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A Man-Made Experiment Aimed to Clarify the Gravity Law in The Solar System

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A new type of man-made experiment is precomputed and suggested to enforce the evidence base for general relativity (GR) as the Solar system gravity. We present a detailed analytical and numerical descriptions of a space-probe flight from the Earth towards Venus with Venus' gravity assist (GA) accelerating the probe to return it to the Earth's orbit. We demonstrate that any planet's GA is ultrasensitive to variation of the probe-planet impact parameter, so it can serve as a powerful amplifier (up to 10^5 times) of deviations from the assigned probe's trajectory. An empiric GA-sensitivity function is built with the help of the "conic patched approximation" method (e.g. [1,2]) and numerical orbit construction [3]. To compare the classical and GR versions of the Sun's gravity we introduce a concept of the probe's "standard flight" and (solving geodesic equation in Schwarzschild coordinates with the tangent space technique) we show that the GR-field distorts the Earth-Venus classical trajectory and reduces probe-Venus GA-distance up to 1% (~40 km at the probe's altitude ~4000 km over planet's surface). Three constituents of the effect are the Einstein's "perihelion shift", the quasi-elliptic orbit compression, and the probe's earlier arrival at the GA point. This effect entails the difference between the flight endpoints (achieved at the same time) of few million km, the distance obviously observable from the Earth [4]. Thus, the proposed experiment makes it possible to distinguish classical and GR gravities. Moreover, using the standard flight scheme we compare the impact of two GR-gravities represented in Schwarzschild and isotropic coordinates. An analytical calculation yields ~0.25% difference between respective probe-Venus GA-distances, which entails ~0.5 million km endpoint distance, making possible to specify even a type of GR gravity [5]. We also discuss a need of convincing empiric statistic and measures to avoid the probe's trajectory random perturbances.

References
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