Photon splitting in laser fields

Bakgrund
It is known that due to the nontrivial nature of the quantum vacuum, a high-frequency photon that encounters a strong external electromagnetic field can be down converted, or "split", into two photons with a total sum of energies equal to the original photon. The process is thought to be of some importance in neutron star magnetospheres, and the formation of pair plasmas in astrophysics.

Problembeskrivning
Currently, the intensity of the strongest available lasers is at a level where effects from quantum electrodynamic (QED) comes into play. A lot of experiments related to QED in laser fields have been suggested over the last few years, e.g., quantum photon emission, pair production, and vacuum birefringence. However, there is still no tangible experimental suggestion for photon splitting in laser fields. Therefore we suggest to estimate if this would be possible, what would be the threshold of observation, and how experimental constraints will affect our ability to see such effects in experiments.

Arbetssätt
For this purpose, we will need to implement the know photon splitting amplitudes in a numerical code, making it, e.g., possible to estimate the integrated effect over finite volumes and the structure of the expected signals. The development of measures for experimental tests is an integral part of the project.

Gruppstorlek
Rekommenderad storlek 3-4 studenter. Även genomförbart med 2 studenter.

Målgrupp
Teknisk fysik (F), Fysikprogrammet GU (GU-Fysik), Teknisk matematik (TM).

Handledare
Mattias Marklund, 0723981097, 031-772 3939, mattias.marklund@chalmers.se
Tom Blackburn, tom.blackburn@chalmers.se
Plats: våning 6, Origo Norra.