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Neutral bremsstrahlung in two-phase argon electroluminescence: first results and possible applications

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A new mechanism of proportional electroluminescence (EL) in two-phase Ar has been revealed, namely that of neutral bremsstrahlung (NBrS), that quantitatively describes the photon emission below the Ar excitation threshold and non-VUV component above the threshold. This paves the way for direct readout of electroluminescence (S2) signals in two-phase TPCs, using PMT and SiPM matrices, in particular in dark matter two-phase detectors. In addition, this mechanism predicts the enhanced contribution of the fast component to S2 signal, which can affect the correct determination of diffusion coefficients and z-coordinate fiducialization in liquid Ar detectors. The NBrS effect has a universal character: it should be present in all noble and molecular gases. It may also explain the non-VUV components observed earlier in various light emission processes, in particular the primary and secondary scintillations in noble liquids in the visible and NIR range.

Author: SHEMYAKINA, Ekaterina (Budker Institute of Nuclear Physics SB RAS)

Co-authors: BONDAR, Alexander (BudkerINP); DOLGOV, Alexander (INFN); BUZULUTSKOV, Alexei (Budker Institute of Nuclear Physics); SOKOLOV, Andrey (Budker Institute of Nuclear Physics); FROLOV, Egor (Budker Institute of Nuclear Physics SB RAS); NOSOV, Valeriy (Budker Institute of Nuclear Physics SB RAS); OLEYNIKOV, Vladislav (Budker Institute of Nuclear Physics)

Presenter: SHEMYAKINA, Ekaterina (Budker Institute of Nuclear Physics SB RAS)

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