The Measurement of Long Lived Alpha Decay Nuclides for Cosmochronometry

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Alpha decay has historically given insight into the inner workings of the nucleus as the decay rate is strongly affected by nuclear structure. Long lived alpha decaying isotopes (about $T_{1/2} \gtrapprox 10^{8-10}$ a) can be used as a powerful tool to date the formation of astronomical objects in the Solar System due to their extremely long half lives. This technique is however very vulnerable to the accuracy of the half-life. This means that improved half-live measurements are important though they pose a significant technical obstacle.

To measure the half-lives of such long lived isotopes besides appropriate targets special care needs to be taken with background and signal efficiency. To overcome these obstacles the design of a twin Frisch-Grid ionisation chamber was chosen [1]. This design combines excellent energy resolution with a hight detection efficiency to measure decay rates in the region of a few counts per day. It is also possible to use pulse shape analysis to obtain position information on each event, allowing for improved signal to background discrimination.

This presentation will give an overview of the detection aspects of the twin Frisch-Grid ionisation chamber, as well as the calibrations that were performed. The latest measurements of the half-lives of ^{147}Sm [2] will also be presented and discussed here. For the first time it will be shown that the direct detection result of the ^{190}Pt [3] half-life agrees with the geological comparison methods. Preliminary results on the decay of ^{154}Dy will also be presented.

[1] A. Hartmann et al., NIM A **814** (2016), pg. 12 - 18

[2] H. Wilsenach et al.,Phys. Rev. C **95** 3 (2017), pg. 034618

[3] Mihály Braun et al., Phys. Lett. B **768** (2017), pg. 317 - 320