

**Vendredi 27 Mai 2016**  
**à 11H**

*Un café sera servi à partir de 10h45*

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## **New approach to experimental observation of the Breit-Wheeler pair generation process**

Direct production of electron-positron pairs in photon collisions is one of the basic processes in the Universe. The electron-positron production  $\gamma + \gamma \rightarrow e^+e^-$  the linear Breit-Wheeler (BW) process, is the lowest order process in photon-photon interaction, controlling the energy release in Gamma Ray Bursts and Active Galactic Nuclei [1]. It is also responsible for the TeV cutoff in the photon energy spectrum of extra-galactic sources. The linear BW process has never been clearly observed in laboratory because of competing pair creation processes. [2]. Based on a new generation of bright MeV photon laser driven sources we propose an experimental set-up permitting to produce more than  $10^4$  BW pairs per shot [4].

This scheme offers a possibility of conducting a multi-shot experiment with a reliable statistics on laser systems with pulse energies on the level of a few joules and in a low noise environment without heavy elements. This scheme relies on a collision of relatively low energy (few MeV), intense photon beams. Such beams can be created in interaction of intense laser pulses with thin plastic targets [3]. By colliding two of them in vacuum, one would be able to produce a significant number of electron-positron pairs in a controllable way. We present details of the experimental setup (Fig.1), estimates from model and numerical simulations of the expected yield of reactions and possible ways of creating of a photon source with requested parameters.

A spatial separation of the photon-photon interaction zone from the source is the best way for the detection of the BW pairs emitted in the preferential direction. The detailed kinetic simulations of intense photon beams enable a robust experimental design. Moreover, the noise level due to other pair process creation is estimated.

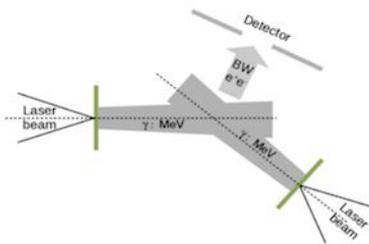


Figure 1: Experimental proposal scheme for BW pairs creations.

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References :

- [1] Ruffini, R. et al. Physics Reports 487, 1-140 (2010).  
[2] Bamber C. et al. Phys. Rev. D, 60, 092004 (1999).

- [3] Capdessus, R. et al., PRL 110, 215003 (2013).  
[4] Ribeyre, X. et al., Phys. Rev. E, 93, 013201 (2016).