Determination of Environmental Dependence on the Half-life of ^{198}Au Undergoing β^- decay

Cyclotron Institute Texas A&M University

Alyssa Dibidad, Florida A&M University

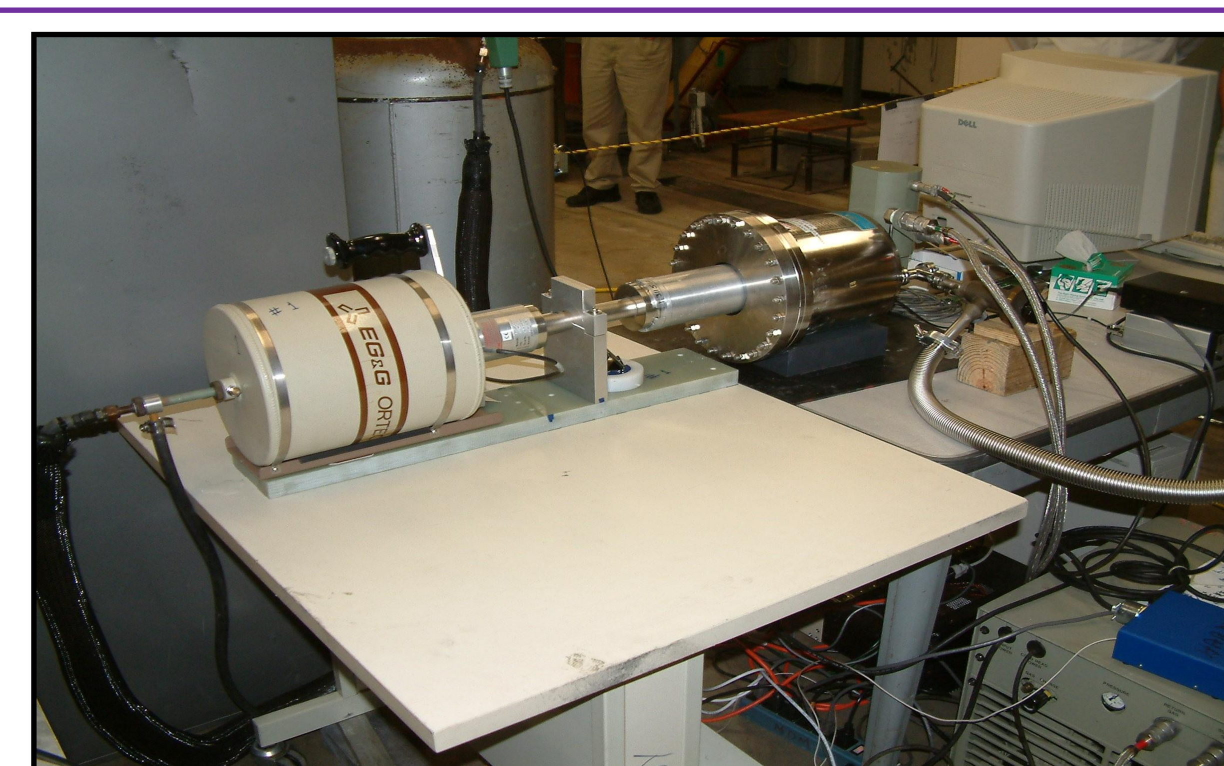
J.C. Hardy, J. Goodwin, Texas A&M University Cyclotron Institute

Introduction

- Half-lives are used to describe the time for decay of a nuclide, where half of the starting material has decayed during one half-life. It had been assumed that half-life was independent of environmental factors.
- A series of articles were published in 2006 and 2007 by the C. Rolfs group, claiming temperature dependence in the half-lives of isotopes undergoing α, β^-, β^+, and electron-capture decays in a conductive environment. It was also suggested by the same group that half-life may change depending on whether the environment was conductive or insulated.
- Simulating the conditions of the Rolfs group experiment with ^{198}Au in a gold environment, our group determined, with a higher precision, that the half-life of ^{198}Au showed no temperature dependence in a conductive environment.
- The current experiment uses ^{198}Au in a gold oxide environment at room temperature.
- The gold oxide is an insulator and we will compare the half-life results between an insulated and conductive environment.

Figure 1 (Left): Experimental Equipment

Figure 2 (Right): Final Positioning



Set-Up/Data Collection

- Gold oxide was irradiated in the TAMU Triga reactor
- The irradiated sample was placed on a planchet, which was attached to the cold head of the cryopump (Fig. 1).
- The cryopump was covered by a plate, then moved into position directly in front of the HPGe detector, with a distance of 42.5mm between the sample and the detector. (Fig. 2).
- The detector signal was sent to an Ortec Trump ™ card, which was controlled by the Maestro program
- Data are being collected for approximately 10 half-lives (about 27 days).

Data Analysis

- The Maestro program collects the data, creating a spectrum of the gamma-ray emissions. Live and dead times are also collected
- The spectra are analyzed using the gf3 fit program on Radware (Fig. 3).
- The gf3 fit program allows us to make a very precise determination of the peak area and uncertainty in each 6-hour spectrum (Fig. 4).
- After all spectra have been analyzed, the results will be evaluated by a maximum likelihood single exponential fit, using the ROOT program.

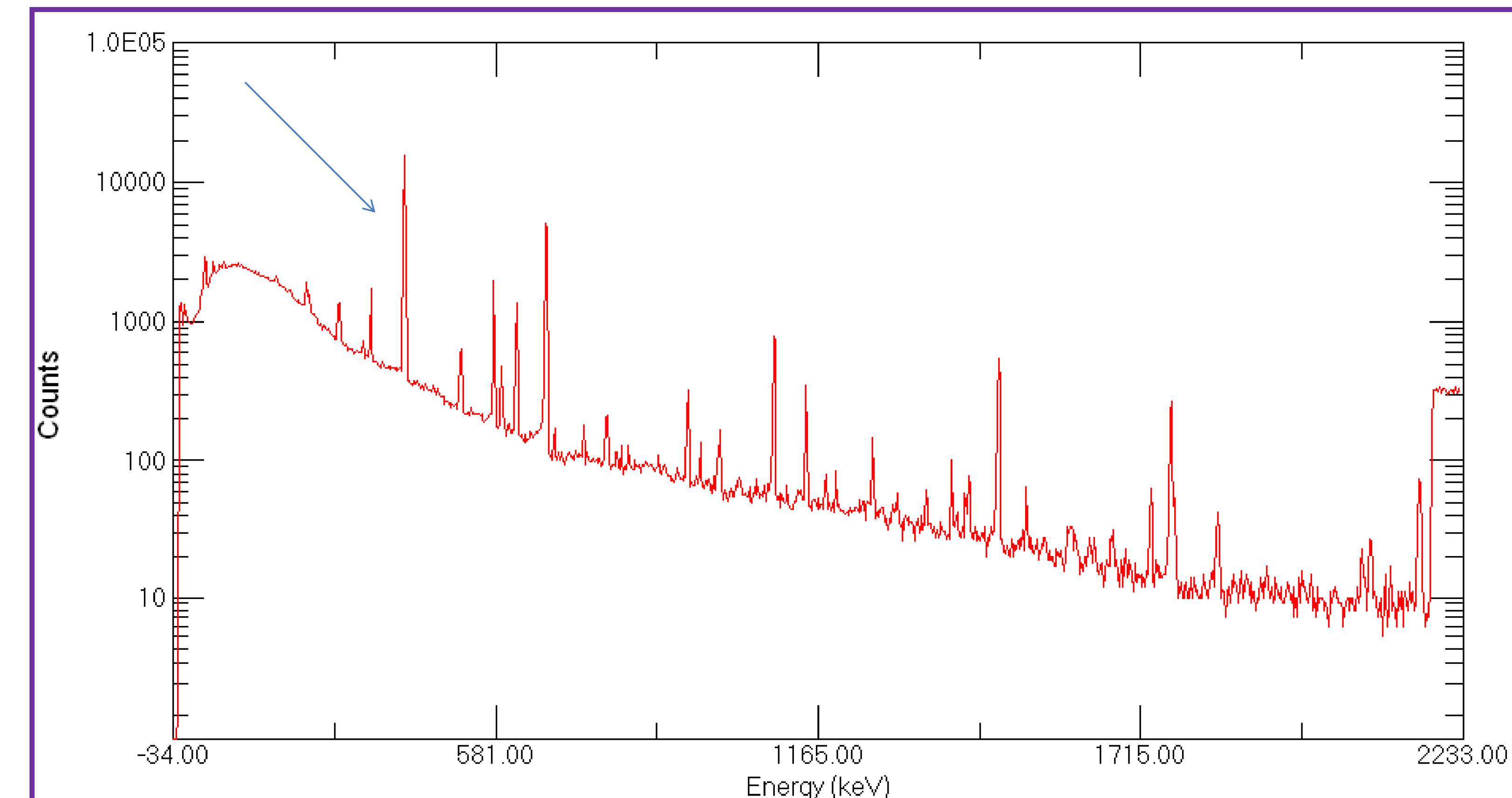


Figure 3: Arrow points to the peak of interest

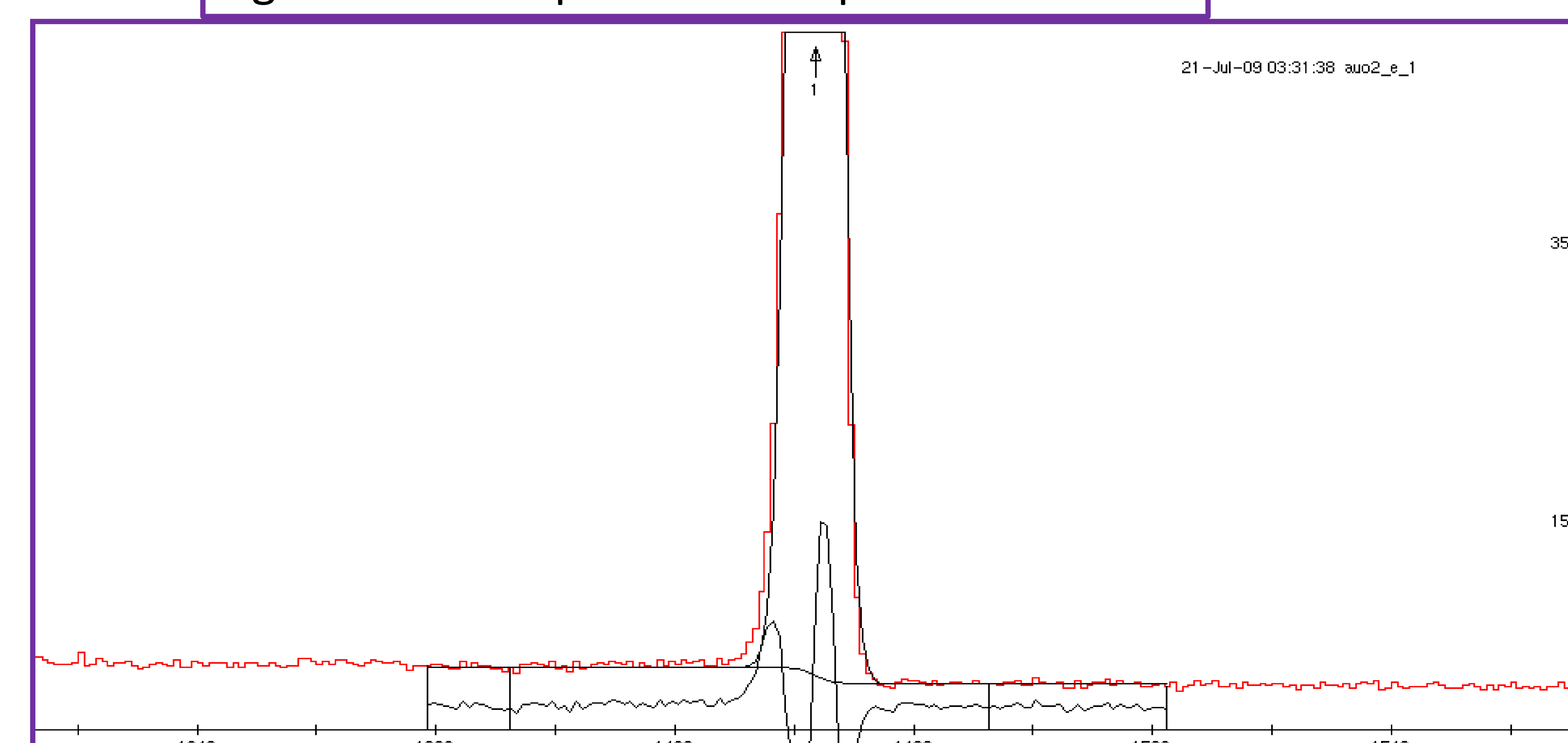


Figure 4: Peak of interest using GF3X_JCH

Conclusion

- At this time, the experiment is still running and is expected to end around August 10, 2009.
- Our latest ROOT fit shows the half-life to be the same (within error bars) as the half-life in metal.

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