DAMOP20-2020-000320

Abstract for an Invited Paper
for the DAMOP20 Meeting of
the American Physical Society

Transportable Optical Lattice Clocks to Test Gravitational Redshift[1]

HIDETOSHI KATORI, The University of Tokyo

Outstanding accuracy and stability of optical clocks allows measuring height differences of a centimetre via the gravitational redshift, which opens new application of clocks to chronometric levelling. So far, such state-of-the-art clocks offering 10^{-18} uncertainties have been solely demonstrated in well-conditioned laboratories. We develop a pair of transportable optical lattice clocks and demonstrate an 18-digit-precision frequency comparison in a broadcasting tower, TOKYO SKYTREE. The tower provides the clocks with a 450 m height difference to test gravitational redshift as well as adverse conditions to demonstrate the robustness of the clocks. Our experiment shows optical clocks resolving centimetres are technically ready for field applications, such as monitoring spatiotemporal changes of geopotentials caused by active volcanoes or crustal deformation and for defining the geoid. We also present our latest activities toward realizing compact and accurate clocks.

In collaboration with: Ichiro Ushijima, The University of Tokyo, Noriaki Ohmae, RIKEN, Masao Takamoto, RIKEN

[1]This work received support from JSPS Grant-in-Aid for Specially Promoted Research Grant No. JP16H06284 and JST-Mirai Program Grant Number JPMJMI18A1, Japan.