



Preliminary experiments of geopotential difference determination between two stations using hydrogen clocks

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According to general relativity theory (GRT), a precise clock ticks slower in a deeper gravity potentials (geopotentials). Then the geopotential difference can be determined by comparing the running rates of two clocks. Here we provide experimental results of determining the geopotential difference based on two atomic clocks located respectively in Luojiashan station (LJS) (in Wuhan) and Jiugongshan station (JGS) (in XianNing) via the Common View Satellite Time Transfer (CVSTT) technique. The geographic distance and height difference between these two stations are around 220 km and 1240 m, respectively. After comparing two hydrogen clocks at the LJS for a period, one portable hydrogen clock is transported to JGS. Then, after a period of comparison between these two clocks, the portable clock is transported back to LJS and compared again with the fixed clock. Using the CVSTT technique we find time elapse between the two clocks, and the geopotential difference is determined based on the GRT. Comparing the relativistic result with the model value of the presently most precise Earth gravity model 2008 (EGM2008) shows a deviation of about 100 m, which is consistent with the stability of the hydrogen atomic clocks (at the level of 10-15/day) we used. This study is supported by NSFCs (grant Nos. 41631072, 41721003, 41429401, 41574007, 41874023, 41804012).