



Contribution ID: 2

Type: **not specified**

Required laser system toward laboratory search for low-mass Dark Matter and Dark Energy candidates

Thursday, 27 June 2013 15:45 (15 minutes)

Probing the nature of the quantum vacuum is indispensable to resolve the crucial problems in contemporary physics; dark matter and dark energy in the universe. Probing the vacuum to date has been limited to either the macroscopic space-time via astronomical observations or microscopic space-time points at high-energy particle collisions. With high-intensity lasers, however, we anticipate to be able to unveil the different aspects of the quantum vacuum at different space-time scales based on analogous observables in quantum optics [1-4]. We present the new approach to realize the laboratory search for low-mass and weakly coupling particles which can be light Dark Matter / Dark Energy candidates by detecting four-wave mixing of two-color laser fields in the vacuum. This can be interpreted as a kind of quasi-parallel photon-photon collider[5]. We emphasize the advantage to utilize high-rep rate and high-intensity laser systems such as ICAN.

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Session Classification: ICAN Applications