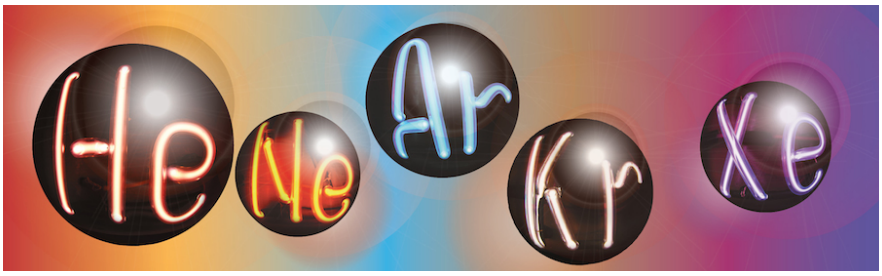

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Secondary scintillation yield and energy resolution of Xe-CO2/CH4/CF4 mixtures for the NEXT electroluminescence TPC

Sunday, 24 September 2017 11:55 (15 minutes)

The NEXT experiment aims at searching for the hypothetical neutrinoless double-beta decay (0νββ) of the 136Xe isotope using a High-Pressure Xenon (HPXe) Time Projection Chamber (TPC). Efficient discrimination of background events through pattern recognition of the topology of primary ionisation tracks is a major requirement for the experiment. However, the spatial resolution of the NEXT TPC is limited by the large diffusion of electrons in pure Xenon. The addition of a small fraction of a molecular gas to xenon may significantly reduce diffusion through electron cooling as new vibrational and rotational states are made available for electron energy transfer. On the other hand, the electroluminescence (EL) yield and energy resolution are degraded, which contributes to a reduction of the NEXT background discrimination capability. Nevertheless, a compromise between electrons diffusion reduction and EL degradation could yield an overall improvement of NEXT sensitivity to the 0νββ.

We have studied the effect of adding several molecular gases to xenon (CO2, CH4 and CF4) on the EL yield and energy resolution using a small prototype of a driftless Gas Proportional Scintillation Counter (GPSC). Our experimental results are compared with simulation of EL yield performed for the same additive concentrations.

Discussion on the technical advantages and disadvantages of each mixture is presented, as well as on the energy resolution contributions for each case. CH4 seems the most promising additive, but experimental studies on the pressure dependence, effect on primary scintillation and charge production, and electron diffusion are needed. This work will be carried out soon in a larger prototype (NEXT-DEMO).

Primary author: Mr HENRIQUES, Carlos (LIBPhys, Departamento de Fisica, Universidade de Coimbra, Rua Larga, 3004-516 Coimbra, Portugal)

Co-authors: Ms FERNANDES, Andreia (LIBPhys, Departamento de Fisica, Universidade de Coimbra, Rua Larga, 3004-516 Coimbra, Portugal); Dr AZEVEDO, Carlos (Institute of Nanostructures, Nanomodelling and Nanofabrication (i3N), Universidade de Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal); Mrs MONTEIRO, Cristina (LIBPhys, Departamento de Fisica, Universidade de Coimbra, Rua Larga, 3004-516 Coimbra, Portugal); Dr GONZALEZ-DIAZ, Diego (Instituto Gallego de Física de Altas Energías, Univ. de Santiago de Compostela, Campus sur, Rúa Xosé María Suárez Núñez, s/n, 15782 Santiago de Compostela, Spain); Mr FERNANDES, Luís (LIBPhys, Departamento de Fisica, Universidade de Coimbra, Rua Larga, 3004-516 Coimbra, Portugal)

Presenter: Mr HENRIQUES, Carlos (LIBPhys, Departamento de Fisica, Universidade de Coimbra, Rua Larga, 3004-516 Coimbra, Portugal)

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