

# Searches for periodic resonance signals in the $e^+e^-$ and $\gamma\gamma$ channels at $\sqrt{s} = 13$ TeV in ATLAS

Thursday, 16 February 2023 20:00 (15 minutes)

We analyzed diphoton( $e^+e^-$ ) and dielectron( $\gamma\gamma$ ) invariant mass spectrums in ATLAS to search for periodic resonance signals which are the decay products of clockwork gravitons predicted by the clockwork model. The clockwork model attempts to answer the hierarchy problem through a novel particle-generating mechanism. The name clockwork follows from the mechanics of obtaining a hierarchically larger field from a smaller field, which can address the hierarchical pattern of quark and lepton masses. We are interested in clockwork graviton because it also offers a solution to the naturalness problem of the electroweak scale. There are two undetermined parameters that define the theory, in addition to the graviton, which are the Higgs-curvature  $k$ , and the 5D fundamental Planck scale  $M_5$ . Monte Carlo graviton samples with different  $(k, M_5)$  are generated with *Pythia* and the detector responses to the graviton are simulated with the transfer method. We included a cascade of decay effect caused by the periodic mass feature, higher mass gravitons decays into lighter mass gravitons, and the process repeats with lighter mass gravitons forming a decay chain if kinematically allowed. A model-dependent  $(k, M_5)$  Fourier analysis is performed for the clockwork graviton signals; also a model-independent analysis is performed to search for any deviation from the standard model in the frequency domain. We have set the first exclusion limits for the phase-space  $(k, M_5)$  and are prepared to perform the unblinding studies.

## Supervisor

Douglas Gingrich

## Funding Agency

school / myself

## Supervisor Email

gingrich@ualberta.ca

## Your Email

hochun@ualberta.ca

**Primary author:** Prof. GINGRICH, Douglas (University of Alberta)

**Co-author:** LAU, Ho Chun (University of Alberta)

**Presenter:** LAU, Ho Chun (University of Alberta)

**Session Classification:** February 16 Evening Session

**Track Classification:** Physics Beyond the Standard Model