The future is already here—it's just not very evenly distributed

– William Gibson

PHYS 107: Physics Concepts

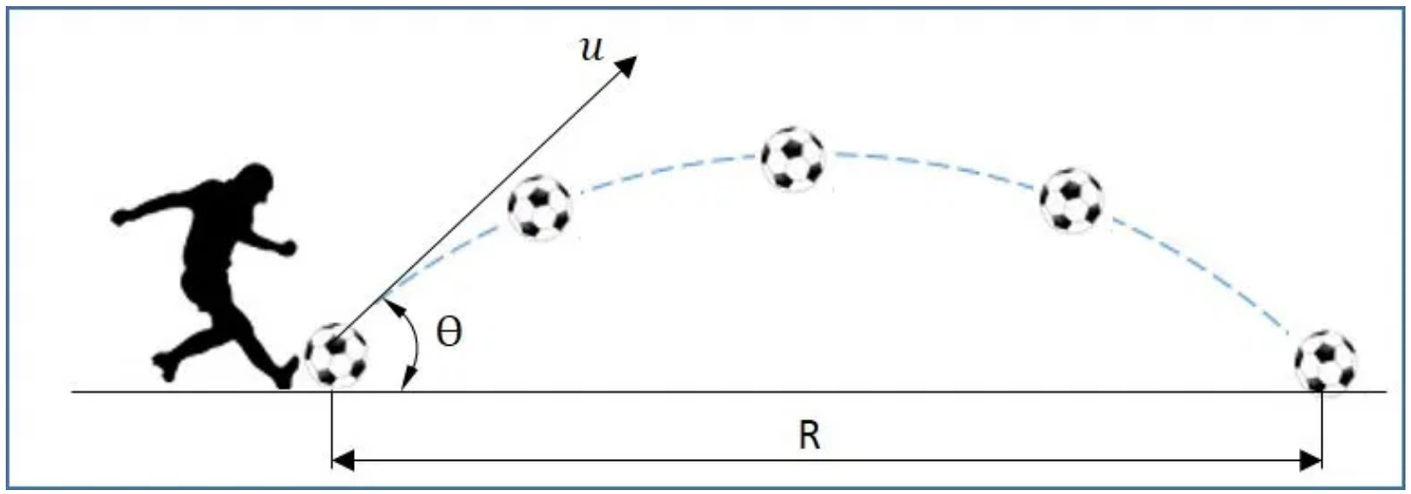
Quantum Mechanics, Relativity, and the Foundations of Our Modern Technological World

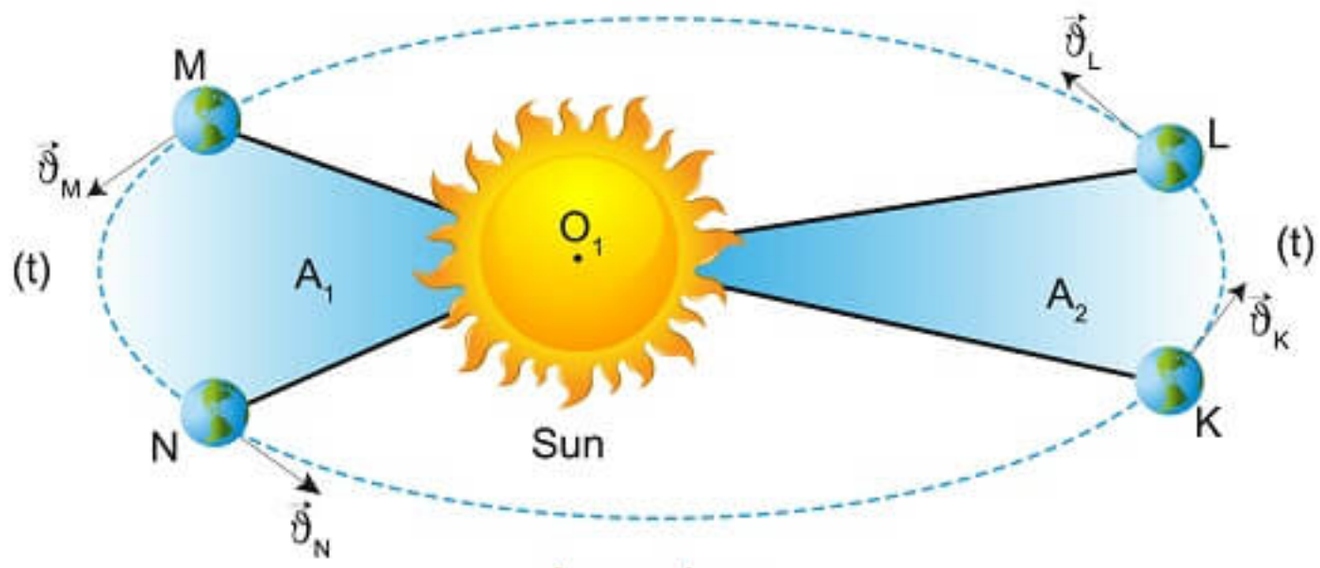
Miguel F. Morales

Course threads

- Physics
- History of measurement & quantitative knowledge
- How our technological world works

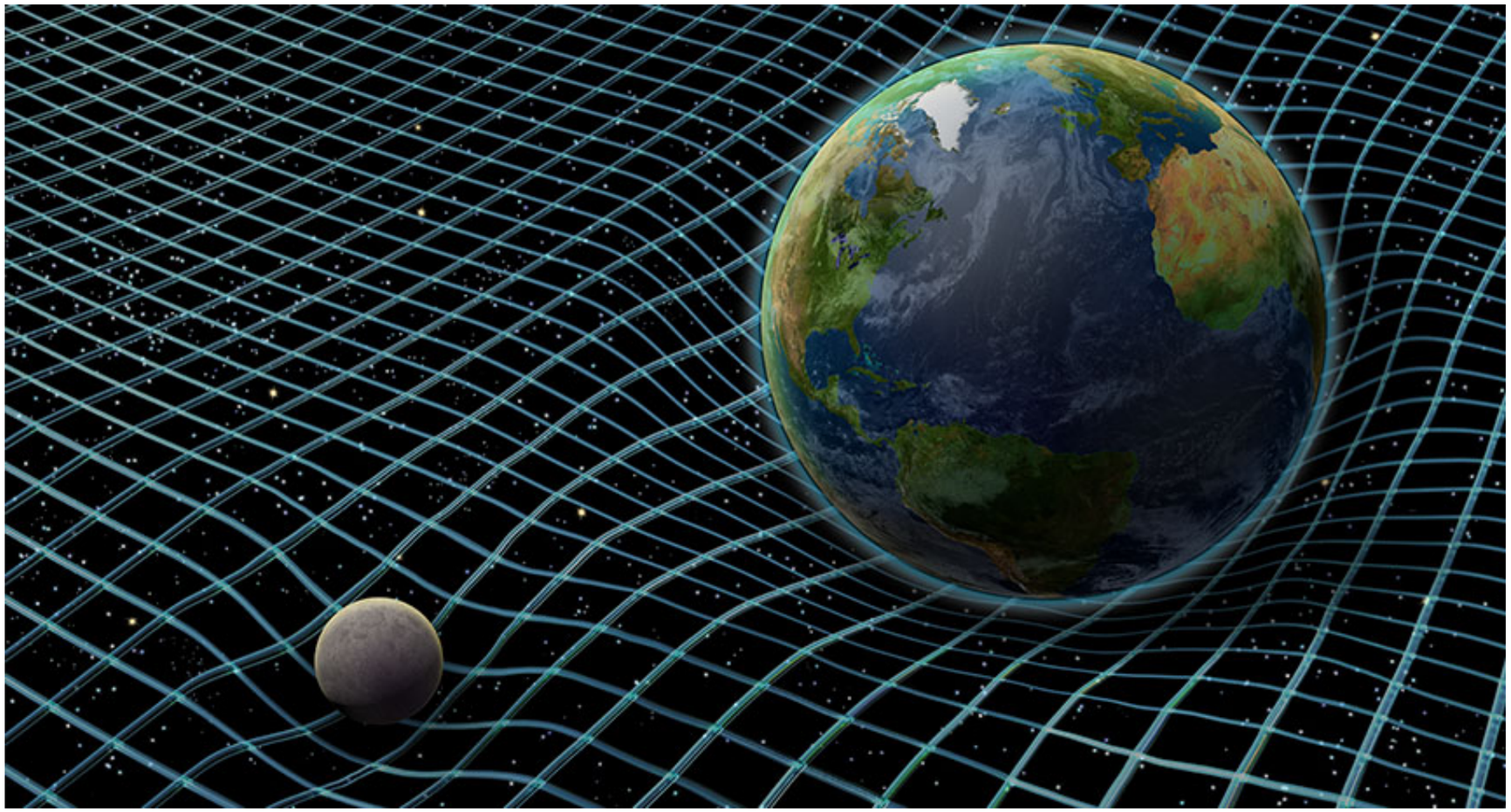
Physics





Classical physics

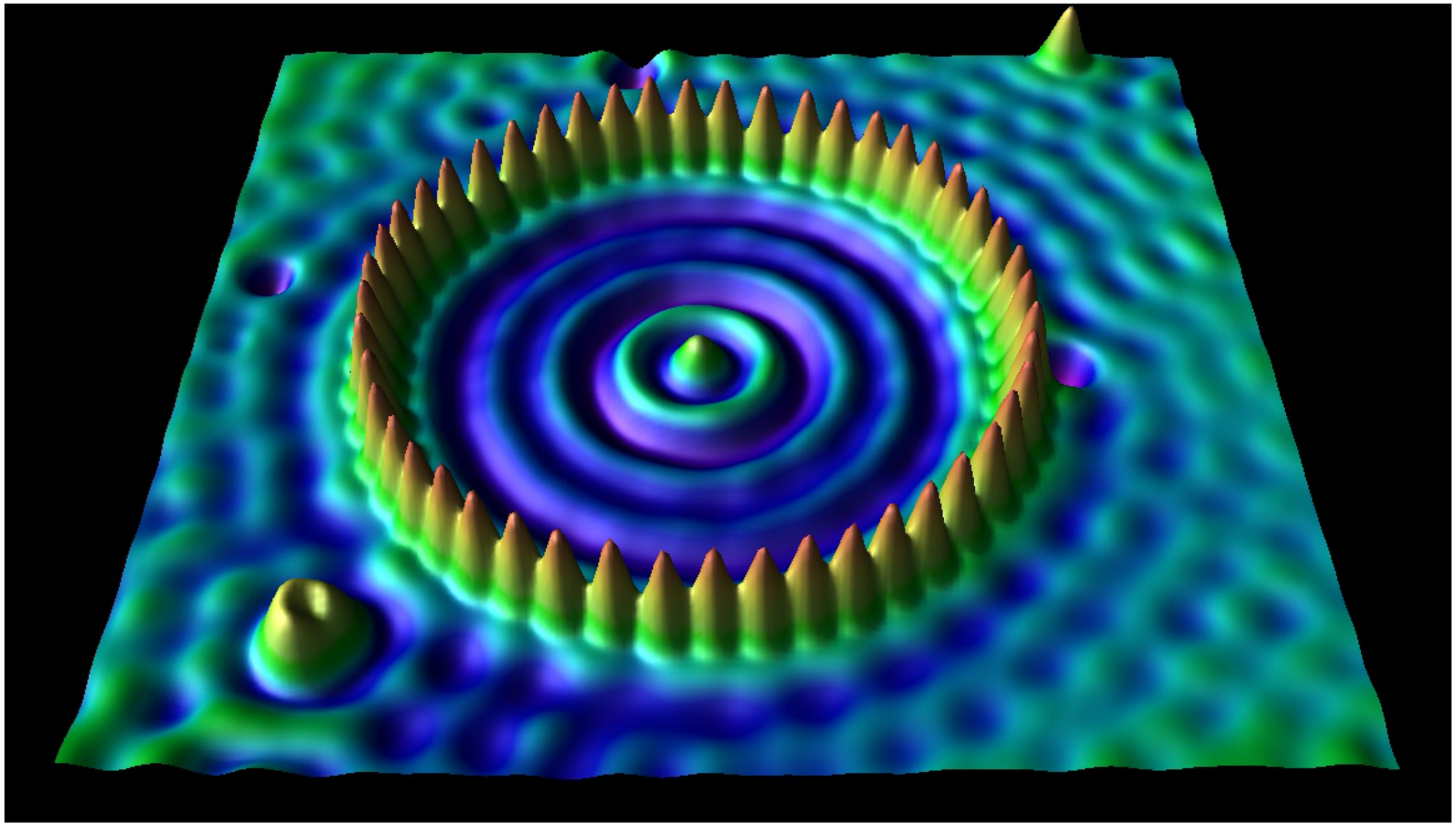
Physics



$$E = mc^2$$

Special & General Relativity

Physics



Quantum Mechanics

Weekly plan

- Start each week with physics
- End each week with how this physics appears in our technological world & the history of measurement

Week 1

- Introduction, Eratosthenes
- Earth's orbital motion, Analemmas
- Ancient way-finding
- The problem of longitude & Harrison's clock

JANUARY

GIRLS IN KUTUPALONG, BANGLADESH, THE LARGEST REFUGEE CAMP HOUSING ROHINGYA REFUGEES

Photo by Paula Bronstein / Getty Images

S	M	T	W	T	F	S
DECEMBER 2019 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	FEBRUARY 2020 S M T W T F S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29		1 NEW YEAR'S DAY	2 BODHI DAY	3	4
5	6 Intro Eratosthenes	7 What time is it? E rot., sidereal, analemma, ssl & stellar elong.	8	9 Where am I? Ancient way finding.	10 Long. & docks.	11 A
12	13 Waves	14 What is light? (or a particle?)	15	16 pt 2. (single photon)	17 FULL MOON Electro magnetic spectrum & telescopes. pt 1.	18 B
19	20 MARTIN LUTHER KING JR. DAY	21 Speed of light. galilean moons	22	23 Special Rel.	24 Surveying & Geodimeter.	25 D (helps bridge)
26	27 Particle Melting pot INTERNATIONAL HOLOCAUST REMEMBRANCE DAY	28	29	30 Better clocks quartz, atomic, optical, UTC, atomic, etc variations in earth's spin	31 GPS. UTC, atomic, etc. Variations on earth's speed.	LUNAR NEW YEAR E or worksheet on ground movement.

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Last homework

- Diagram all the treads connecting the lectures (creativity a plus)
- Pick your favorite thread and in ~1 page describe the connections

JANUARY

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Photo by Paula Bronstein / Getty Images

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Grades

- Reading quizzes
- Homework
- Midterms (Feb 1st & Mar 1st)
- Final Paper

Promises

- No math
- No philosophy
- Everything we encounter will be experimentally verified

Hopes

- Name
- Class & what you are studying
- What you are passionate about

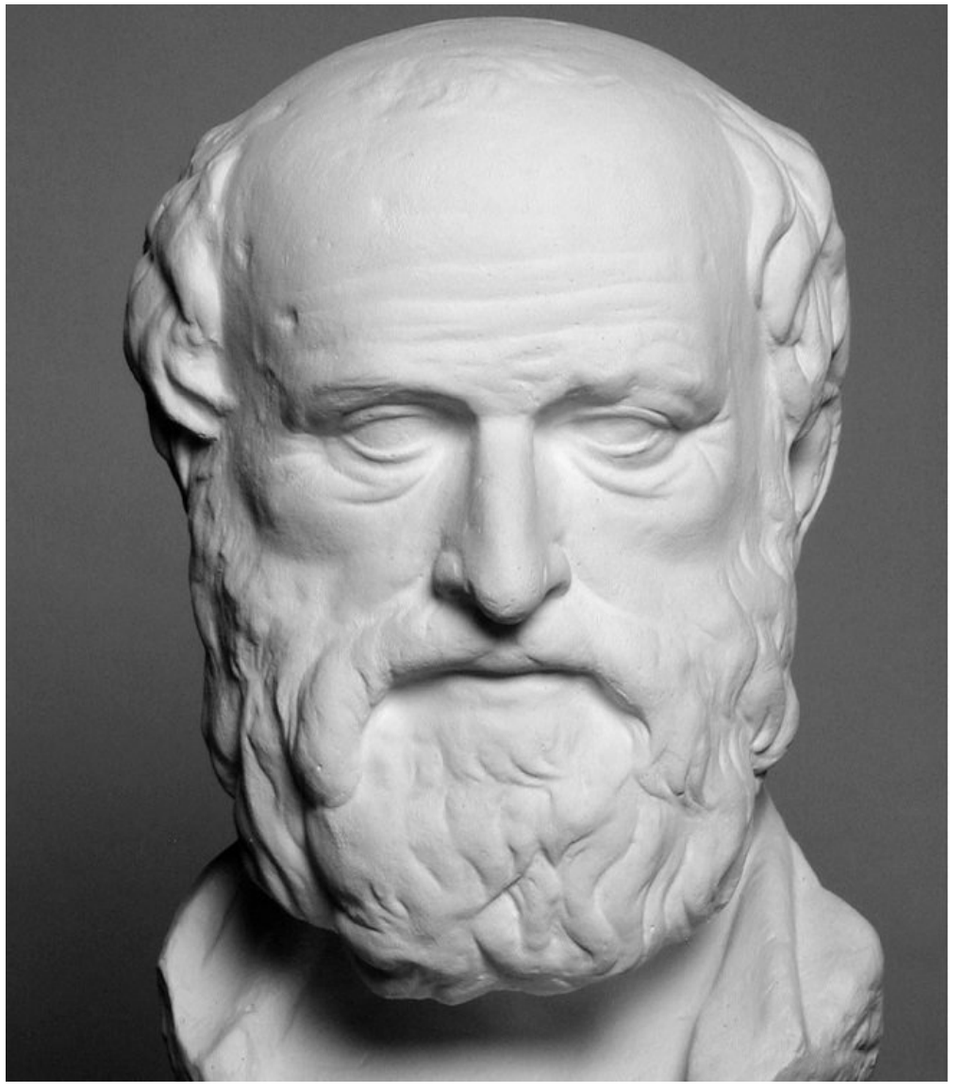
Hopes

Leah
Angela
Iris
Isabella
Ellie
Camille
Shaquan
Alek
Yahir
Sarah
Trina

Griffin
Bruce
Xiyang
Skylar
Jeremy
Giselle
Max
Deiosha
Eveliina
Coco
Michelle

- **Name**
- **Class & what you are studying**
- **What you are passionate about**

Eratosthenes 276–194 BCE



Eratosthenes

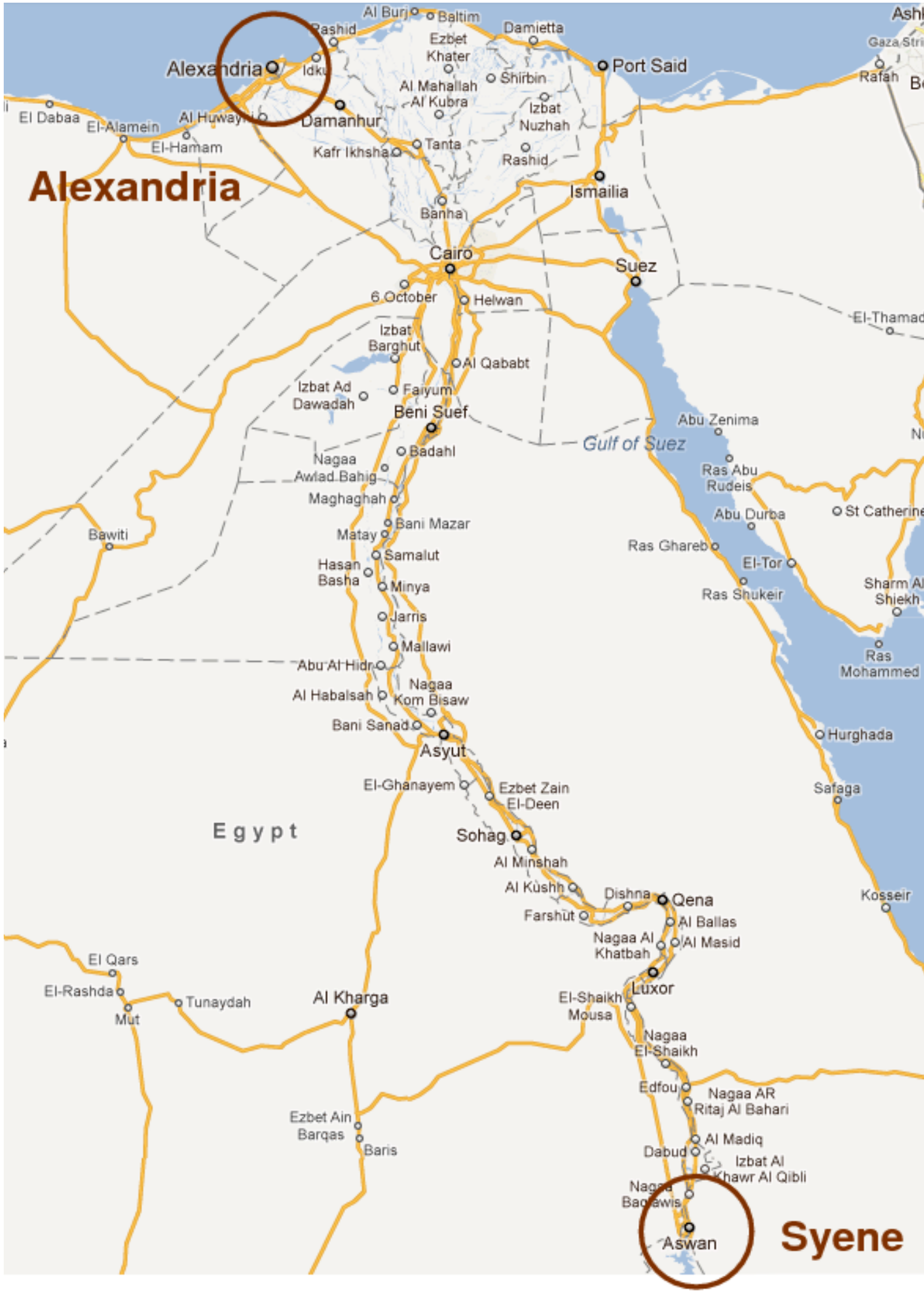
- Chief librarian of the Library of Alexandria
- Invented geography and chronology
- Poet, astronomer, etc.
- Very good at nearly everything (beta)

Bernardo Strozzi

Library of Alexandria

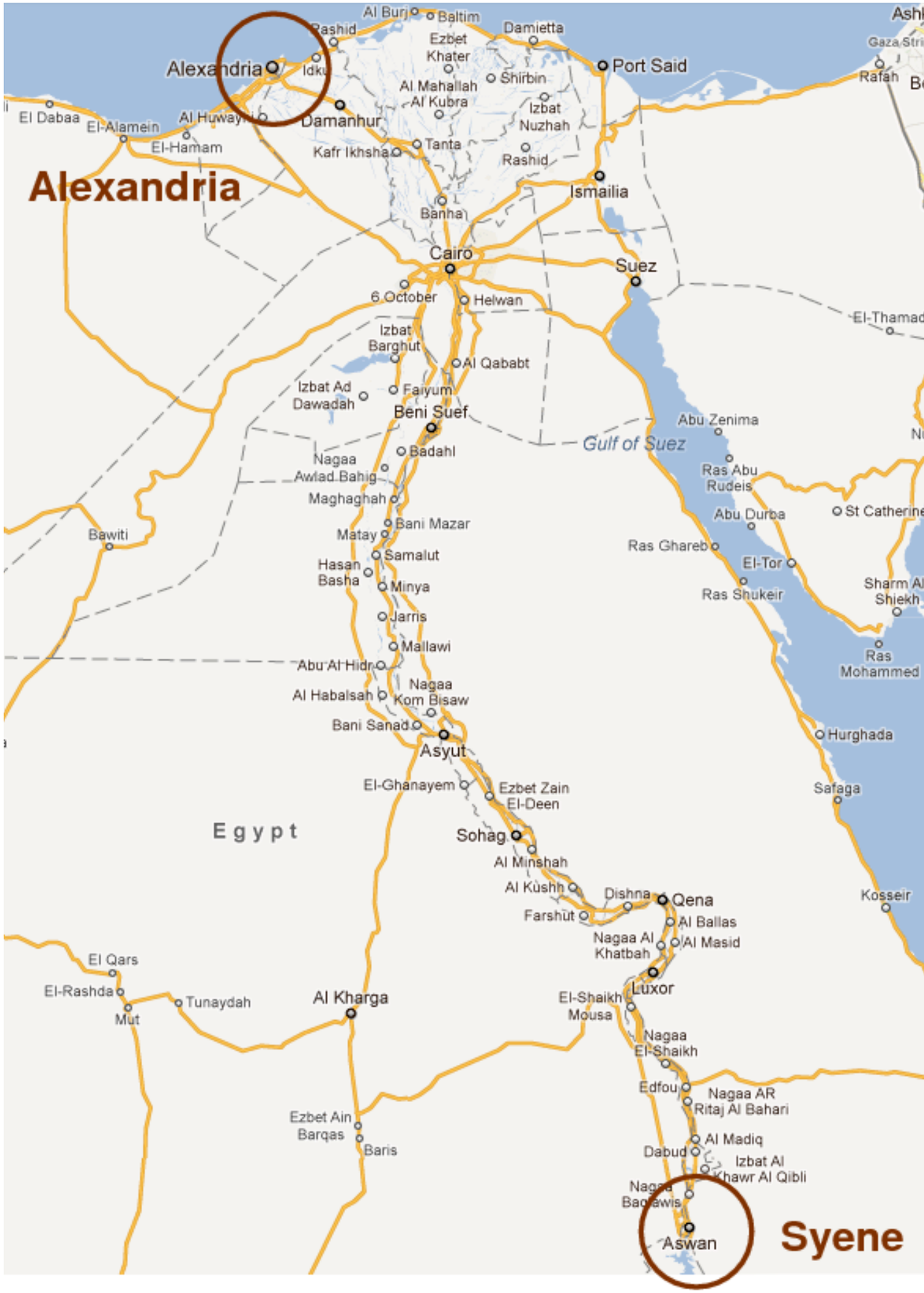
Assassin's Creed

Size & shape of the Earth

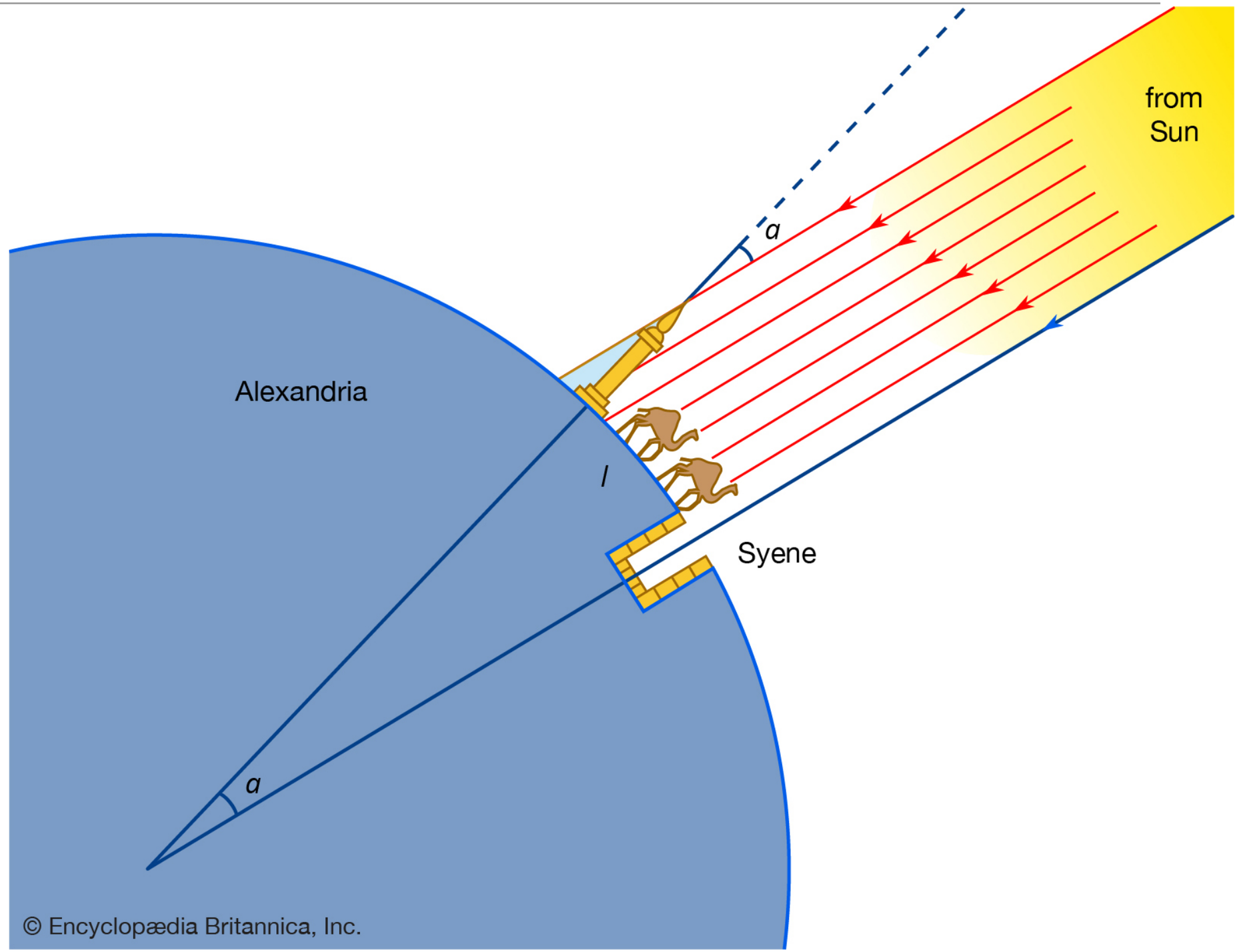


Well at Kom Ombo

Size & shape of the Earth



Calculating the size

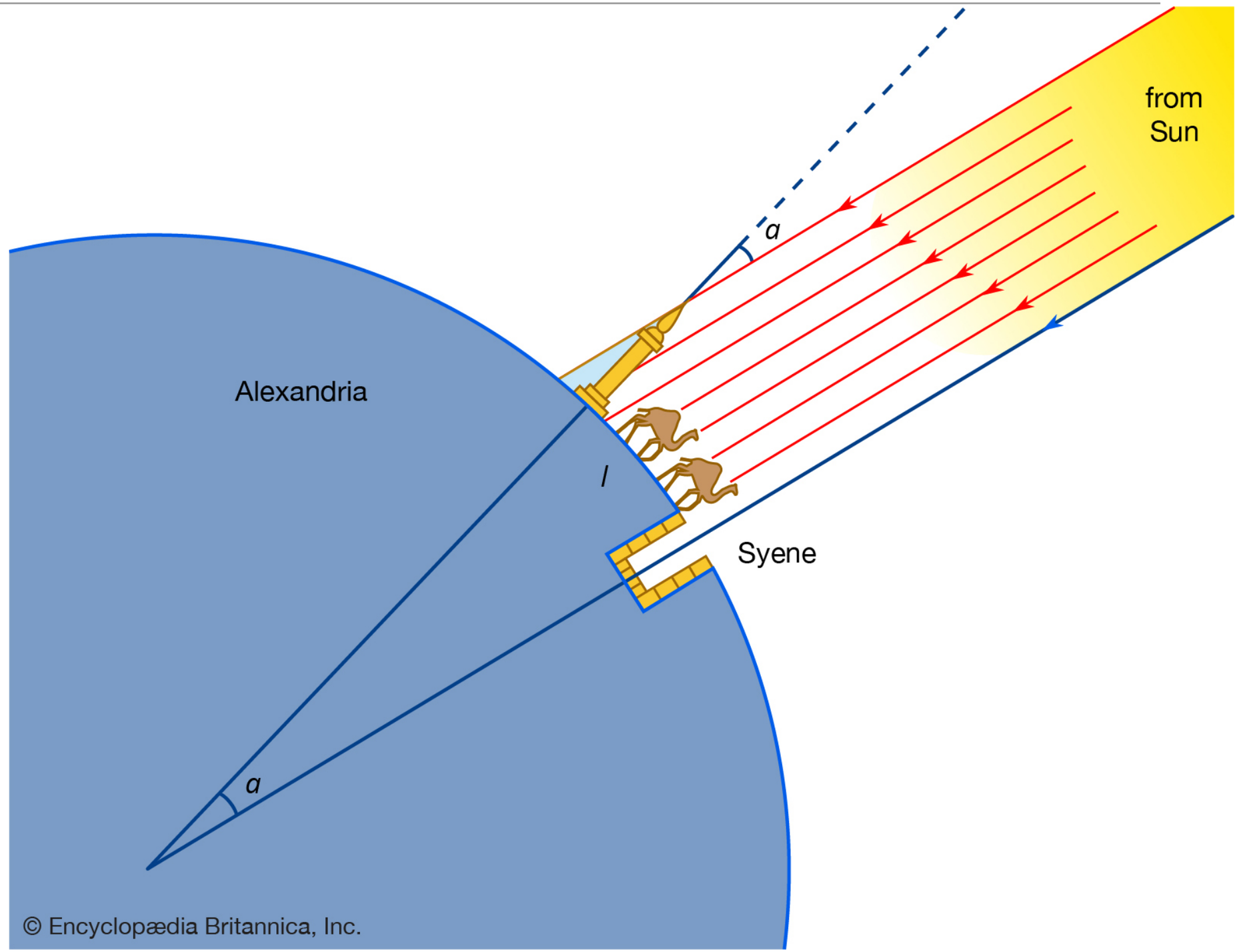


Encyclopedia Britannica

Ancient evidence for spherical earth

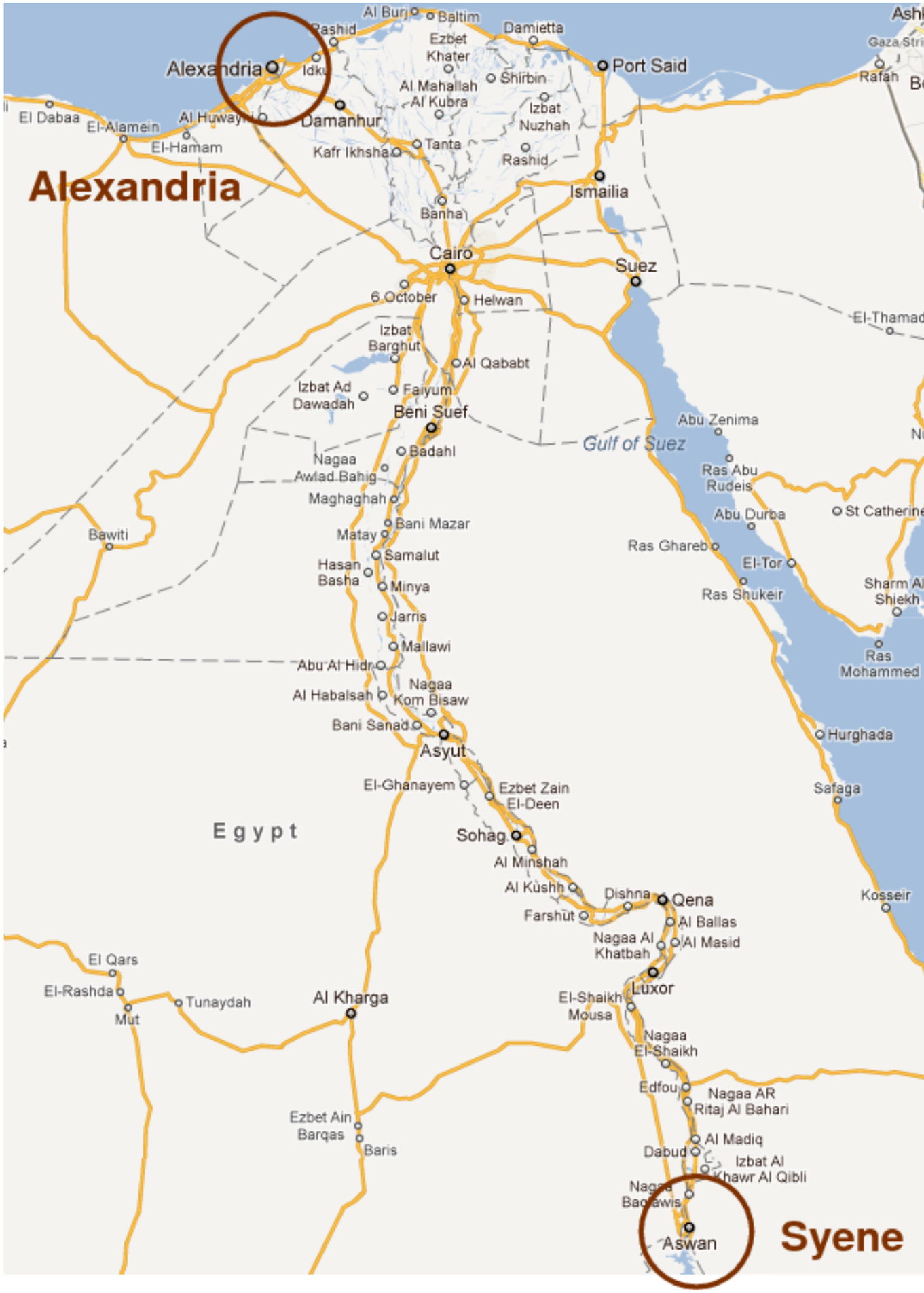
- Change in shadows with latitude
- Phases of the moon, showing spherical moon
- Shadow of the Earth during lunar eclipse
- Lunar eclipses appear in different locations with longitude
- Solar eclipses appear differently depending on location

Calculating the size



Encyclopedia Britannica

Size & shape of the Earth



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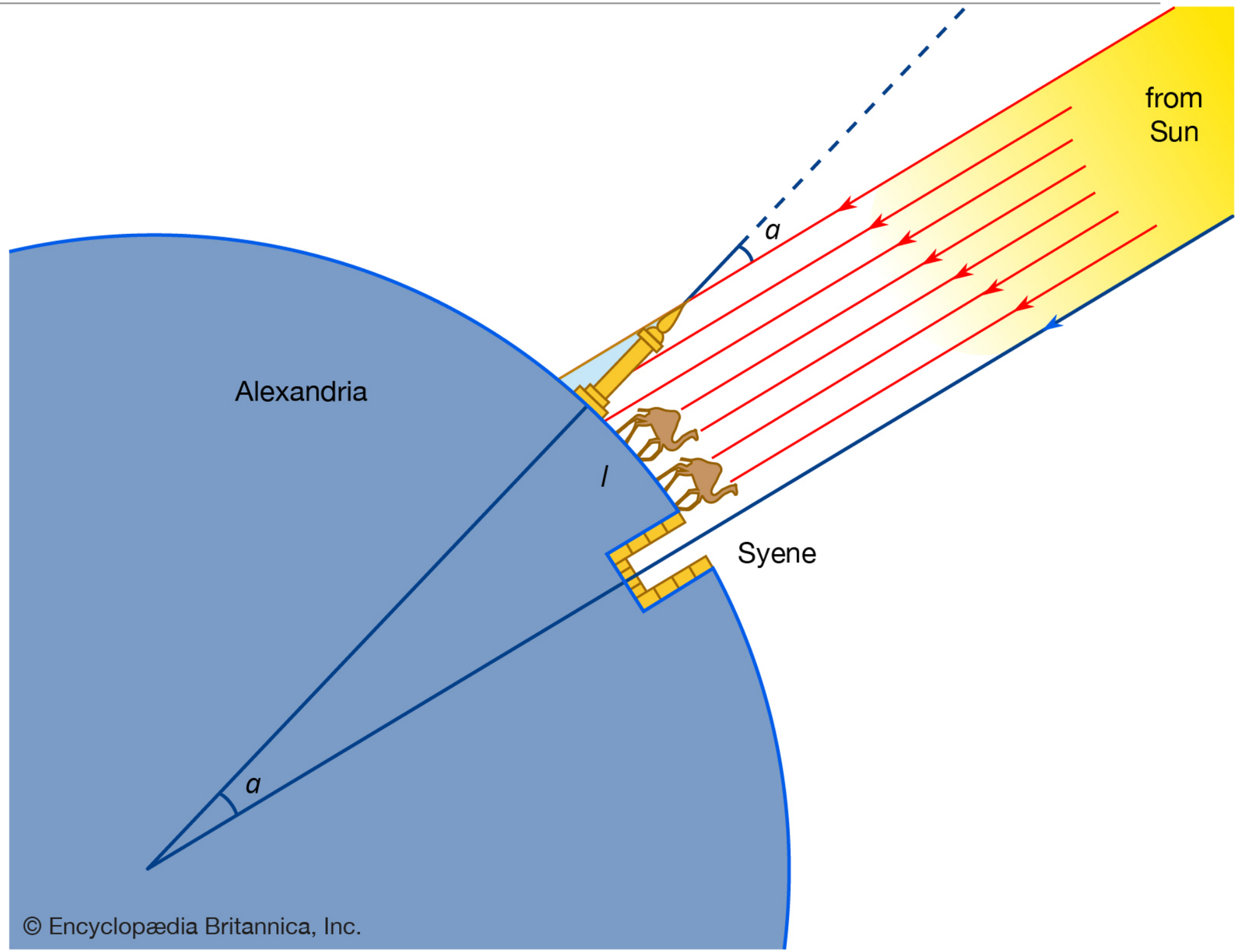

Encyclopedia Britannica

History & myths of a round earth

- ‘Discovered’ by Columbus (or Magellan)
- Known by every educated individual in the western world since before the birth of Christ
- Accurately known (few percent) since Eratosthenes

Tomorrow:
Analemmas, seasons, and the motion of the Earth