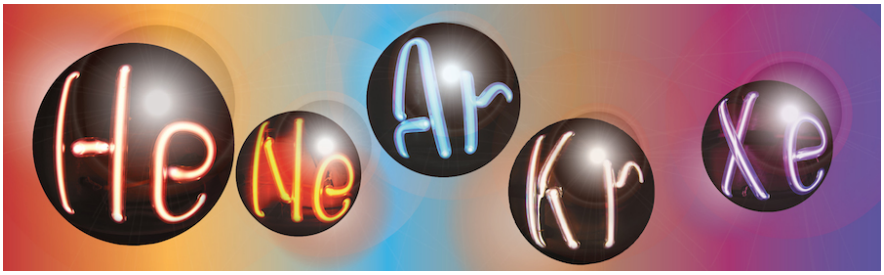

Contribution ID: **48** Type: **Poster**

Investigation of the Temperature-Dependent Optical Properties of Wavelength Shifters Used in High-Energy Physics Experiments

Wavelength shifters (WLS) are widely employed in high-energy physics experiments to con-vert ultraviolet (UV) and vacuum ultraviolet (VUV) radiation into wavelengths compatible with the spectral sensitivity of photodetectors. Among the materials investigated in this work are p-terphenyl (PTP), tetraphenyl butadiene (TPB), and polyethylene naphthalate (PEN), which are commonly used in scintillation detectors, cryogenic systems, and optical readout devices based on silicon pho-tomultipliers (SiPMs). The optical properties of these WLS materials are studied through tempera-ture-dependent absorption and photoluminescence measurements performed over a temperature range extending from liquid argon conditions to room temperature. In addition, structural and topo-graphical analyses are conducted to investigate the influence of morphological and crystalline cha-racteristics on their optical response. The main objective is to evaluate the impact of temperature on spectral conversion efficiency, emission behavior, and optical stability. The observed temperature dependence is discussed in terms of the interplay between radiative and non-radiative relaxation processes. As temperature increases, thermally activated non-radiative pathways become more sig-nificant, enhancing thermal quenching mechanisms and consequently reducing the photolumines-cence quantum yield. Furthermore, stronger electron–phonon coupling promotes spectral broadening and possible peak shifts, reflecting the increased contribution of vibrational modes to the excited-state dynamics. Temperature-induced structural effects, including thermal expansion, confor-mational rearrangements, and variations in crystallinity, may further modify the local electronic en-vironment of the emitting centers, affecting both absorption and emission spectra. Understanding these effects is essential for establishing correlations between optical performance and material structure. The results provide valuable insights into the optimization of wavelength-shifting mate-rials for photon detection systems operating under a wide range of thermal conditions, particularly in cryogenic environments employed by modern high-energy physics experiments.

Primary author: AGUIAR DE MENDONÇA, Ana Paula (Universidade Estadual de Campinas)

Co-authors: BERGAMINI MACHADO, Ana Amélia (Universidade Estadual de Campinas); SEGRETO, Ettore (Universidade Estadual de Campinas); ANDRES RODRIGUES, Ieda (Universidade Estadual de Campinas); LONGHITANO PAGLIUSO, Lucca (Universidade Estadual de Campinas); BARBOSA ALVES, Mirela (Universidade Estadual de Campinas); POMARICO ZETULA, Murilo (Universidade Estadual de Campinas); Mr PILON, Theo Basso (Universidade Estadual de Campinas)

Presenter: AGUIAR DE MENDONÇA, Ana Paula (Universidade Estadual de Campinas)