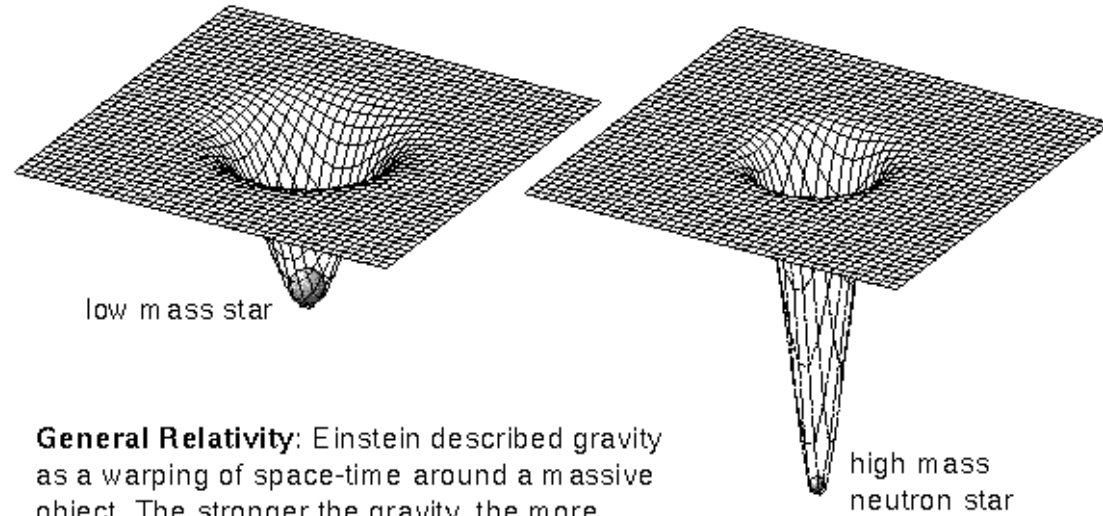
A black and white photograph of Albert Einstein standing in a lecture hall. He is wearing a dark suit and a white shirt with a tie. He has his characteristic wild hair and mustache. He is holding a small object, possibly a pipe, in his right hand. Behind him is a chalkboard with a large circle drawn on it and the letter 'K' written below it. The lighting is dramatic, with strong shadows.

Introduction to Cosmology

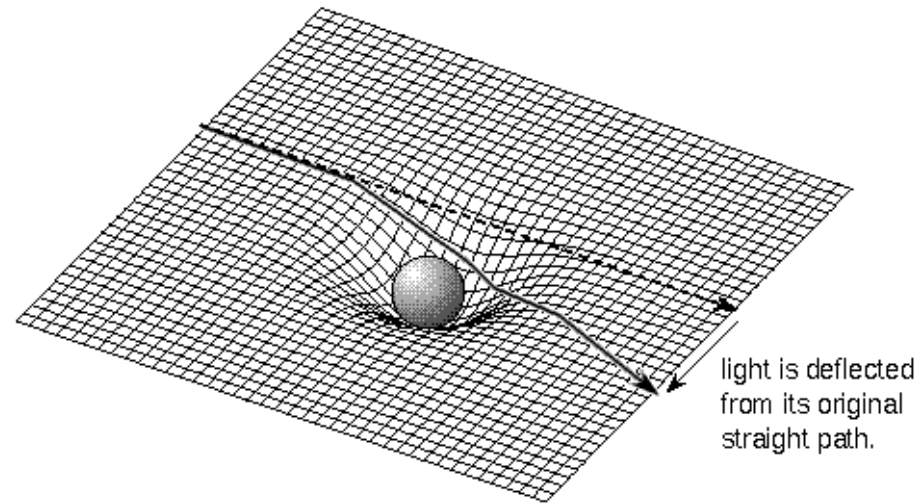
Lecture 3

Matter tells
Spacetime
how to curve



General Relativity: Einstein described gravity as a warping of space-time around a massive object. The stronger the gravity, the more space-time is warped.

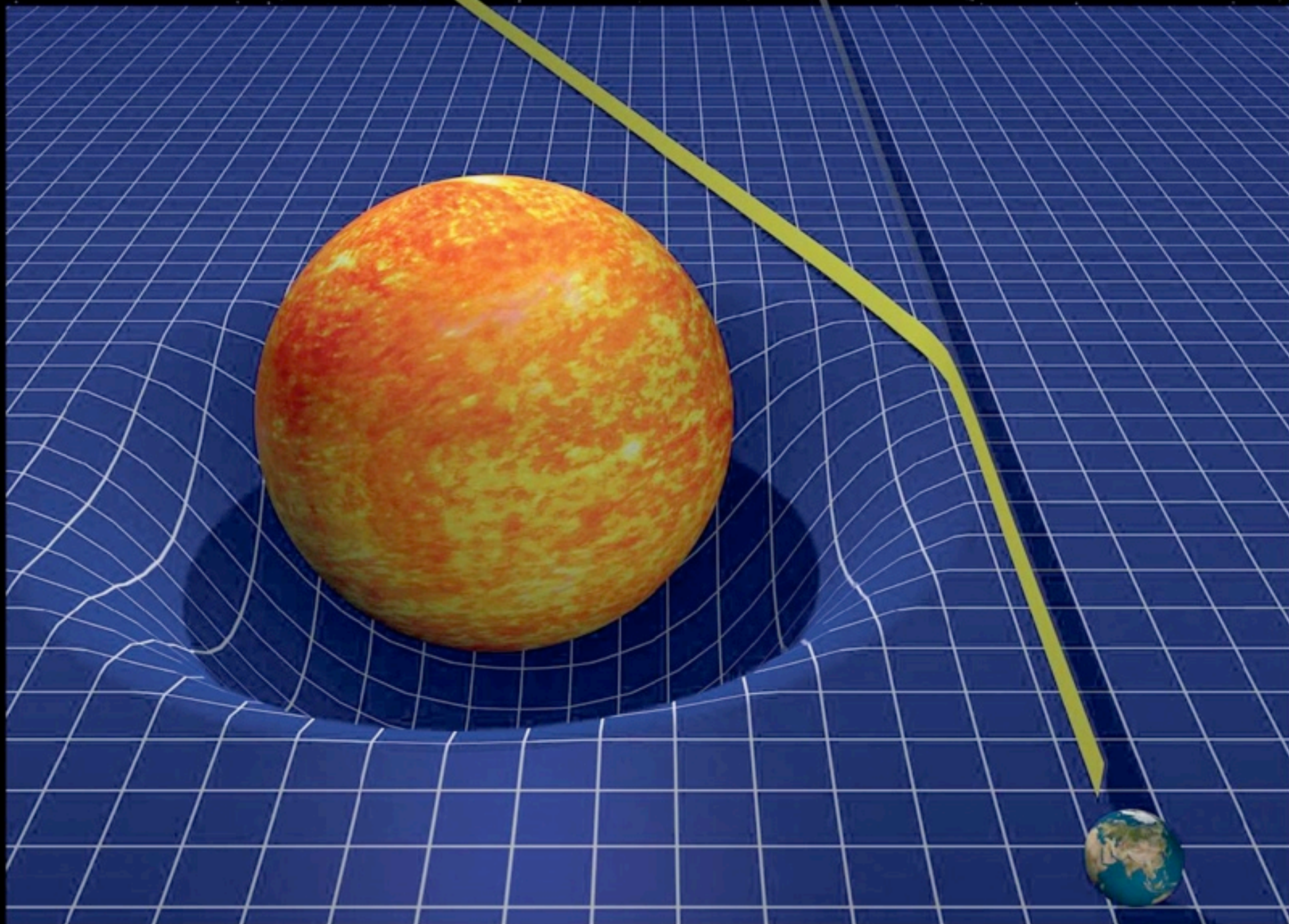
Spacetime
tells Matter
how to move



General Relativity: Light travels along the curved space taking the shortest path between two points. Therefore, light is deflected toward a massive object! The stronger the local gravity is, the greater the light path is bent.

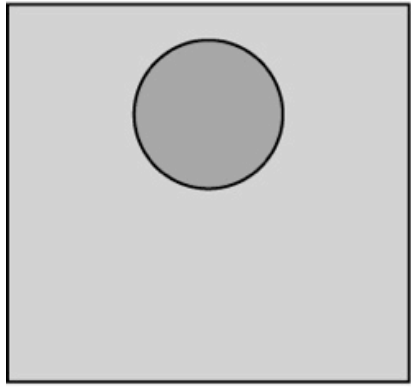
Real

Observed

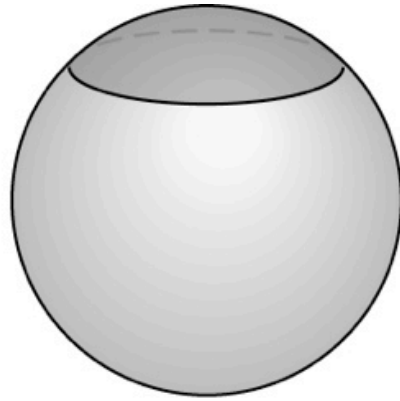




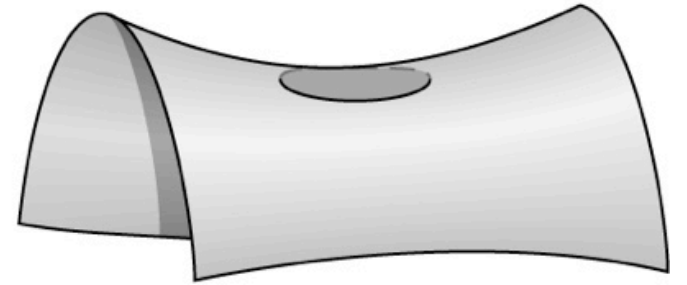




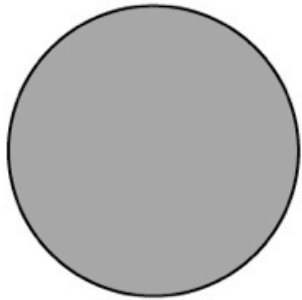
$$C = 2\pi D$$



$$C < 2\pi D$$

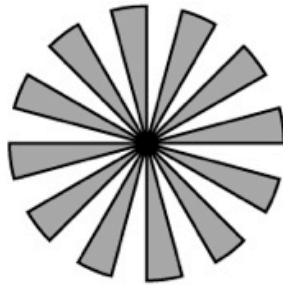


$$C > 2\pi D$$



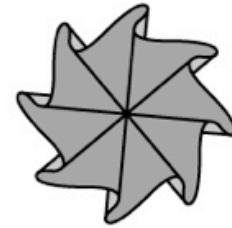
Zero curvature

(a)



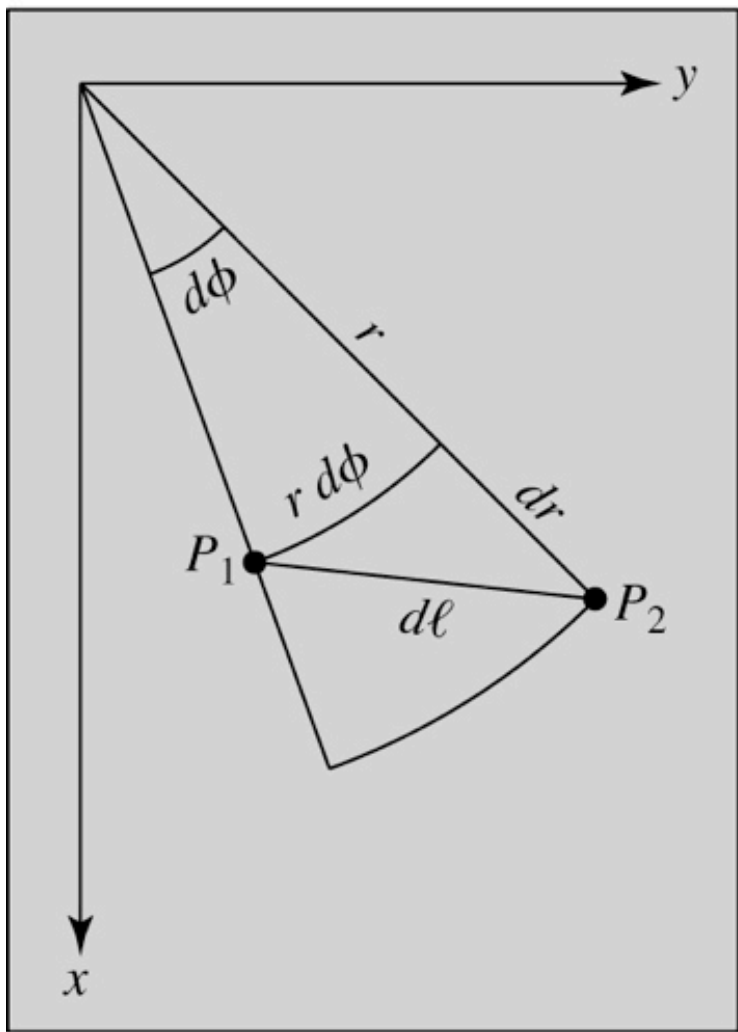
Positive curvature

(b)

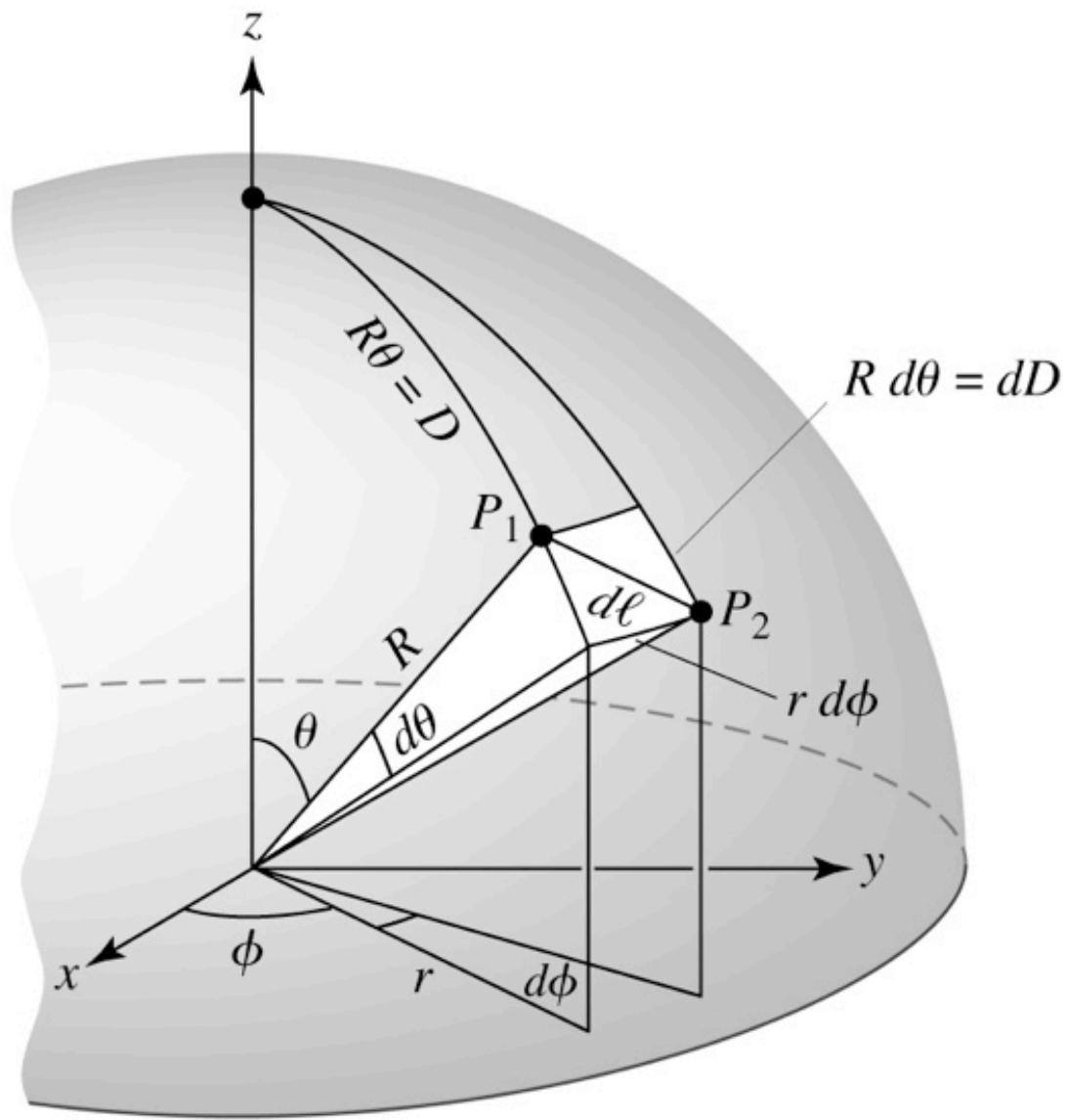


Negative curvature

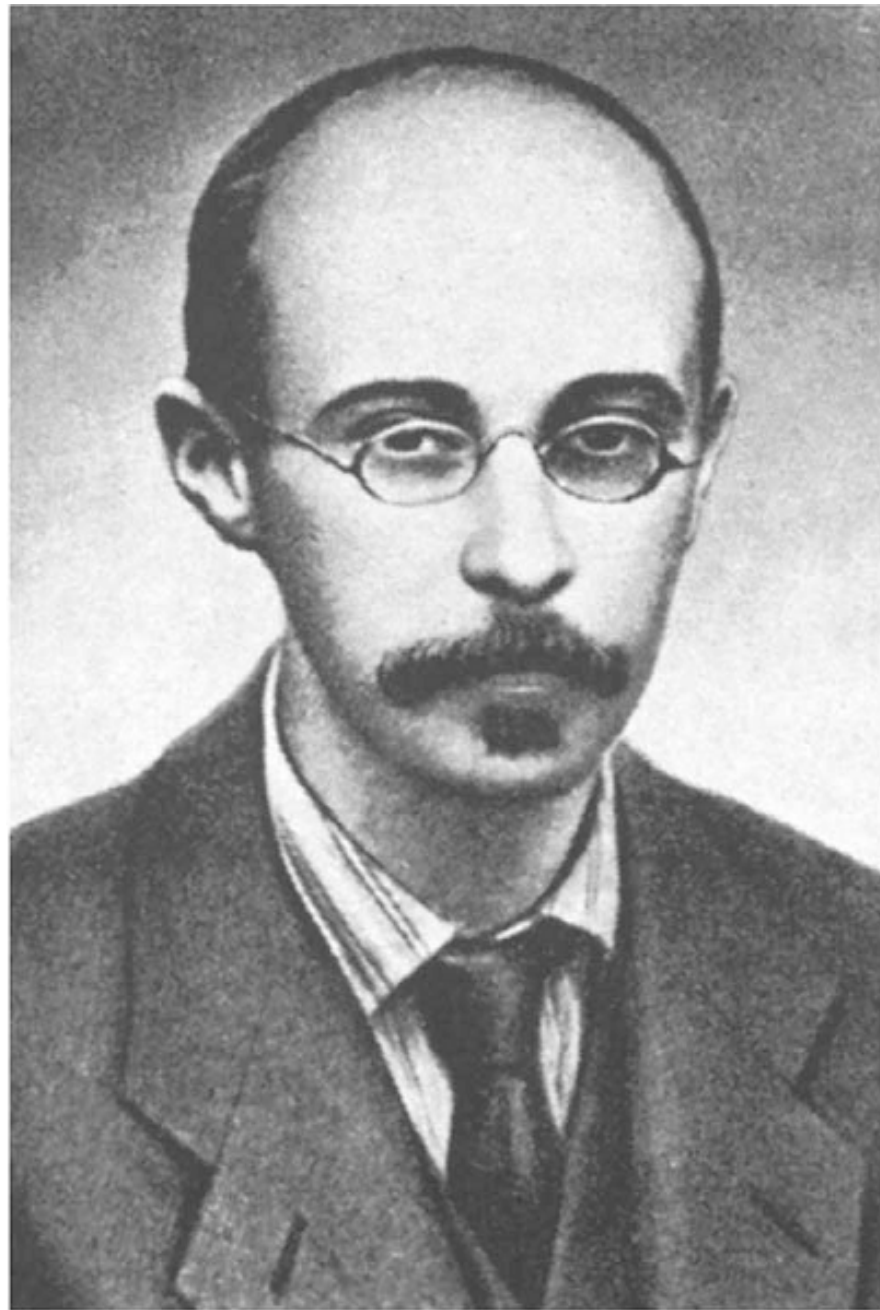
(c)



(a)



(b)



A. P. Piqueras.

