An analysis topic that is dear to my heart in the Majorana Demonstrator

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(Dated: November 30, 2016)

A summary of the analysis of the MAJORANA DEMONSTRATOR data in terms of a search for ultracool things about the universe. This template is intended to give the author guidance on what is expected in a unidoc style of analysis documentation. Guidelines such as these are highlighted as this one is in blue background. You may change the sections and headings as you feel appropriate, but those listed here should give some guidance on the level of detail expected from the unidoc. The majority of the text in this document is filler using lipsum for example. I have also used a number of common latex environments and some of the custom commands found above in the filler to demonstrate usage for those less familiar with latex.

CONTENTS

I. INTRODUCTION

This section is for an introduction of the unidoc topic. You may rename it if you wish, but please introduce the topic so the reader understands its relevance.

The measurement of *ultra-cool* things using germanium detectors is long-standing unresolved question (Feldman and Cousins, 1998). A series of papers (Adler, 2007; Curceanu *et al.*, 2014, 2015; Fu, 1997) can confirm this. While developing a solid precedent for cool things with germanium, each of these analyses miss one key aspect. In this unidoc we describe a MAJORANA DEMONSTRATOR analysis that results in an improved limit.

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II. THE SIGNATURE FOR ULTRA-COOL TOPICS

This should explain without ambiguity the techniques used in the analysis and the probably the data required and/or used to show this. If there is some precedent for performing this analysis list the examples here and prior results.

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$$\frac{d\Gamma(E)}{dE} = \frac{\alpha\lambda}{\pi a^2 m_e^2 E}, \tag{1}$$

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$$\lambda < \frac{R_0}{k_T N_{Ge} N_e \gamma}. \tag{2}$$

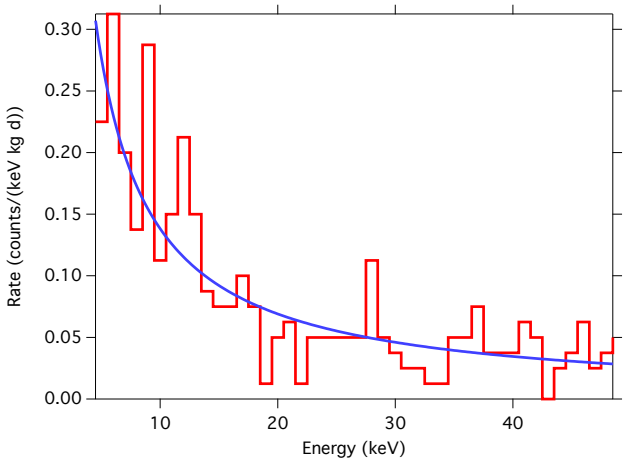

FIG. 1 The energy spectrum from IGEX (Morales *et al.*, 2002) with a fit to the function R_0/E with the result $R_0 = 1.38$ counts/(kg d).

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III. A TEST OF OUR METHODS

Validate your techniques. Since this is a unidoc we want lots of detail here. What did you do to convince yourself the analysis is correct? Did you benchmark your analysis? How did you do this? How does it compare to previous analyses?

The result of our R_0/E fit is shown in Fig. 1 and the resulting value for $R_0 = 1.38$ /(kg k) agrees very will with the previous work.

To convert R_0 into a limit on λ,

$$\lambda < \frac{1.38/\text{kg d}}{(86400\ \text{s/d})(7.96\times10^{24}/\text{kg})(22)(3.46\times10^{-14})} < 2.6\times10^{-18}\ /\text{s}. \quad (3)$$

This result agrees with the previous work.

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IV. MAJORANA ANALYSIS

This is the results, you applied the methods described previously to the data described previously and these are the results you get. First what are they with no interpretation. Next do you have an interpretation of these results? Is future work required? What worked? What didn't?

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V. JOURNAL THOUGHTS

How were previous results published? What journals make sense to present these results in?

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