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Development of a novel neutron detector using trapped 3He

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The global demand for portable neutron detection is on the rise for security, monitoring and scientific investigations [1]. Practical uses could include deploying advanced radiological and nuclear detection capabilities at border points, as monitors around small modular reactors for energy or centres for medical radioisotope production, or directly as part of a scientific analysis package. Portable neutron detectors add flexibility and utility and are crucial for various current purposes and planned future uses. Helium-3 (3He) based detectors have been the standard for thermal neutron detection due to their high efficiency and excellent radiation discrimination, however, these detectors tend to be large and obtrusive and require high voltages to operate. [2] Therefore, the development of a compact 3He neutron radiation detector is critical.

Utilising our proprietary adaptation to known fabrication methods, we show how He can be embedded in high quantities. These 3He-embedded materials are then used as converter media, exploiting the reaction between 3He and a thermal neutron to produce tritium and a proton. This release of energy can then be detected using a photodiode. In this work, we will show how we produce these novel materials as well as how we characterise them. We have also incorporated these materials into a detector and shown a neutron response from our converter media.

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[1] Future Market Insights, Inc. "Neutron Detectors Market", REP-GB-17843 Available at: https://www.futuremarketinsights.com/reports/ (Accessed 9 August 2024)
[2] Richard T. Kouzes, et al. Neutron detection alternatives to 3He for national security applications, NIM A, Volume 623, Issue 3, 2010. ISSN 0168-9002 https://doi.org/10.1016/j.nima.2010.08.021

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