Study of gaseous argon scintillation in the 160-650 nm range

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Argon gaseous detectors have been widely used in dark matter search and neutrino experiments over the last decade, owing to their unique ionization and scintillation characteristics. The primary and secondary scintillation in argon mainly result from the radiative de-excitation of singlet and triplet excimer states produced at gas pressures above 100 mbar. This well-known light production mechanism dominates the argon scintillation spectrum, consisting of Gaussian-like emission, 10 nm in width, and centered at 128 nm, with a 10-nm width, commonly referred to as the 2nd continuum. On the other hand, alternative scintillation mechanisms, such as neutral bremsstrahlung and 3rd continuum emission, have been less studied due to their lower scintillation yield compared to the 2nd continuum. Despite this fact, their longer wavelength region, covering from the near vacuum ultraviolet to the near-infrared range, is typically more accessible to current photosensors, thus eliminating the need for wavelength shifters. In this work, we conducted a systematic study on the yield and time properties of the primary and secondary scintillation emissions in gaseous argon within the 160-650 nm wavelength region. In addition to the fast emission, we observed a slow component with time constants of the order of tens of microseconds. The yield and time properties of the slow contribution was studied for a wide range of electric fields values.

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