# Contributions of Professor Anthony Cowley to the Field of Nuclear Reaction Studies

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Nuclear reaction studies have been used very successfully as a tool to probe the nature of nuclear structure, including single-particle properties of nuclei by means of proton-knockout reactions [1]. Nucleon-induced knockout reactions have also proven useful to unravel details of the nucleon-nucleon interaction, as well as the notion of ground state $\alpha$-clustering in nuclei through, for example ($p$, $p\alpha$) reaction studies. Furthermore, statistical multistep processes such as proton-induced pre-equilibrium emission of $\alpha$-particles can provide deeper understanding of the mechanisms involved in nuclear reactions [2], as well as fundamental nuclear properties such the degree of $\alpha$-clustering in nuclei.

From the early ($p$, $2p$) knockout reaction experiments performed on light $^{2}$H, $^{3}$He and $^{4}$He targets in the 1970s, to his recent 2021 publication looking at the extent to which knockout, as opposed to a pickup reaction mechanism, contributes in pre-equilibrium ($p$, $\alpha$) reactions [3], Anthony Cowley leaves behind a legacy of experimental nuclear physics research and training not only in South Africa, but across the globe. In this talk we specifically look at knockout reactions and the pre-equilibrium emission of composite ejectiles, such as $^{3}$He and $\alpha$ particles, through the different experimental contributions that Anthony Cowley made throughout his 50-year career in nuclear physics research.

### References

[1] A. Gade, and J. Tostevin. Knockout reactions. *Nucl. Phys. News* **20** (2010) 11-16.

[2] A.A. Cowley, *Nucl. Instr. Meth. Phys. Res. A* **977** (2020) 164298

[3] A.A. Cowley, *Phys. Rev. C* **103** (2021) 034622.