

## Einstein Equivalence Principle test with RadioAstron: preliminary results

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We report on preliminary results of the gravitational redshift test performed with the space radio telescope RadioAstron, which has been in a highly eccentric orbit around the Earth since 2011. We probed the flow of time on board, which varies while RadioAstron passes through the varying gravitational potential of the Earth, by recording the spacecraft's downlink signal synchronized to its on-board H-maser. A total of 17 successful experiments were performed, each comprised of several observations carried out at various distances between the spacecraft and the Earth. The experiment requires us to extract the tiny gravitational redshift signal from the mixture of much larger effects, including the nonrelativistic Doppler, ionospheric and tropospheric frequency shifts, higher-order kinematic effects of special relativity, Earth tides, and various instrumental effects. Preliminary analysis of the data of two experiments gives us a fractional accuracy of the relevant Einstein Equivalence Principle violation parameter of  $2 \times 10^{-4}$ , which is comparable to that obtained by Gravity Probe A. We argue that the accuracy of our result so far is likely dominated by that of the ionospheric frequency shift and discuss prospects for improving this result further. We also present the results of a simulations study of other factors contributing to the experiment accuracy, including the frequency measurement noise, uncertainty of the on-board H-maser frequency bias, solar radiation pressure, ground stations' positions, etc. We found that, apart from the propagation media, the major contribution to the experiment accuracy is due to the frequency measurement noise and the on-board H-maser frequency bias.