Investigation of Wavelength Shifting Materials in an Active Helium Target

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The strong nuclear force, responsible for binding nucleons and nuclei together, has proven challenging to study experimentally. Asymptotic freedom allows the strong force to be studied and tested effectively at high energies, however in medium to low energy regimes, it is not well understood. One way of gaining insight into the strong force at this energy is to study neutron scalar polarisabilities, fundamental structure constants akin to charge or mass. In an effort to determine these values to a high order of precision, the A2 Collaboration in Mainz, Germany is implementing an active helium target. One of the main motivations for using this target is that it allows for the collection of scintillation light after a Compton event, which may be used to more accurately identify such events in the analysis. However, the silicon photomultipliers in the active volume are unable to detect the vacuum ultraviolet light emitted by the helium gas, and thus a wavelength shifting material is required. One such material, popular in other scintillating noble gas targets, is an organic compound called Tetraphenyl Butadiene. This material is promising because of its particular ability to shift light from the vacuum ultraviolet to the visible spectrum, where the photomultipliers are most sensitive. This compound was tested in various conditions, and promising preliminary results support further study of this material in the active helium target.