

## From the Torsion Balance to Space Gravimetry

Annamária Komáromi

annamarcsi1015@gmail.com

Balassi Bálint Secondary School, Budapest

In 2019 we commemorated the 100th anniversary of the death of Loránd Eötvös. Up to the 1960s, his famous torsion balance had been used for detecting the unevenness of the gravity field, even in industrial activities. Students may ask what devices are used to make these measurements today, a hundred years after Loránd Eötvös. As an answer to their question we may tell them that nowadays the gravity field of Earth is measured with the help of aircraft and satellites. In the meantime, a new field of science was also born, namely, Space Gravimetry. A world-renown expert of this field was Imre Izsák, whose work is also worth mentioning in class, since he was the one who first made calculations about the shape of Earth based on satellite measurements hence gaining reputation as an internationally recognized scientist.

The Gravity Recovery and Climate Experiment-Follow-On (GRACE-FO) twin satellites, successfully launched on 22 May 2018 and they examine the gravity field of Earth with the state-of-the-art laser interferometry technique. The tiny gravity anomalies of Earth can be tracked by measuring the changes in the distance between the two artificial satellites. Nowadays, the use of Arduino micro controllers in Physics classes has become more and more popular. My students, for example, applied them to create a simplified version of GRACE-FO twin satellites' measurement method. The models of the satellites were designed by one of my fourteen-year old students, who 3D printed them with the help of some imaginary online drawings. Similarly to the original procedure used in space, distance measurement in class was also carried out by laser. Simultaneously, the results could be demonstrated on a graph with a program. With this experiment it is not only possible to bring space research closer to our students, but we can also show them how these measurements can contribute to the research on e.g. climate change if we use additional online sources in connection with the original measurements.

**Keywords:** Space Gravimetry, GRACE-FO, ARDUINO, 3D printing

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