**BSc project plan BW process**

Dong Ha Lee, Sam Zhou supervisor: Professor Stuart Mangles

The final goal of the project currently is to create a code in python which can take experimental data on the number of gamma ray photons and the number density of x-ray photons to give the number of electron, positron pairs produced via a Breit-Wheeler process for a range of photon energies.

We want to (for now) consider pairs produced at all angles and so can consider the total cross-section in the centre of momentum frame as given in the B Kettle et al 2021 paper:

Where and s is the square of the invariant mass of the two photons given by . As s must be greater than the rest mass of two electrons, the function should initially filter the data and set the number of pairs for those with less energy than required to = 0.

The number of pairs in this process will be

To start with, wanted to be able to see how the cross-section varies with the photon energies for a given angle of interaction. Used the energies given in the paper of 1.3-1.4 keV x-rays and gamma rays. As the angle of interaction had a significant impact on the CoM mass, needed to first see how s changes with the angle which is shown in fig. 1. Then, tried to see how the cross-section would change under the same conditions.

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Fig. 1. distribution of s for x-ray energies and interaction angle. If s was less than the minimum required energy for BW, it was denoted as 0.

Fig. 2. distribution of for x-ray energies and angle. A head on collision does not yield the highest values unlike s.

Along with this, found the cross-section for varying photon energies at given an interaction angle (fig. 3.) the next steps will be to consider the number of gamma photons in interaction region and the number density of x-ray photons along the path of the gamma beam to find the number of pairs produced for given energies of gamma and x-ray photons.

In the future, we may need to run Monte-Carlo simulations in python with given parameters of the x-ray field and gamma beam to determine expected the number positrons detected in the experiment.

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Fig. 3. Cross-section for a range of photon energies at cos theta = -0.1.