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A School Competition on the computation of the solar parallax using observations from the Mercury Transit of 9 May 2016 – Results and Discussion

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Abstract

We report on the school event, a competition like activity, around the Mercury transit on 9 May 2016. With the historical background in mind, especially the fact that the Mercury transit data were never used to calculate the solar parallax, we asked all participating schools to do actually this. From the participating schools we received not only interesting results, but very positive feedback on the excitement "to be a scientist" for a day.

1. Introduction

On 9 May 2016 an intriguing and rare event occurred. Seen from most countries in Europe, Mercury, the planet nearest to the Sun, crossed the Sun's surface. Such a phenomenon is better known for the moon, for during such an eclipse it gets dark (or darker), so everyone will notice that something special is going on. But as Mercury is very, very small compared to the Sun, one will never remark such a Mercury-eclipse by oneself.

It was the famous astronomer Johannes Kepler who realized in 1601 that Mercury (or Venus) transits could be observed from the Earth. Later in 1691, Edmund Halley published a mathematical algorithm to compute the solar parallax (from which one can determine the distance from Earth to the Sun) from observations made during the transit. It is sad to note that neither of the both scientists had the chance to witness a Mercury transit during their lifetime.

Well before the event, the ESA Communication Office announced a school competition to observe the Mercury transit and repeat the measurements proposed by Edmund Halley and other scientists since then. Several hints were given on the observation possibilities (telescope, binoculars, solar glasses), and examples of the algorithms in form of written formulae or excel sheet formulae were given. All schools were encouraged to share their data with each other and the needed support was provided by ESA.

2. The Transit Event

Unfortunately, several of the authors had bad weather conditions and could observe only part of the transit event. Several schools however, had acceptable weather conditions and were observing by projection methods or with simple telescopes.

In total, 12 school teams from the United Kingdom, Romania, Germany, Denmark, and Greece participated successfully to the event, covering a total of 148 students and many motivated teachers and parents.

A large variety of observational and computational methods were applied. All but one class was able to provide an estimate for the Sun-Earth distance. Some of the distances were really good, others were far off – but this did not matter, as the students did achieve something, that Halley was never given the gratitude (or should we say the time) to achieve.

Figure 1 Students at the Neues Gymnasium Oldenburg, Germany

Figure 2 Students from 9th Grade of the Tudor Vianu National High School of Computer Science, Romania

3. Discussion

Besides the difficulty in observing the transit, in particular the weather condition, the measurement difficulties, and the algorithmic complexity, the enthusiasm of students and teachers was high.

With some modest efforts, a number of students could execute an astronomical experiment and compute the Sun-Earth distance and learn about science history, instrumentation, and our solar system: be prepared for the next Mercury transit event in 2019.

This event was driven by scientists and supported by the ESA Communication Office. It was therefore for most of the authors a pilot project to find out on the challenges when confronted with young students and their teachers at school. We realized that the participating schools were driven by the enthusiasm of either the teachers or one or several parents, who obviously invested a large amount of their time in the preparation of the experiments and the analysis of the data.

The computation of the solar parallax requires a number of assumptions, depending on the available equipment and its accuracy. We underestimated the efforts for the students on this respect and provided finally the full formalism to compute the solar parallax.

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