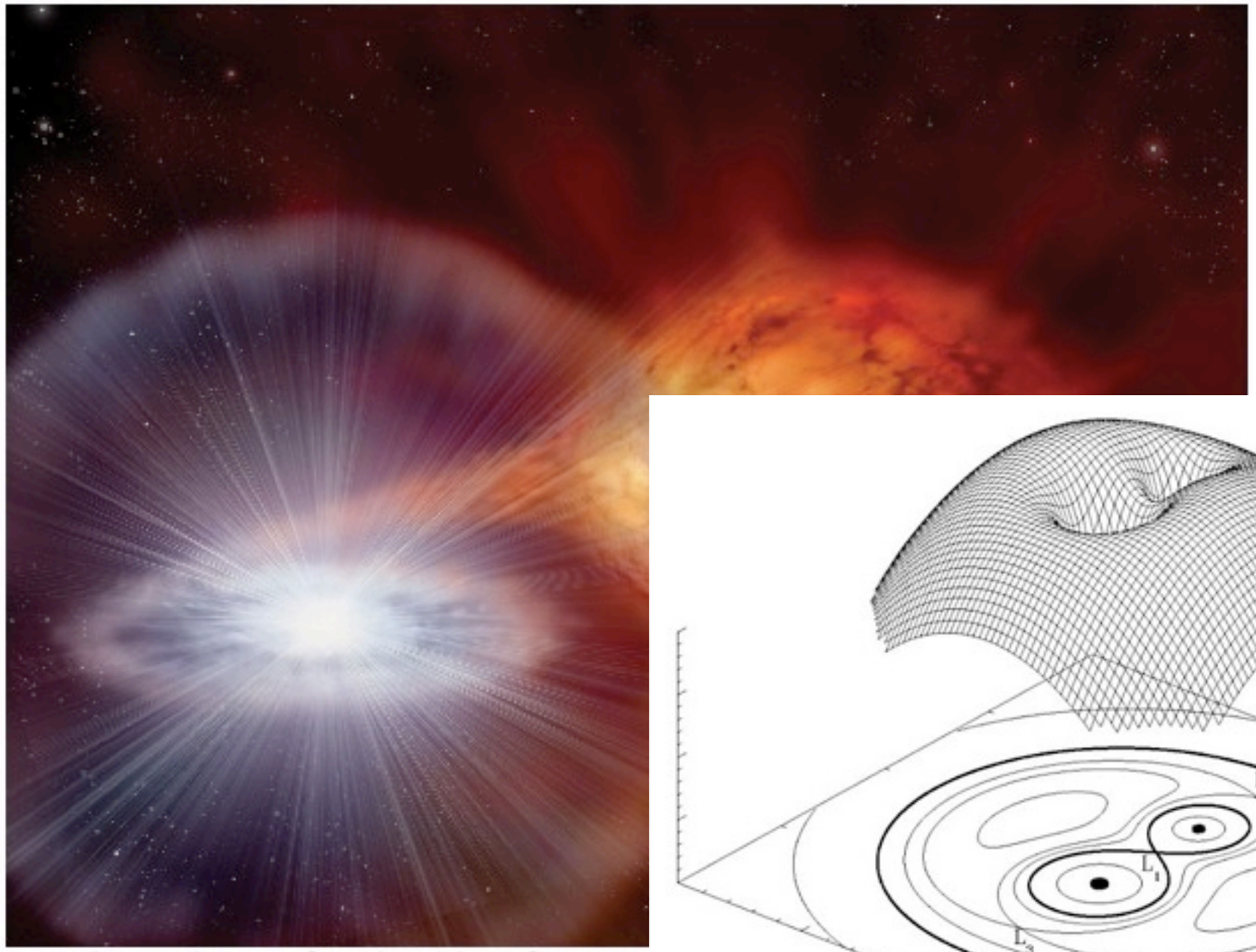
Type Ia supernova



Artist's rendition of a white dwarf accumulating mass from a nearby companion star. This type of progenitor system would be considered singly-degenerate.

Image courtesy of David A. Hardy, © David A. Hardy/www.astroart.org.

Type Ia supernova



Artist's rendition of a white dwarf accum
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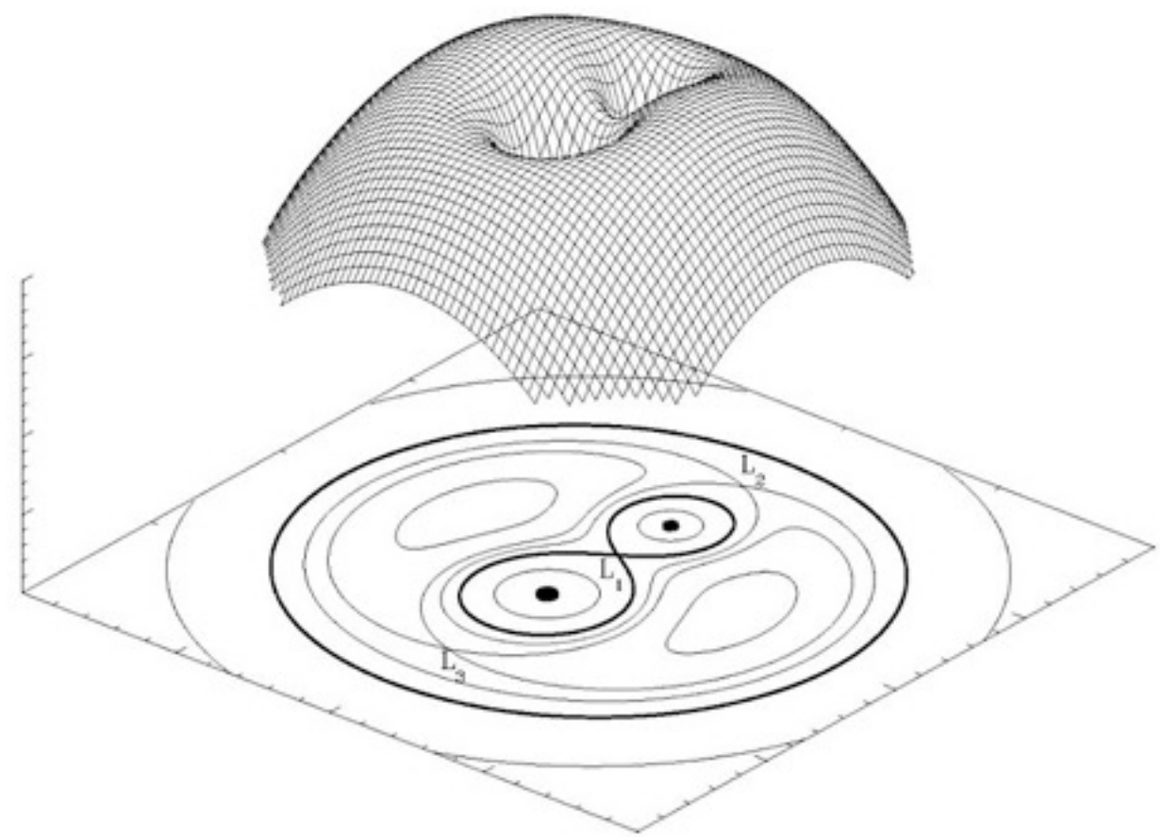
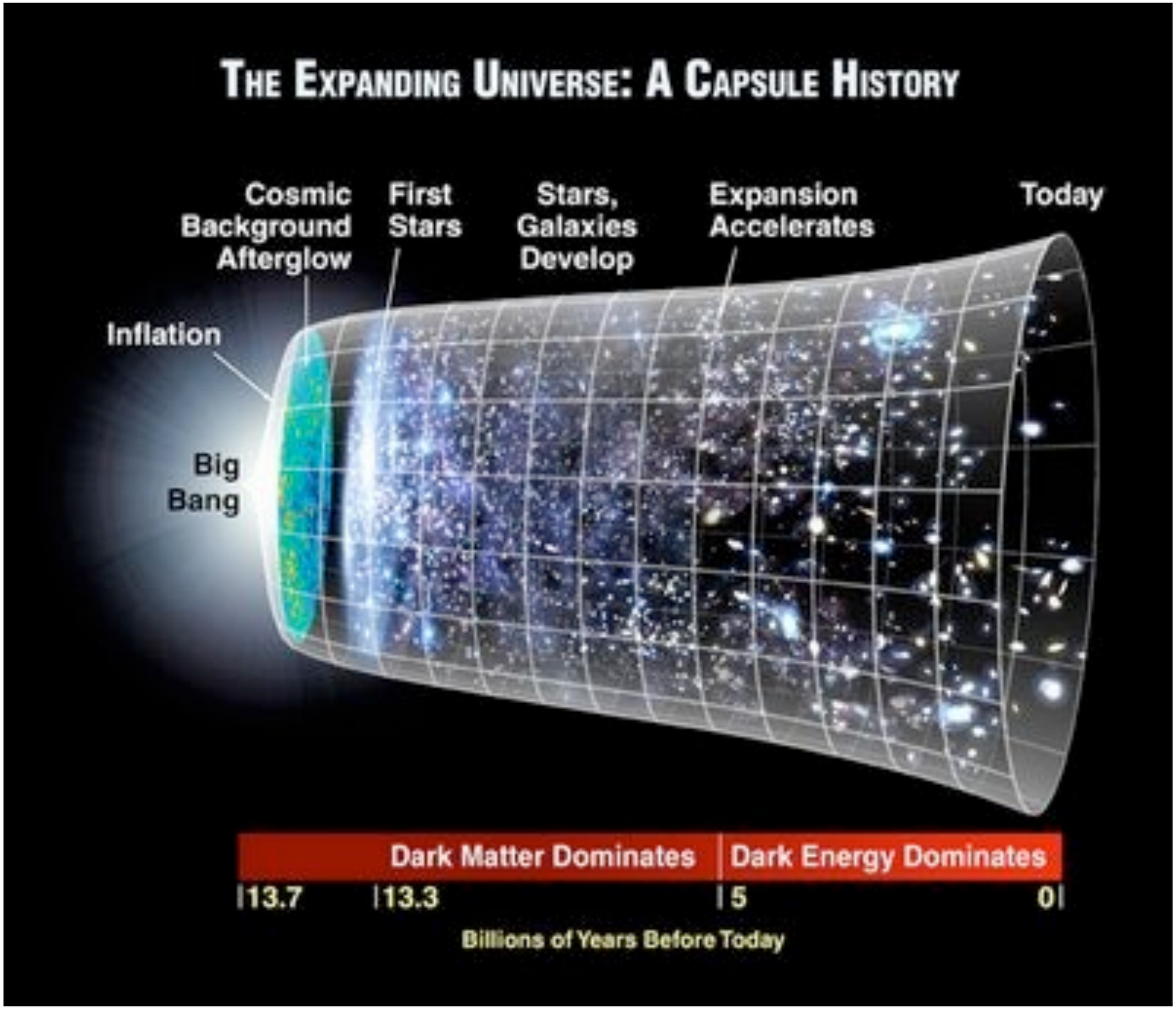
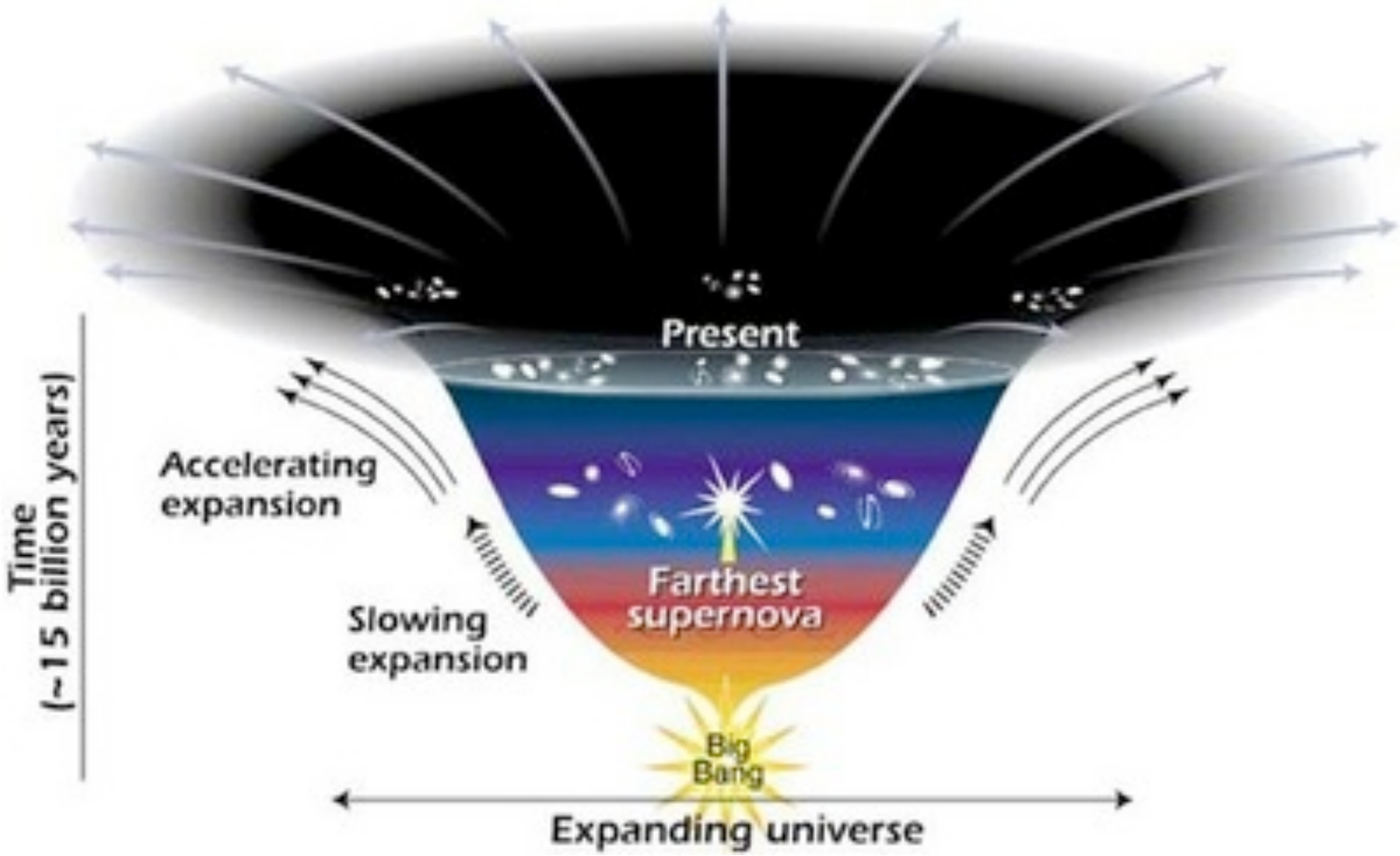


Image courtesy of David A. Hardy, © David A. Hardy/www.astroart.org.

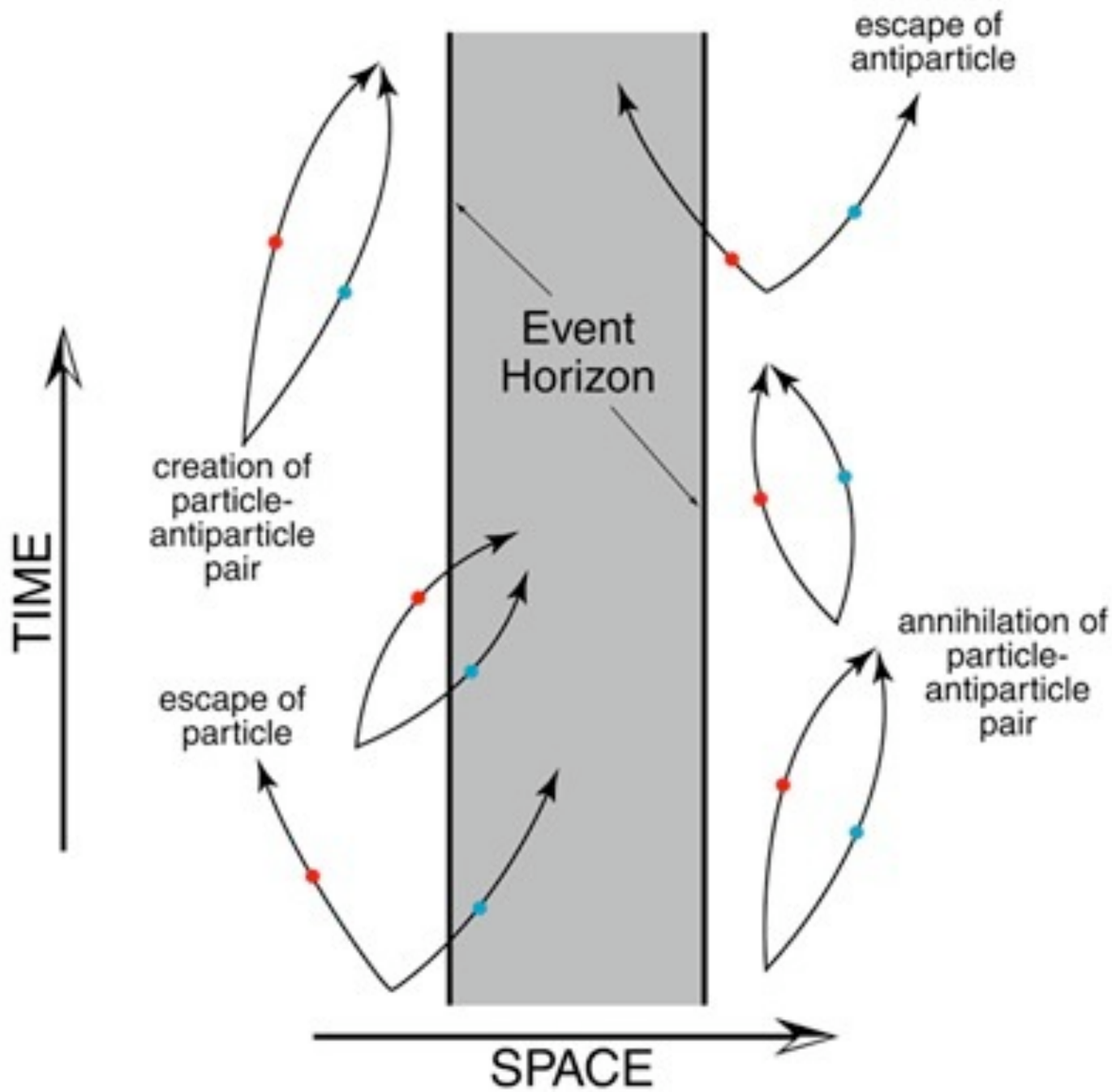
NASA / WMAP Science Team



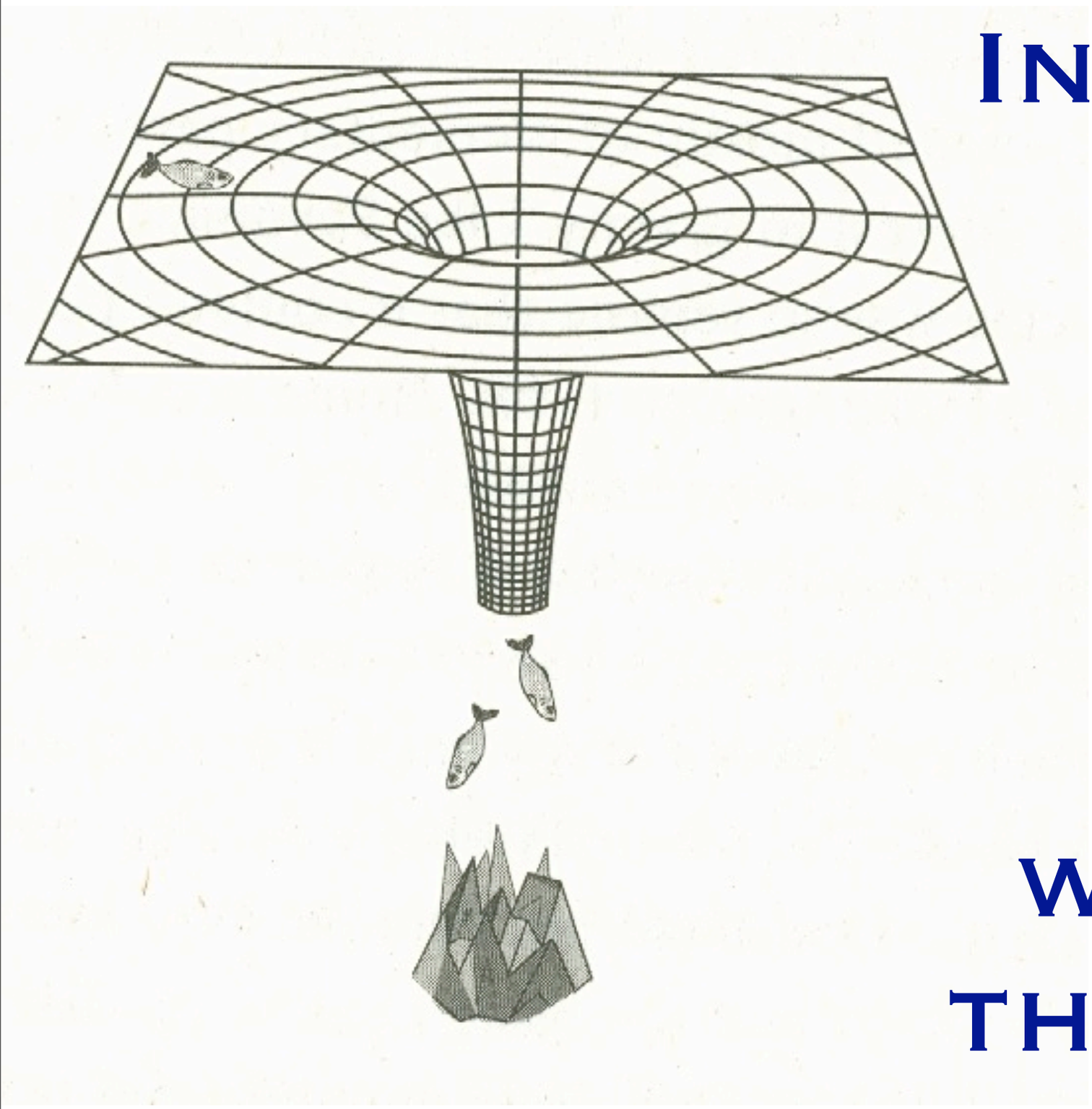
Dark energy


Present
Accelerating expansion
Time (~15 billion years)
Farthest supernova
Slowing expansion
Big Bang
Expanding universe

Hawking Radiation

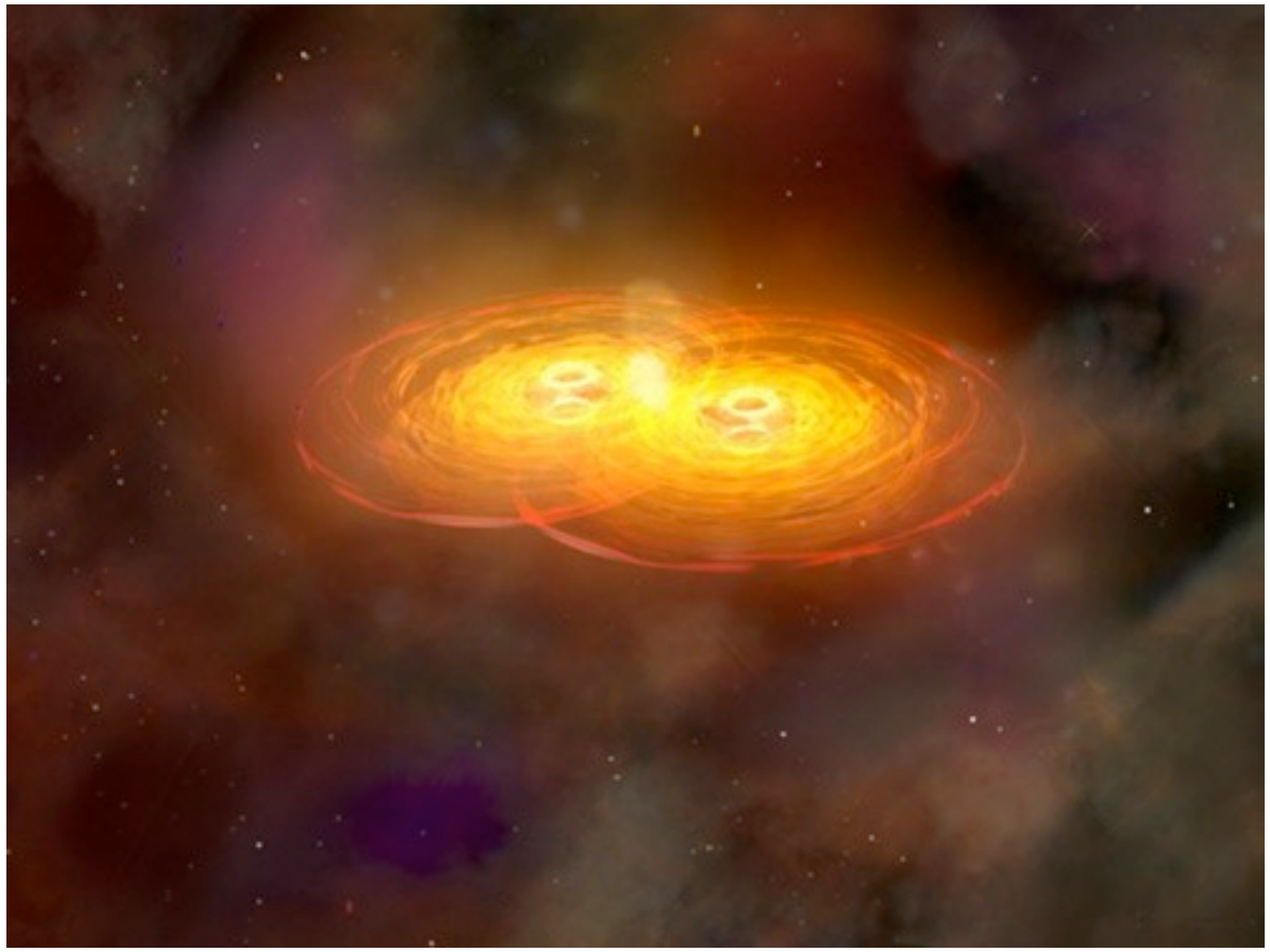


The black hole Information Paradox



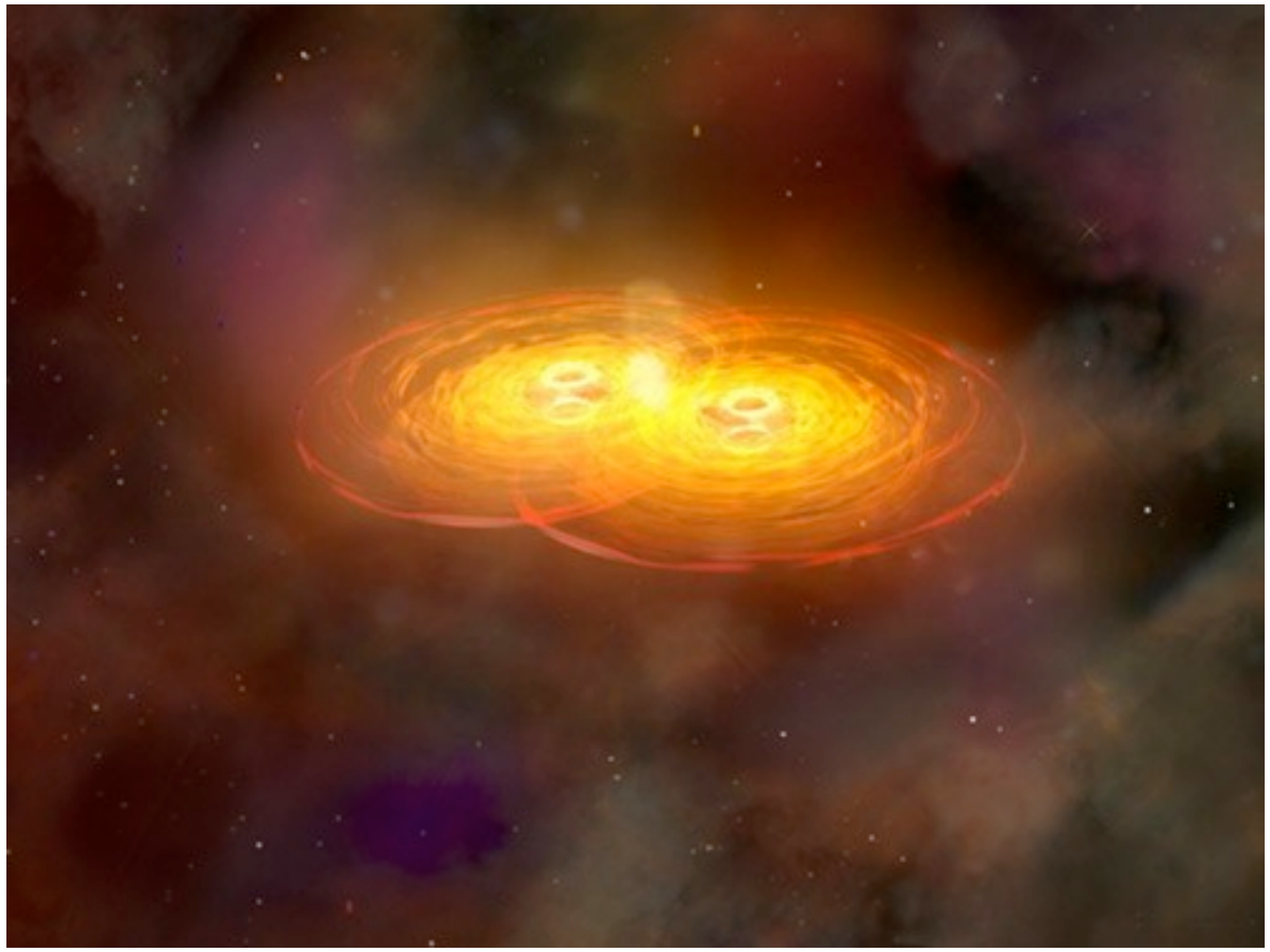
Or, where did the fish go?

Thermodynamics & gravity



Thermodynamics & gravity

- Surface gravity ~ Temperature



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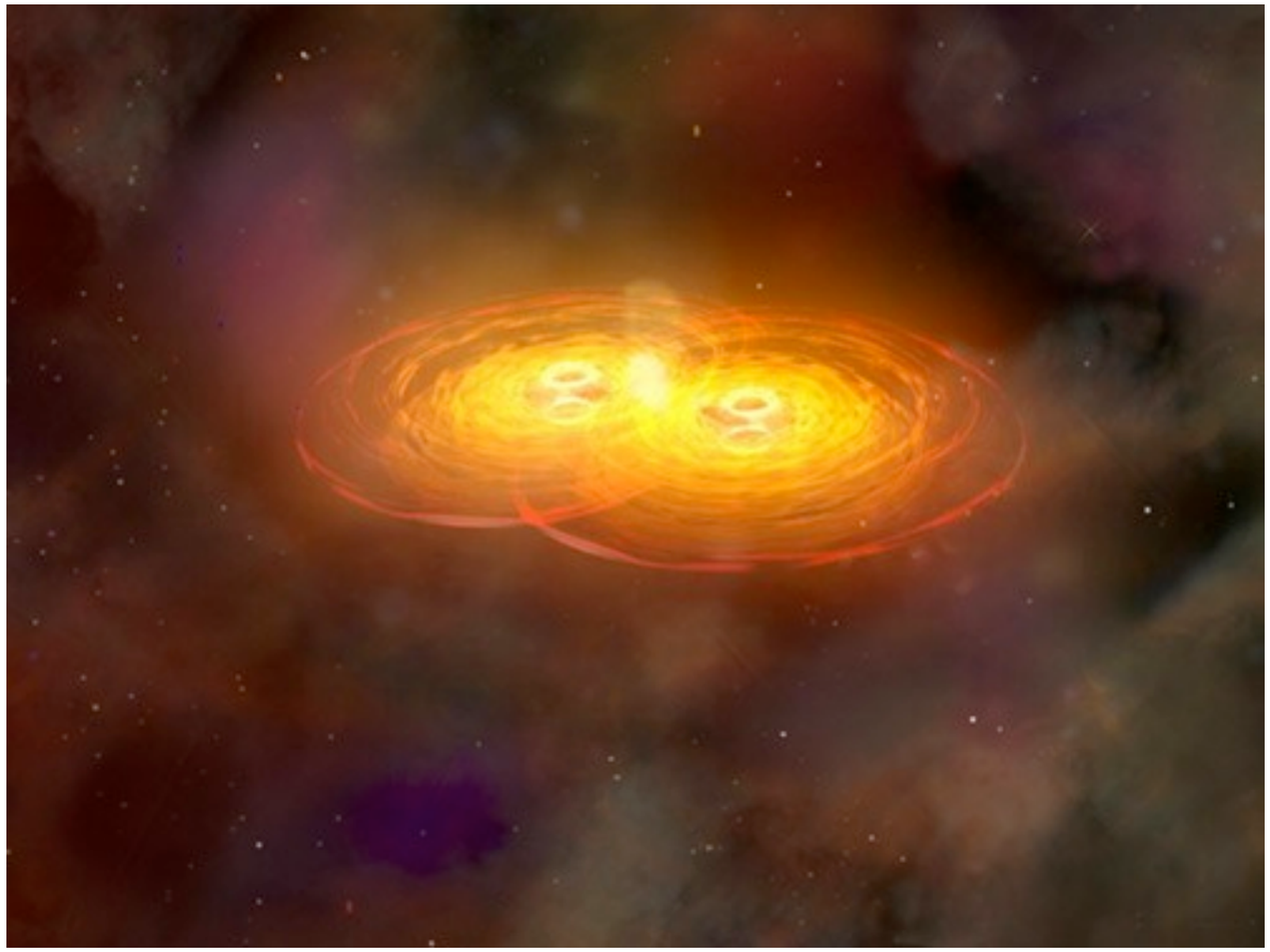

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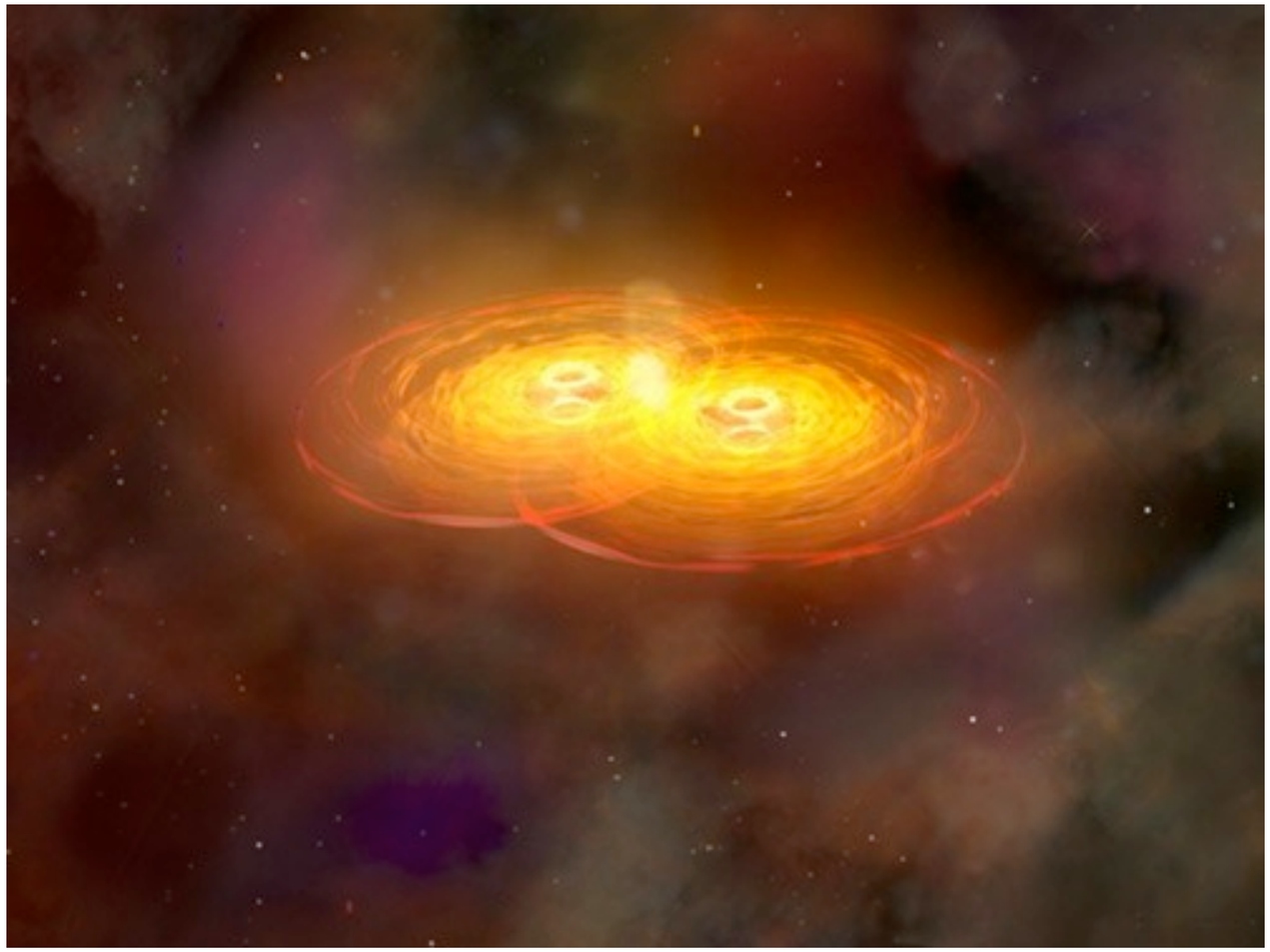

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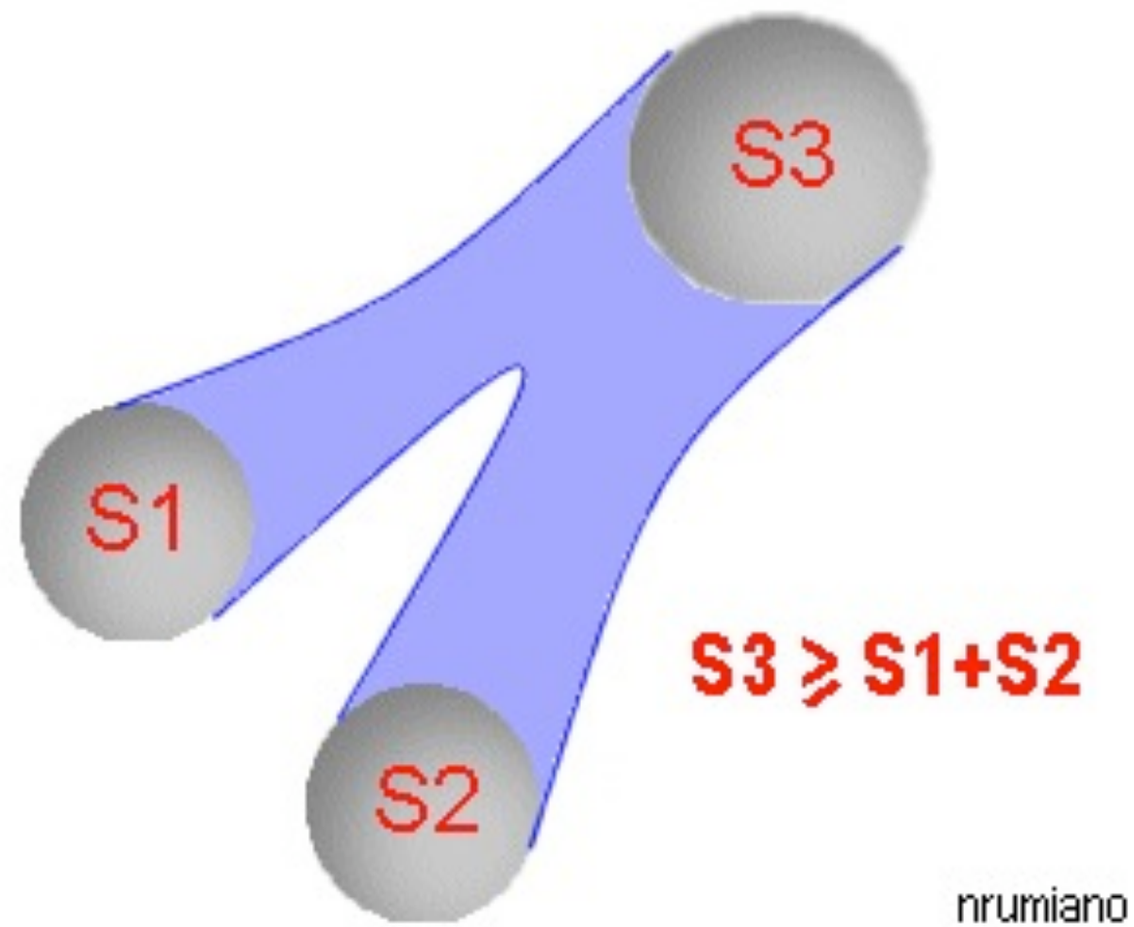
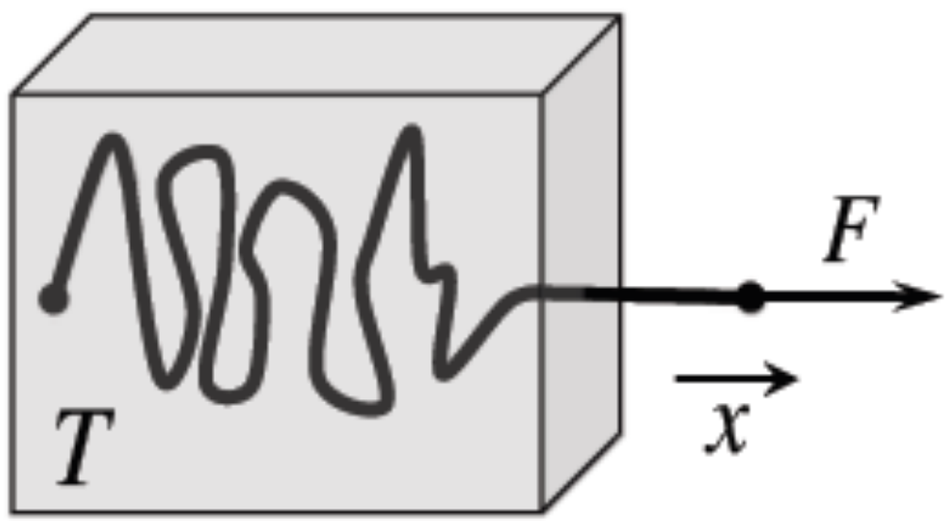


Verlinde's entropic gravity



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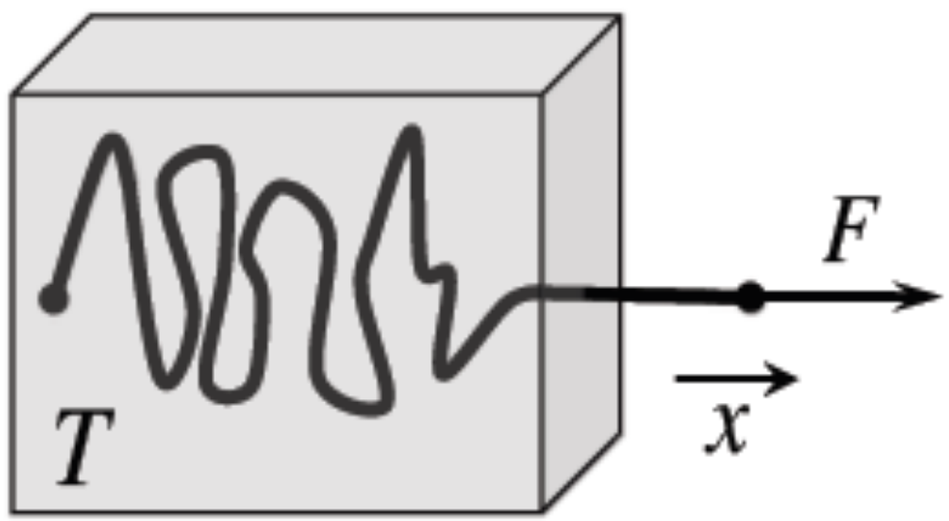

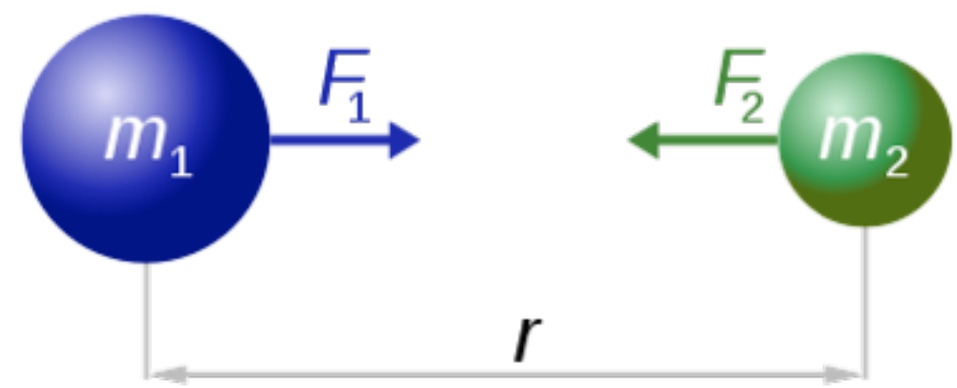

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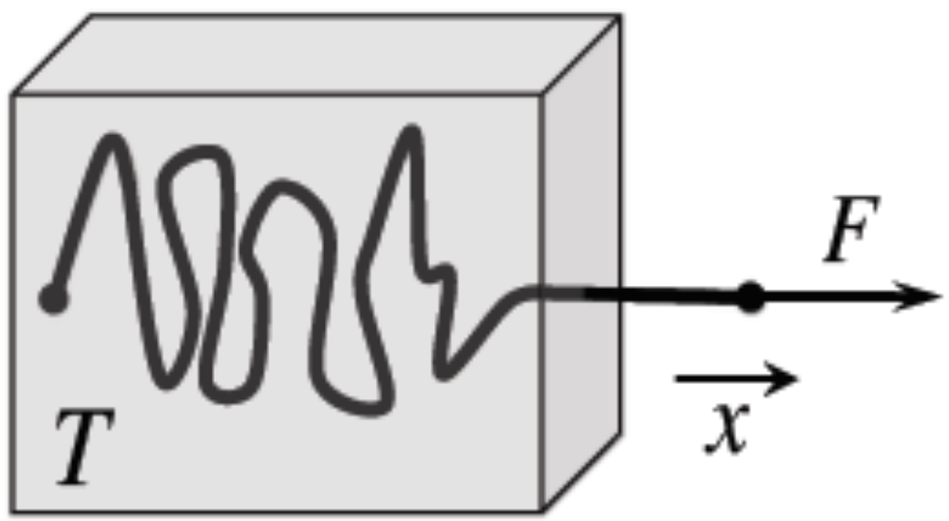

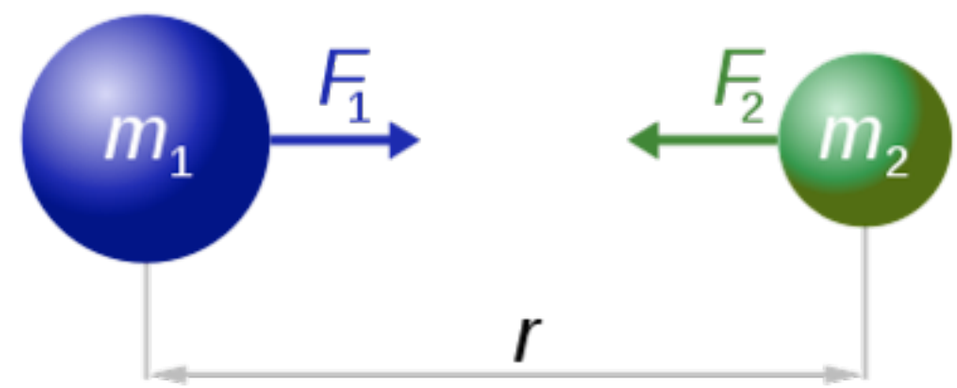

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FOR ME GRAVITY DOESN'T EXIST," — VERLINDE

Mass, energy, & momentum

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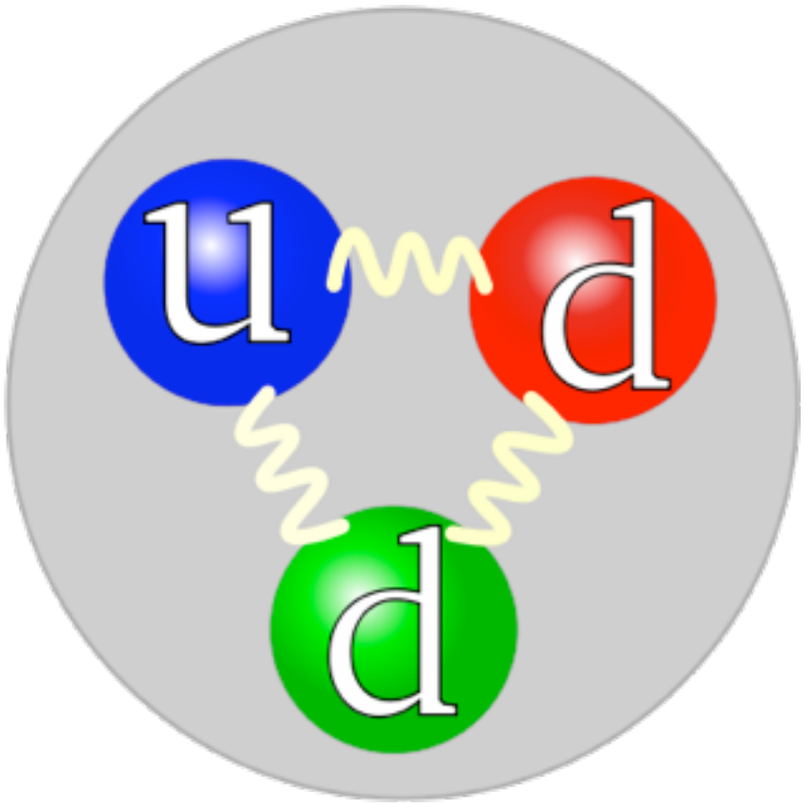
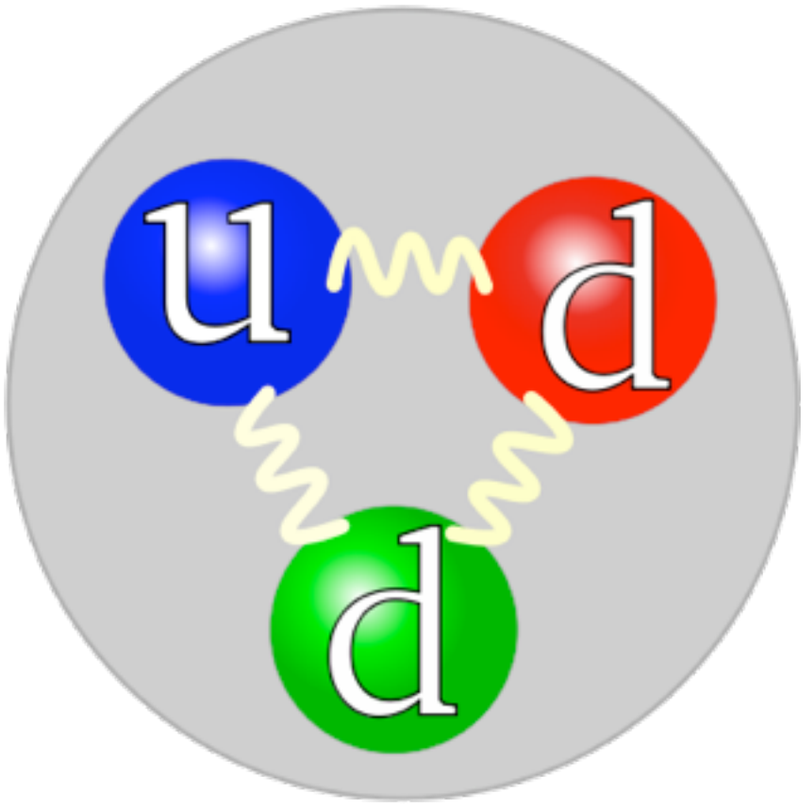
- Tachyons - faster than light, imaginary mass

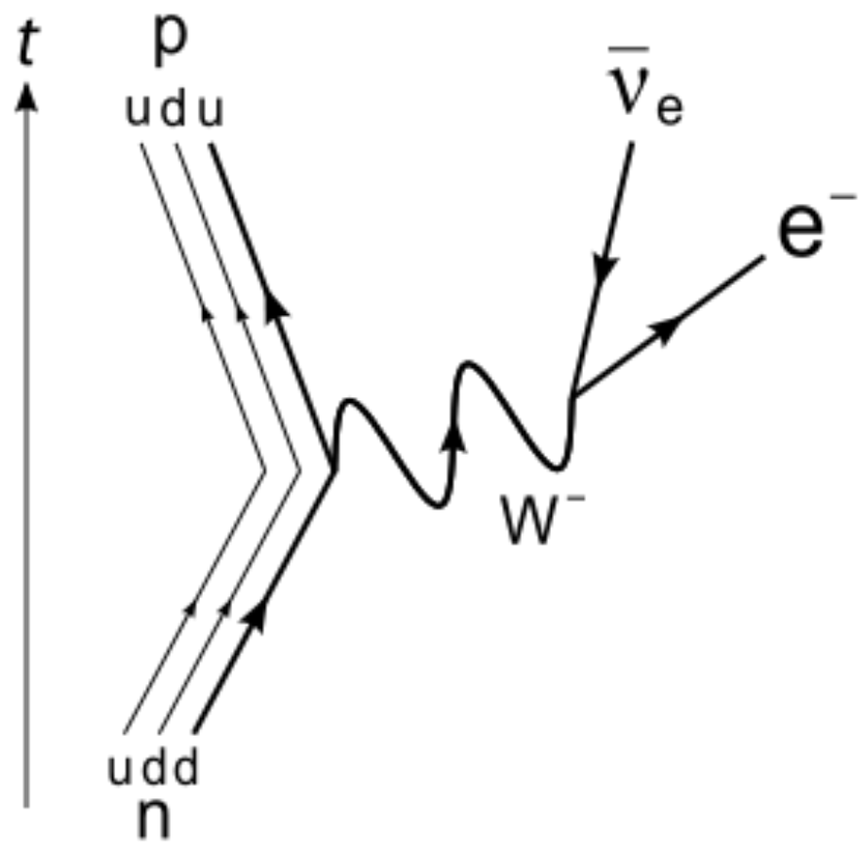
Little Neutral Ones



NEUTRON

Little Neutral Ones

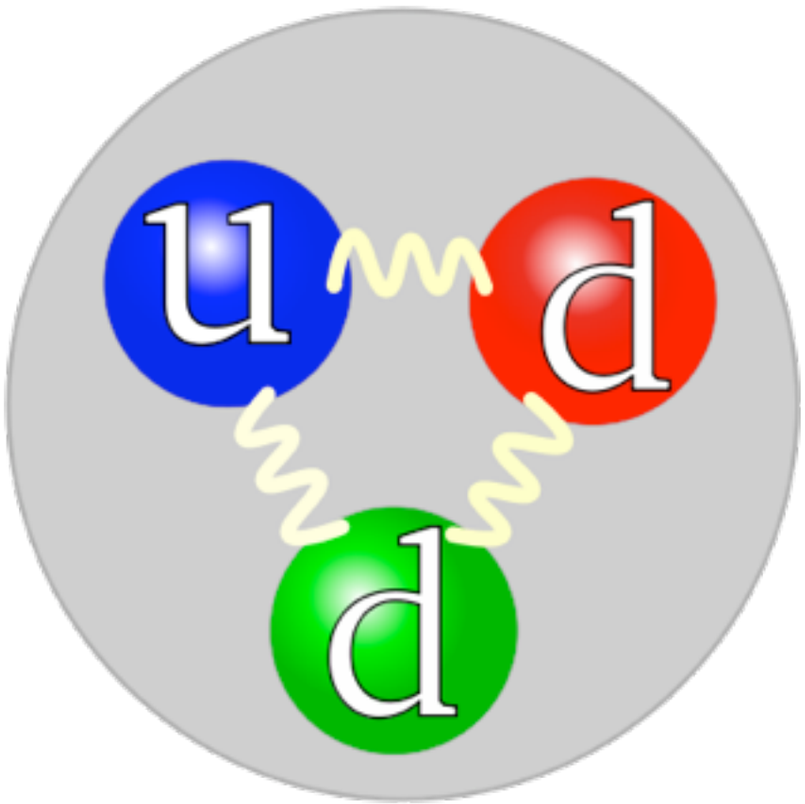


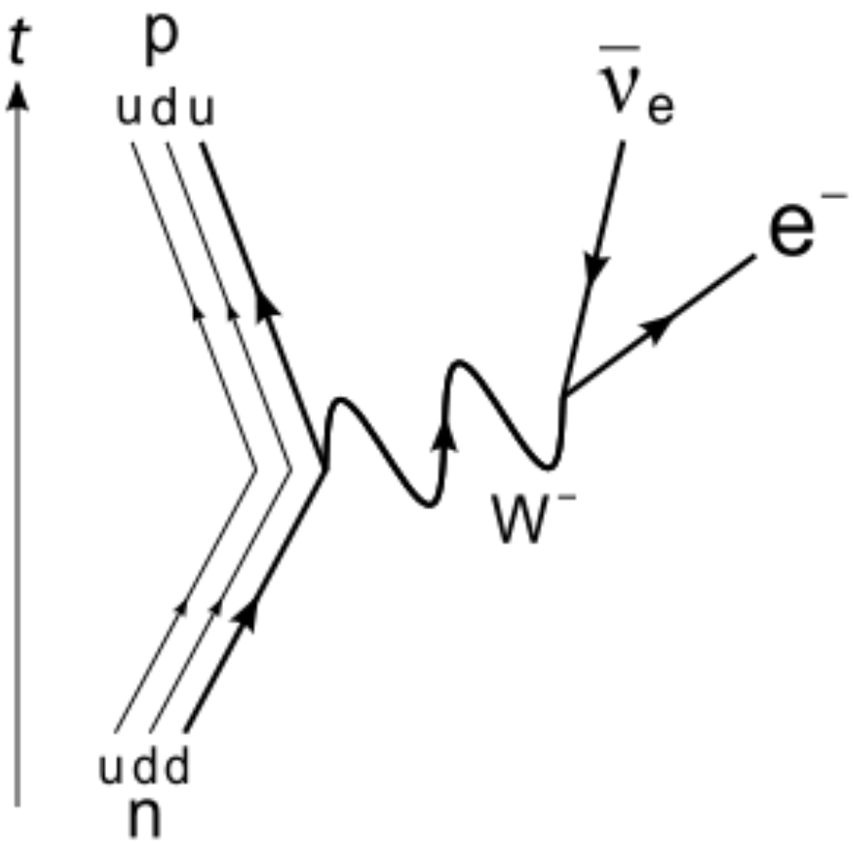


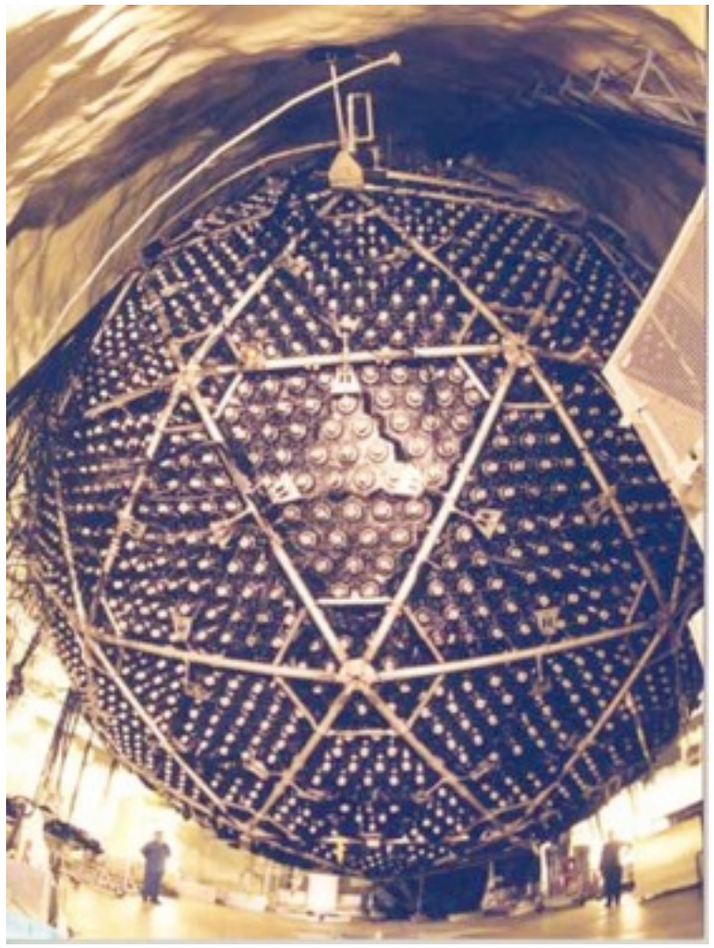
Neutron

Neutron Decay

Little Neutral Ones







Neutron

Neutron Decay

Sudbery Neutrino Detector

SUPERLUMINAL NEUTRINOS?

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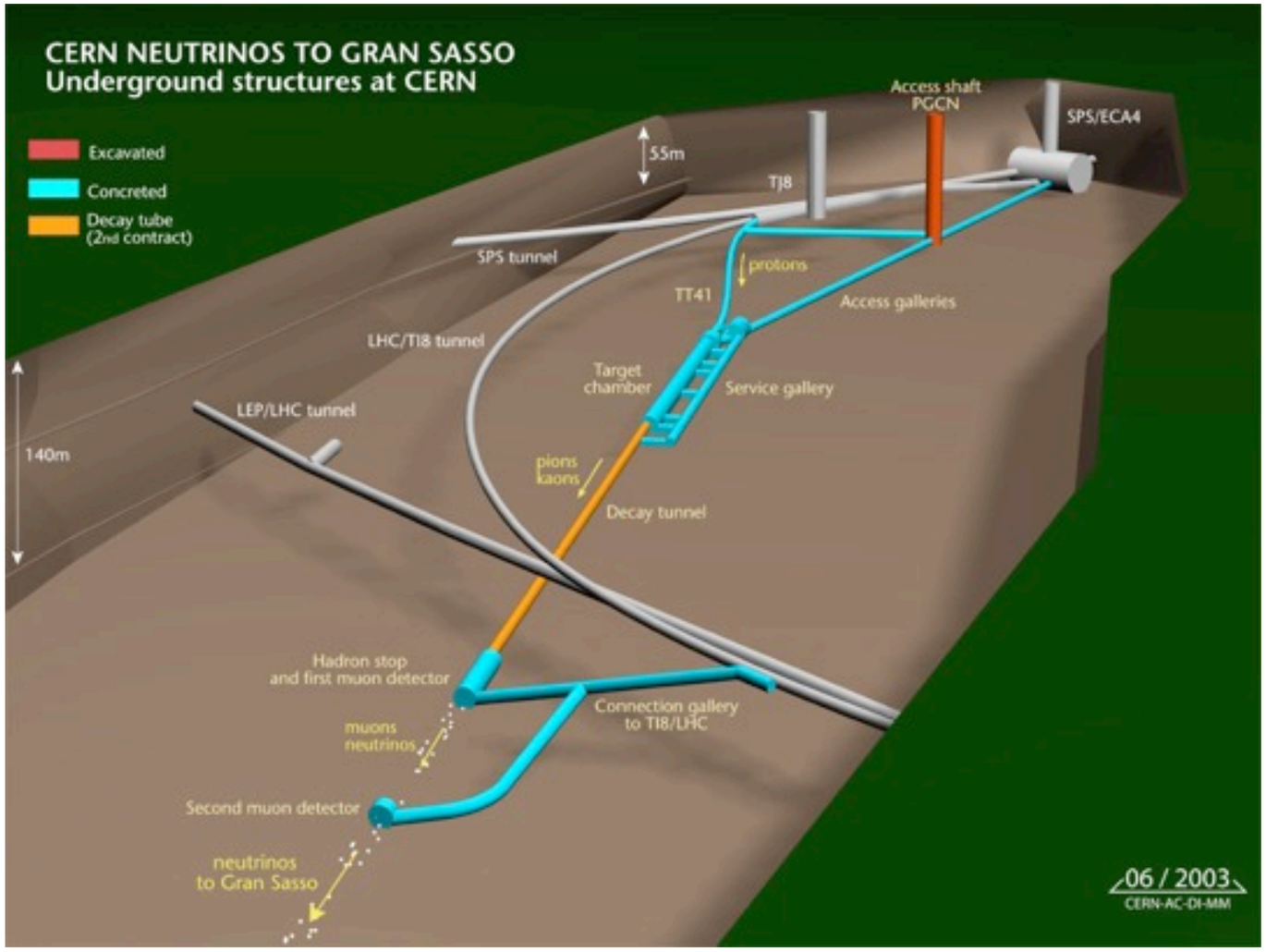

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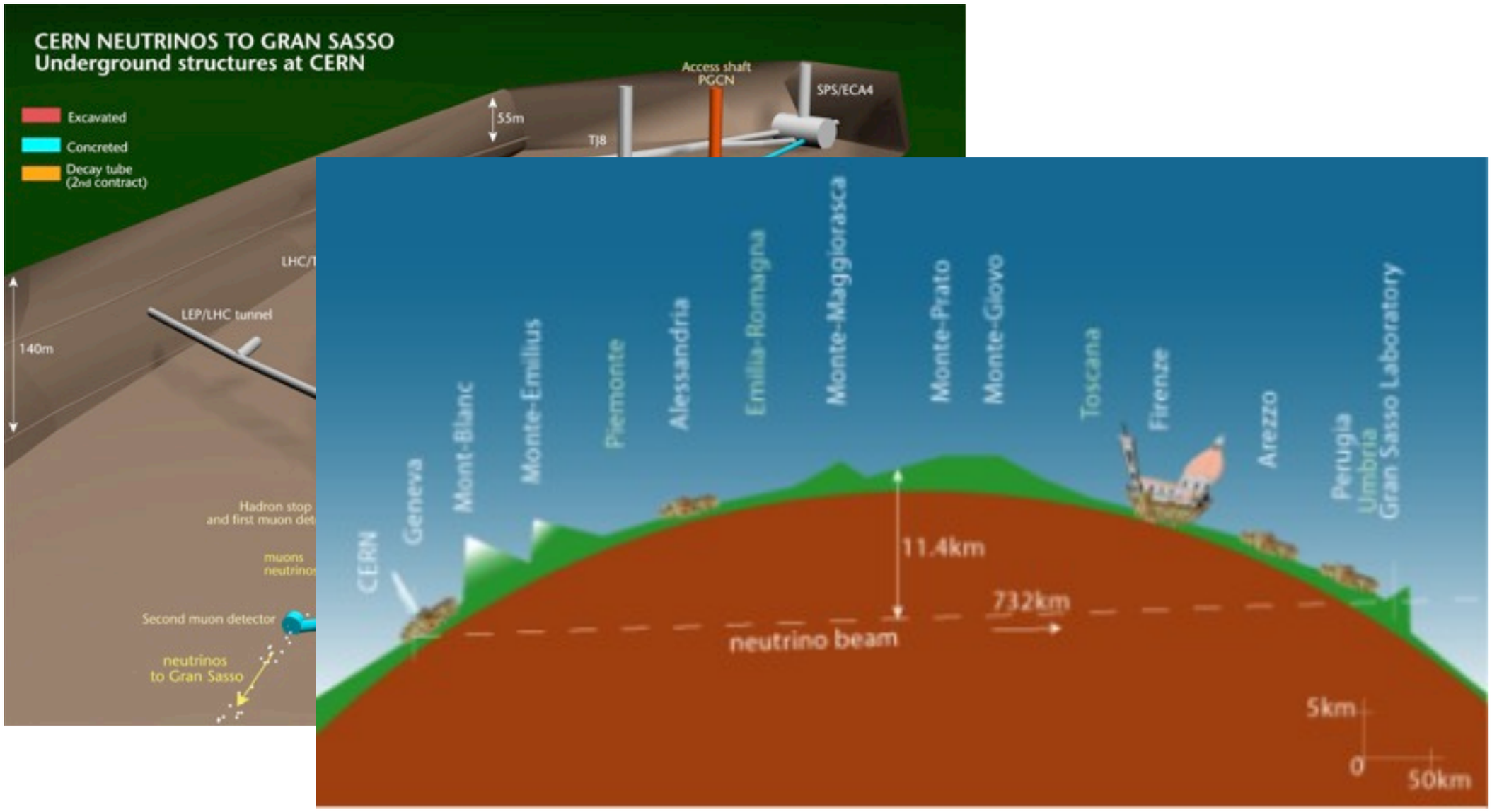

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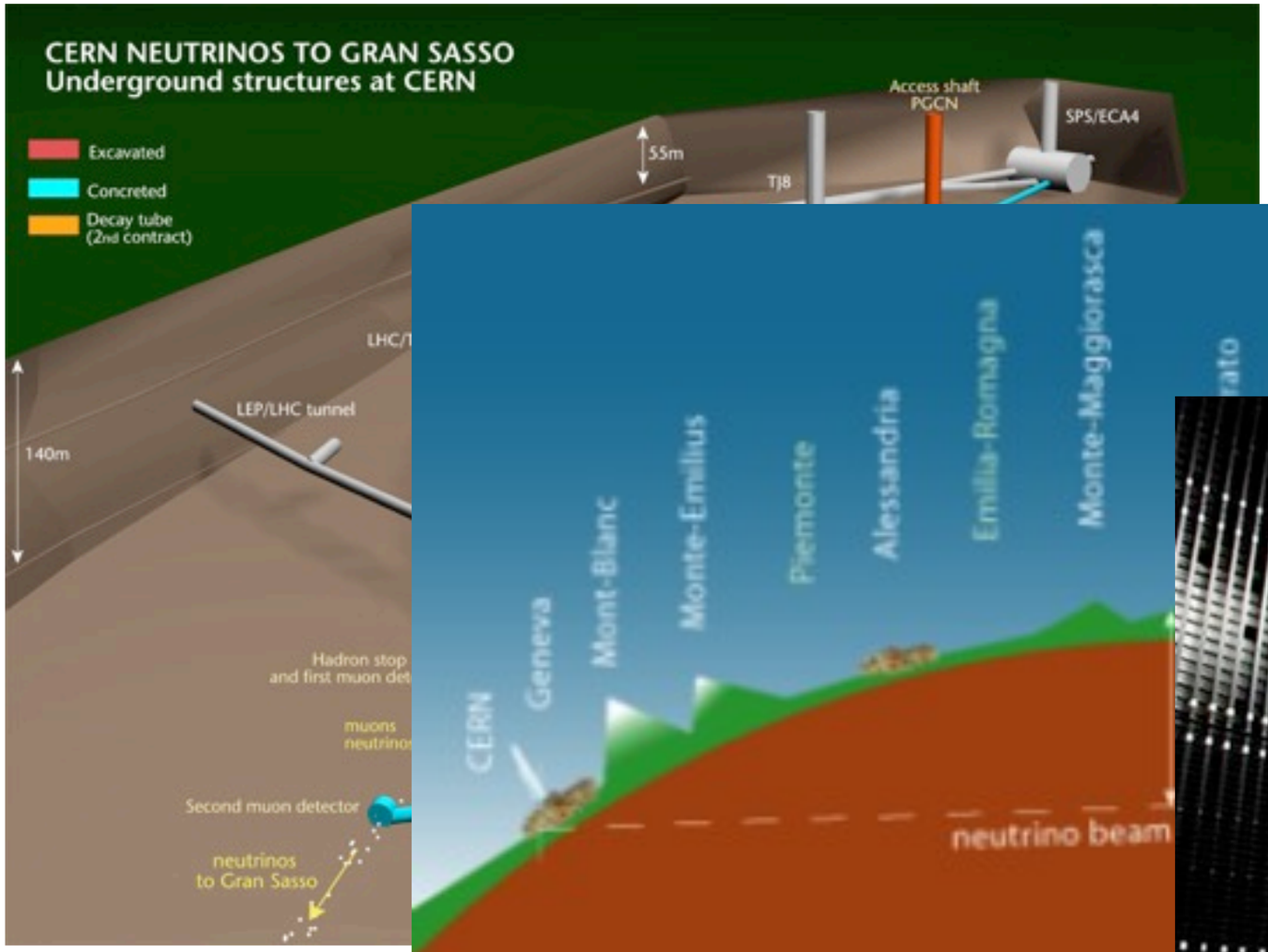

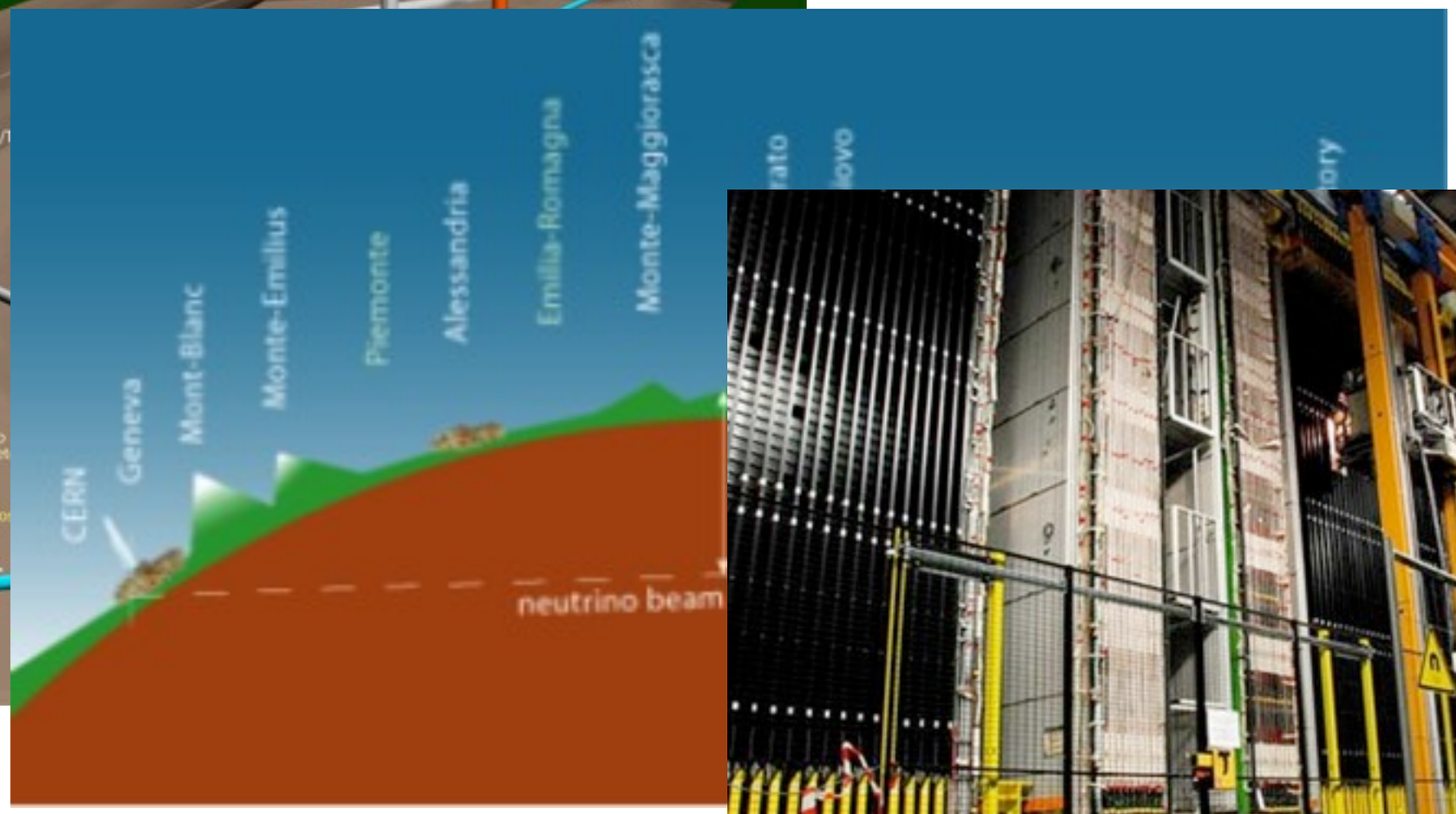

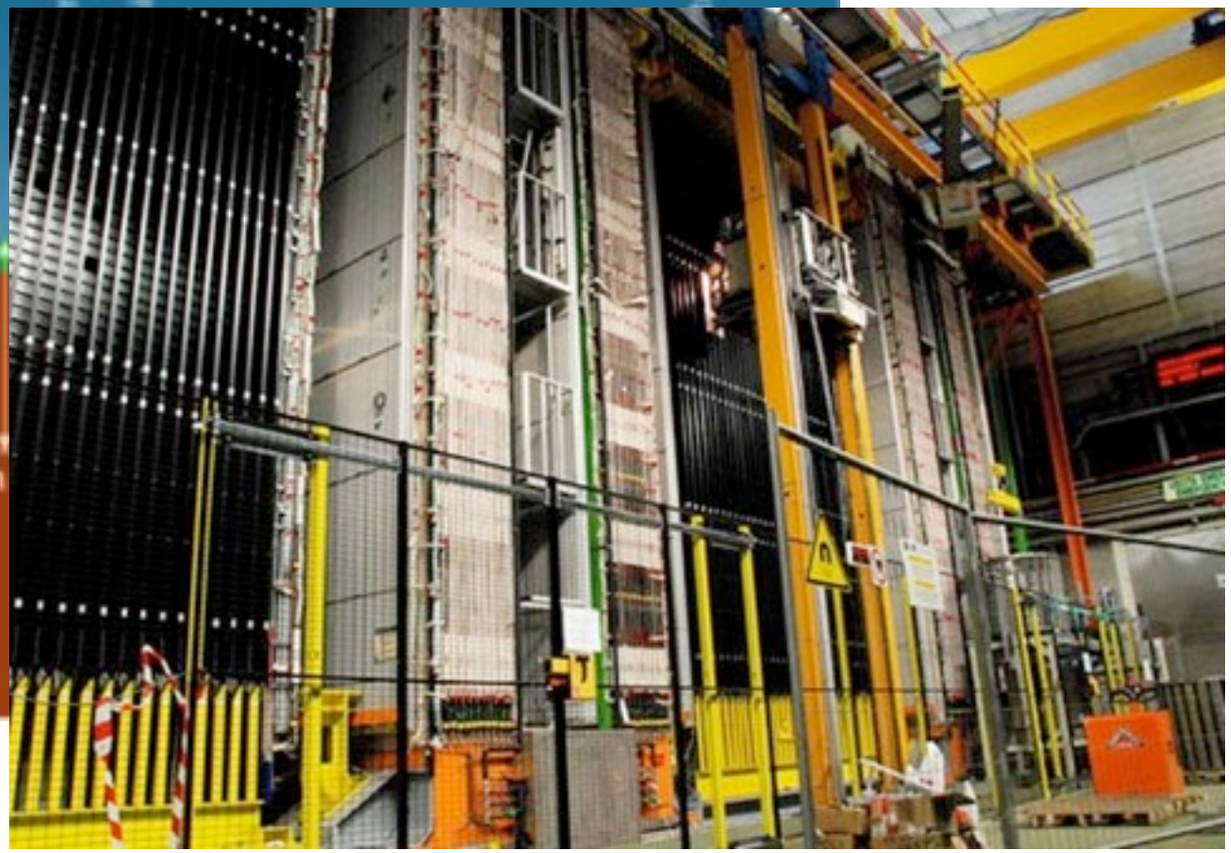

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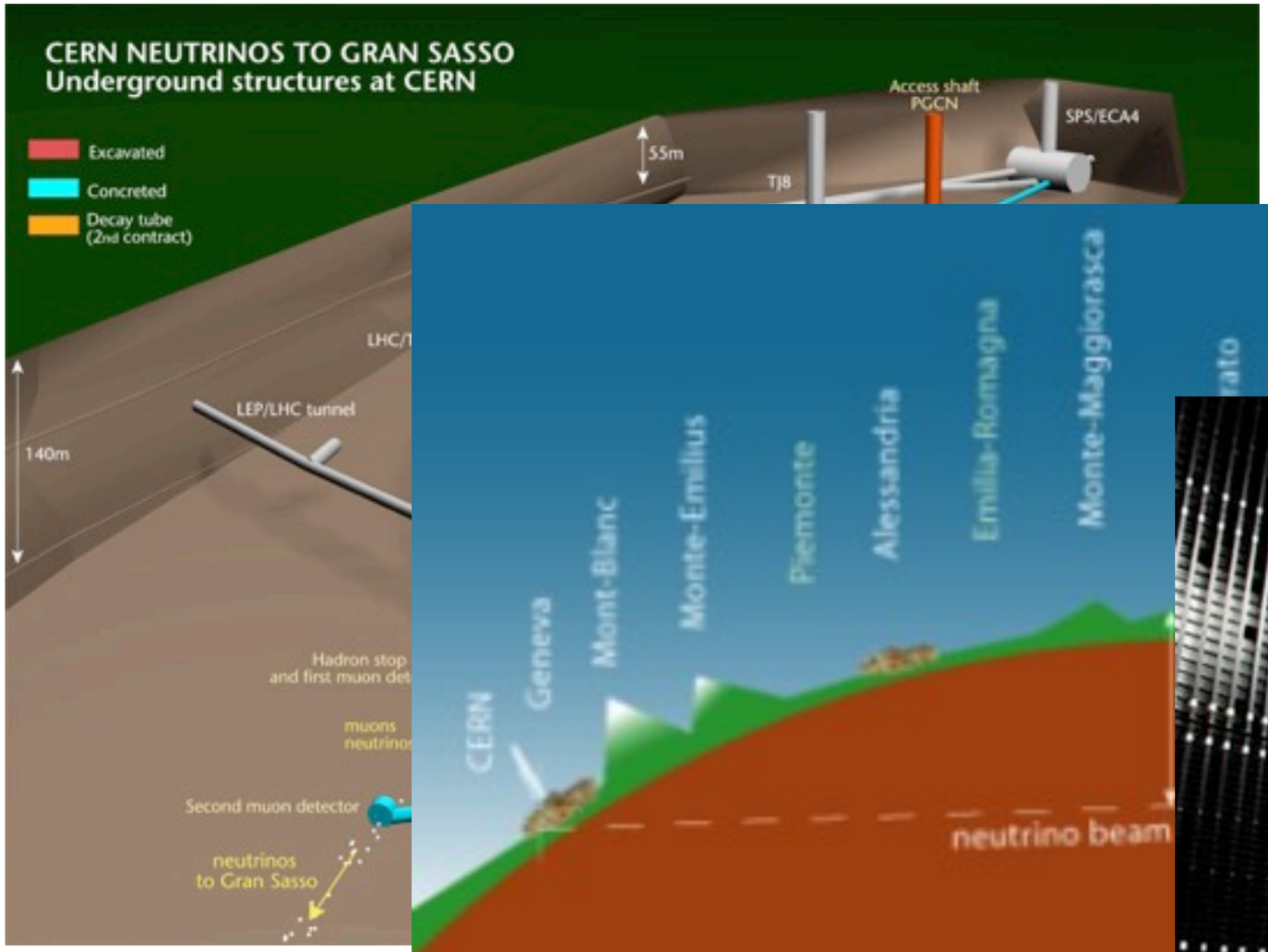
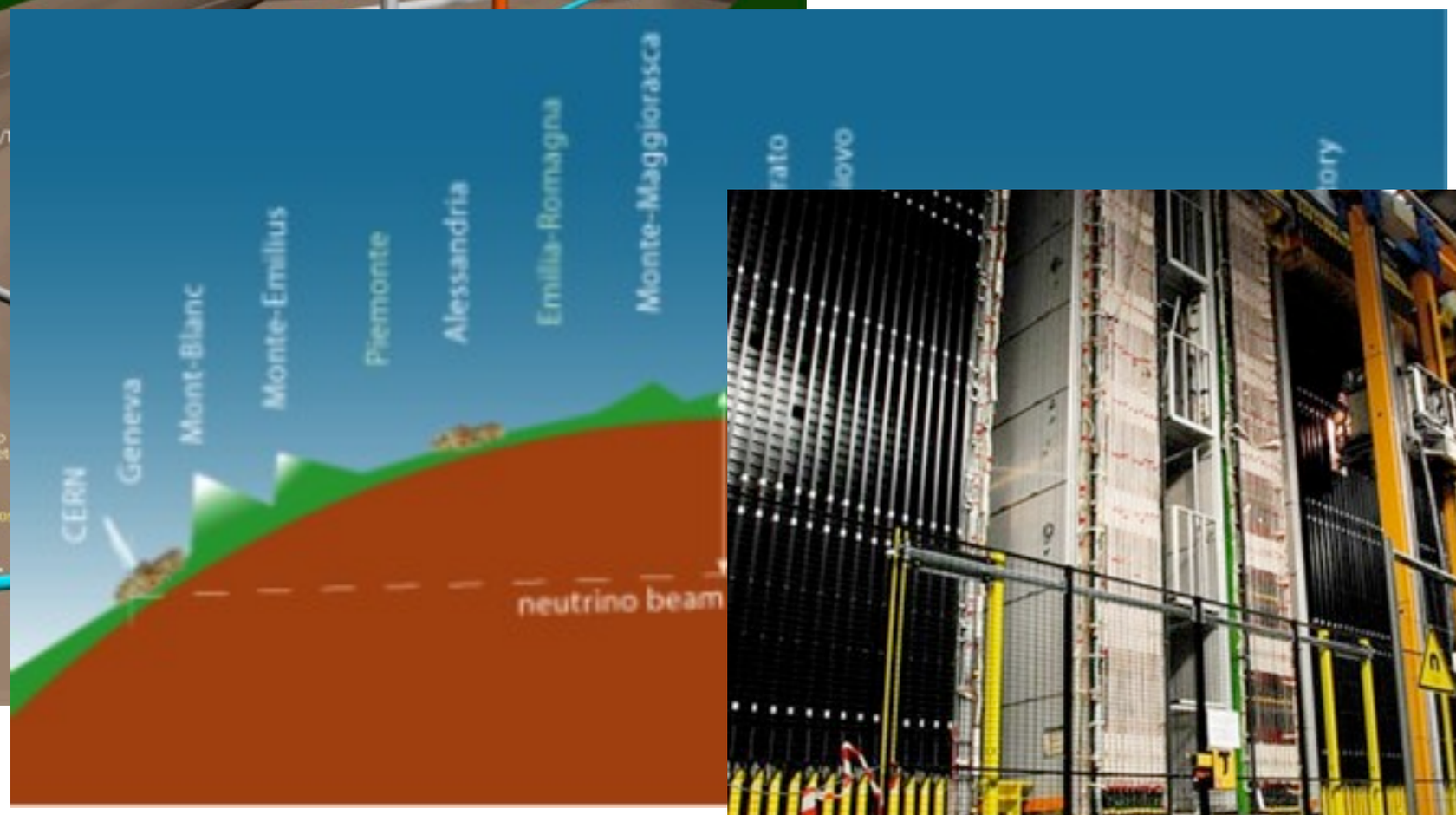
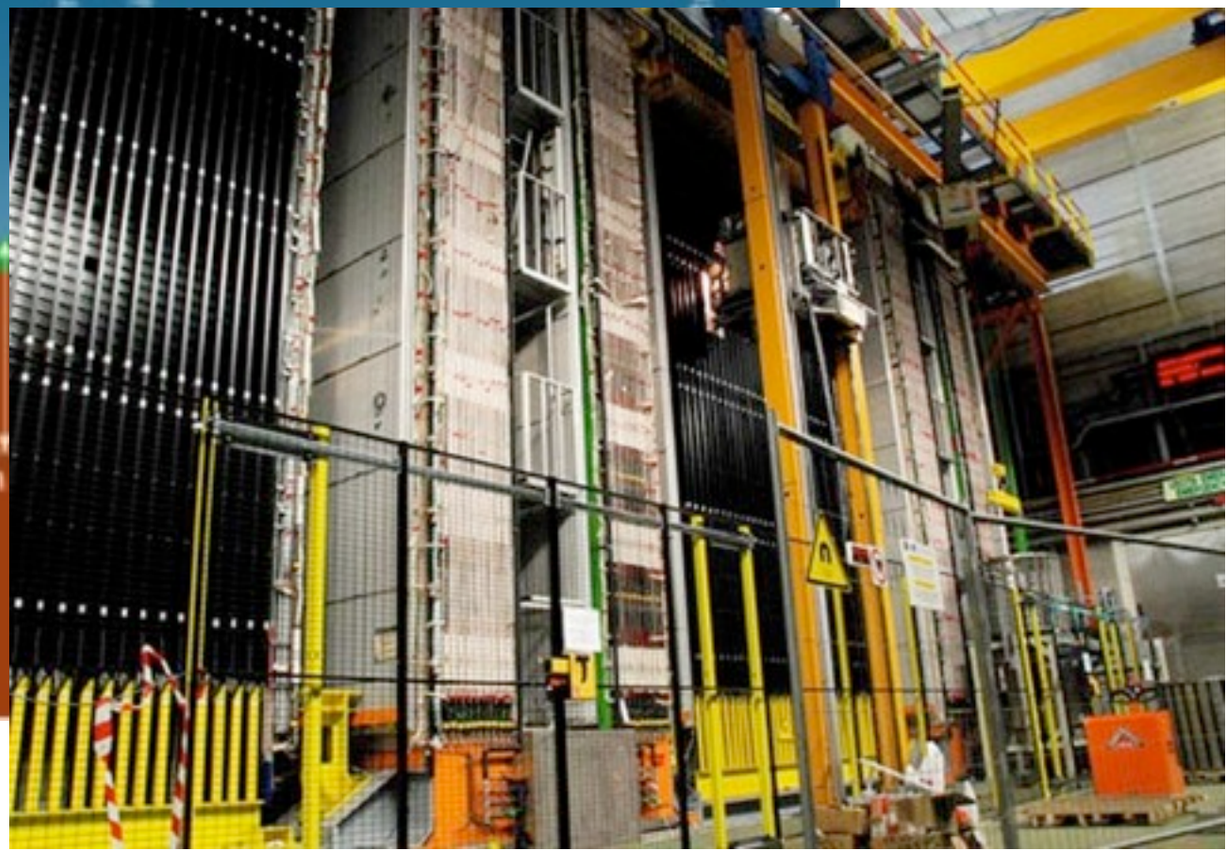
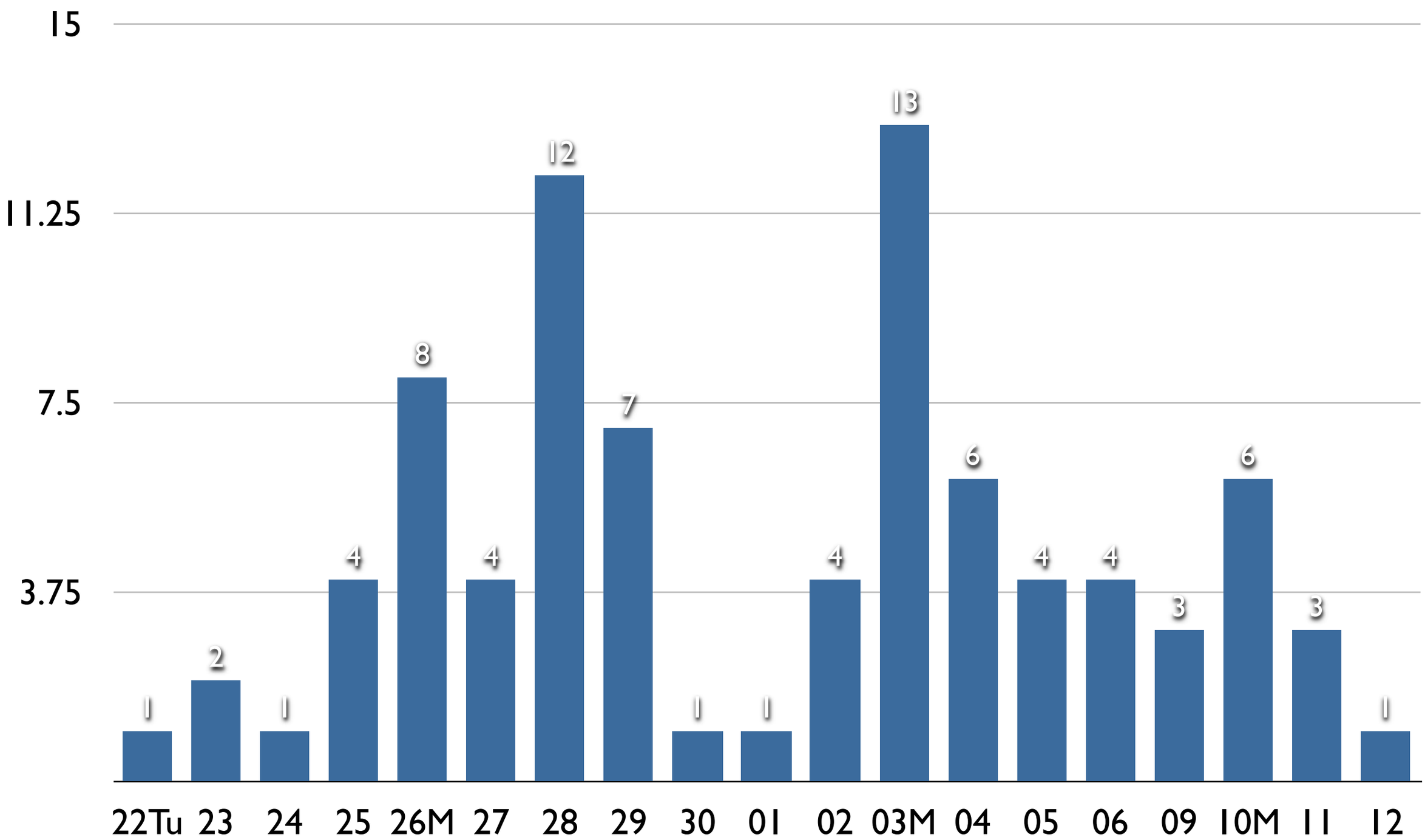




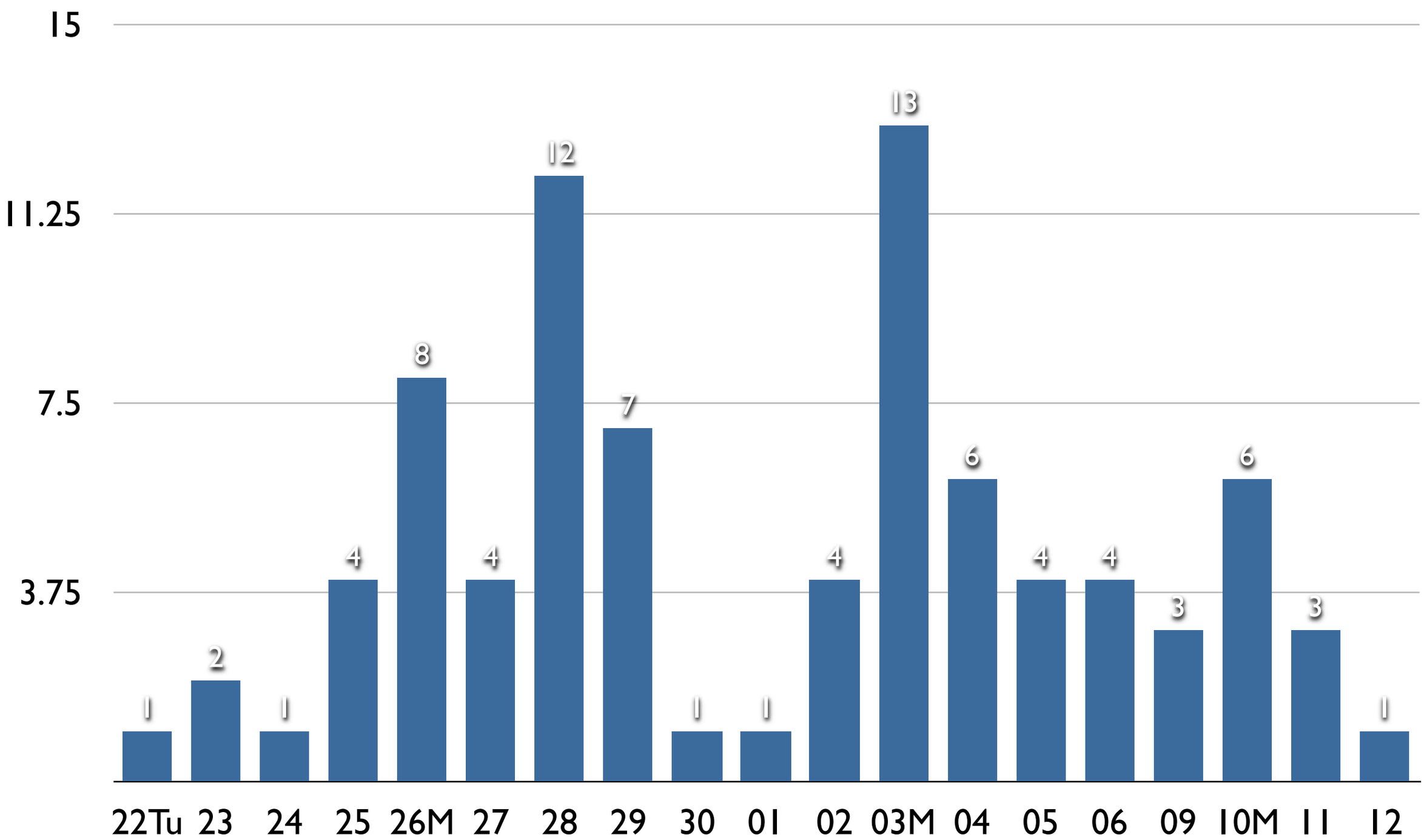


Baseline of 730 kilometers, arrival too early by 60 nanoseconds: speed of neutrinos is 2.48 10^{-5} c too fast

85 papers as of 10/12



126 papers as of 11/18



126 papers as of 11/18

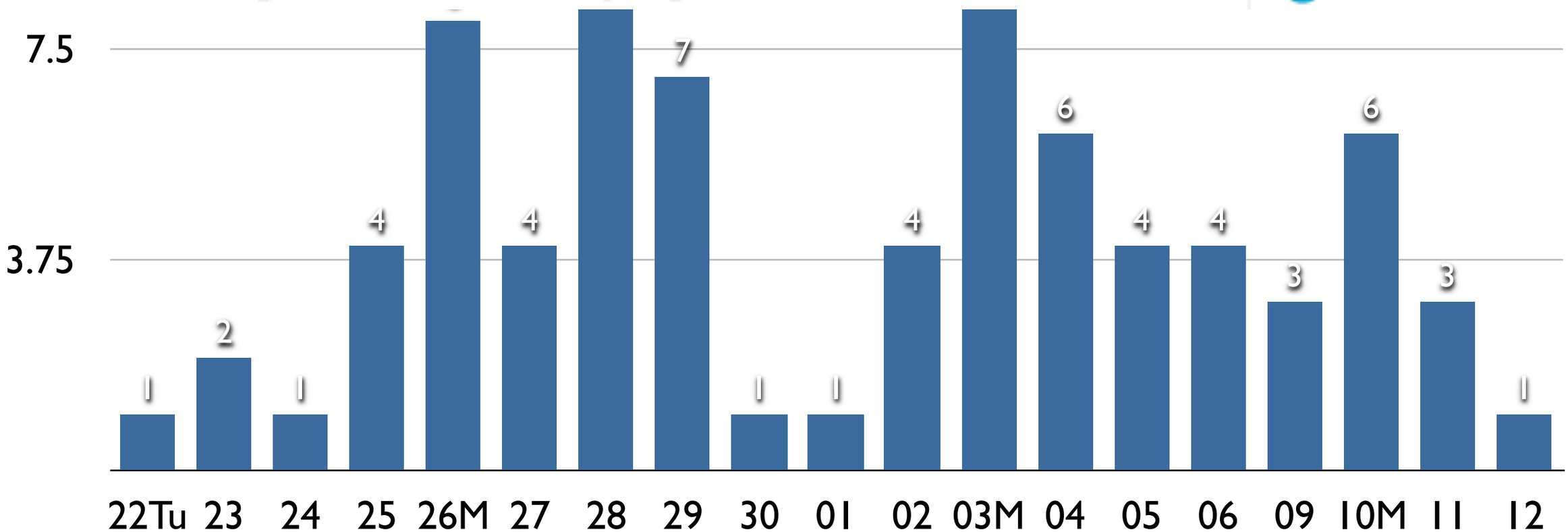
Scientists Report Second Sighting of Faster-Than-Light Neutrinos

By DENNIS OVERBYE
Published: November 18, 2011

Few scientists are betting against Einstein yet, but the phantom neutrinos of Opera are still eluding explanation.

RECOMMEND

TWITTER



A disputation Of Ideas

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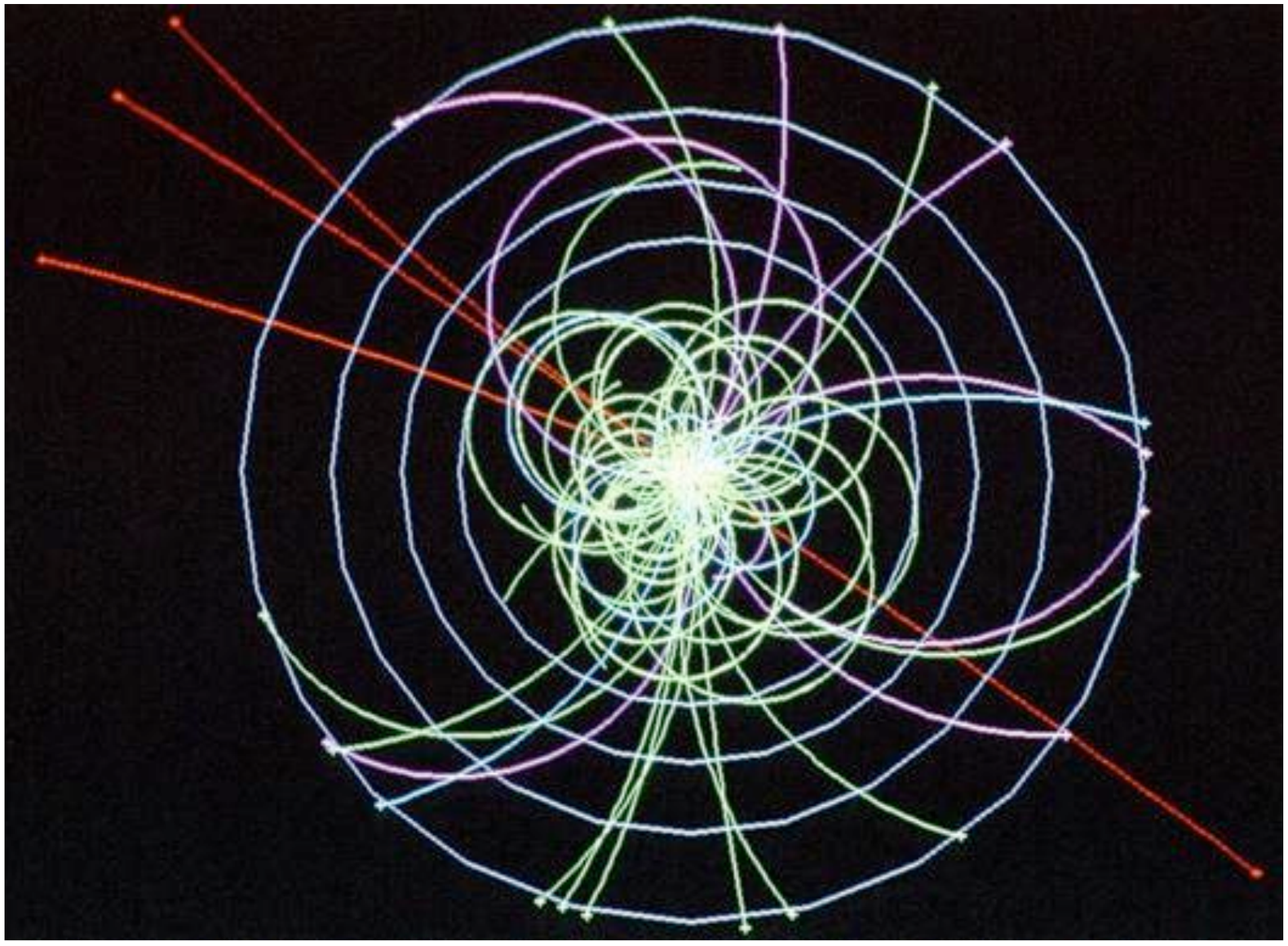
- Clear evidence for pet theory x

Non-barking Higgs



If a Higgs particle is produced in a proton-proton collision, an LHC detector might infer what you see here. The four straight red lines indicate very high-energy particles (muons) that are the remnants of the disintegrating Higgs.

How will it fall out?

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- Higgs has fewer & fewer places to hide

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