Contribution ID: **172** Type: **poster**

Interferometric techniques with high resolution emulsion detectors

Wednesday, September 15, 2021 3:55 PM (1 minute)

I will present an interferometric technique suitable for the measurement of particle masses. The goal of this study is to attain the capability of measuring particle-antiparticle mass ratio in a way that is independent of particle electric charges, a technique that is gaining interest in view of recent developments of experiments looking for CPT violations and antimatter gravitational fall.
In order to obtain an accurate estimate of the mass ratio, the proposed method relies on the possibility to have a very high-resolution detector which can reliably respond to low energy particles and antiparticles.
Nuclear emulsions are position sensitive detectors that feature these fundamental characteristics. Recently, super-fine-grained nuclear emulsions have been developed using a new method, which leads to a resolution up to 50 nanometers (A. Alexandrov et al; Sci. Rep. 2020, 10, 18773).
Furthermore, nuclear emulsions have already been successfully tested with antimatter: the capability to reconstruct antiproton annihilations with micrometric resolution has been demonstrated by the AEGIS collaboration; the high detecting efficiency for low energy antiparticles has been proved by the QUPLAS collaboration with the demonstration of positron interferometry (S. Sala et al; Sci. Adv. 2019, 5, eaav7610).
Therefore, thanks to the improved resolution of the nuclear emulsions and their tested response to low energy particles, the emulsion-based detector represents an ideal device for this quantum interferometry study, where micrometric fringes of the periodic spatial distribution generated by the interferometer have to be measured.

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Session Classification: Poster Session 3 (Applications in Particle Physics)

Track Classification: Applications in Particle Physics