Taken from *A Journey Into Gravity And Spacetime* by John A. Wheeler

## *EÖTVÖS'S EXPERIMENT*

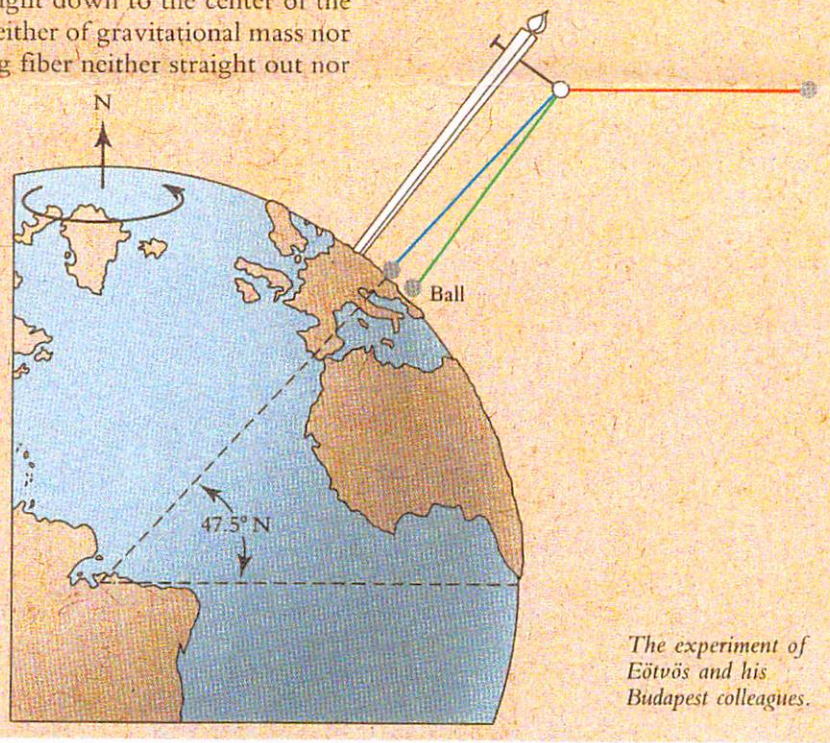
To measure the travel time of a falling body more precisely demands more time. So realized Baron von Eötvös, who therefore devised an experiment of a new kind that offered unlimited time for measurement. It focused on the central issue: Is there for any substance any such distinction, as old writers assumed, between its "gravitational mass," on which the center of the Earth is conceived to pull, and its "inertial mass"? The "inertial mass"—today simply "mass"—resists being set in motion or, if already endowed with a velocity, resists any change in the magnitude or the direction of that velocity.

Imagine an object endowed with inertial mass but no gravitational mass, hanging at the end of a fiber and carried around and around in a circle by the spin of the Earth. With no gravity to hold it down, it will pull the fiber straight out from the axis (red line in the diagram). On the other hand, an object that has no inertial mass at all will not be thrown outward from the axis of spin of the Earth. Instead—if it has any gravitational mass—it will tug the supporting fiber to a position where it points straight down to the center of the Earth (blue line). An object deprived neither of gravitational mass nor of inertial mass will pull the supporting fiber neither straight out nor straight down, but instead to an angle of uprise (green line). Does the ratio of inertial to gravitational mass differ from one substance to another? Then the angle of uprise will differ, too. And for measuring it there's all the time in the world!

This beautiful idea Eötvös put into action. He and his colleagues, in experiments extending over some thirty years, on a variety of substances, were able to establish that there is an angle of uprise: that angle is greatest at latitudes 45°N and 45°S, and amounts there to a tenth of a degree. They found to an accuracy of 5 parts in $10^9$ that the angle of uprise was identical for every substance tested.

Baron Roland von Eötvös

*Born July 27, 1848, Budapest. Died April 8, 1919, Budapest.*




*The experiment of Eötvös and his Budapest colleagues.*