Yaml2LMS

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CHAPTER

ONE

GENERAL PURPOSE

The purpose of this tool is to convert a *yaml* file into a file usable for multiple-choice questions in LMS. The code also creates LaTeX and PDF files as needed.

1.1 Functionalities

1) Creation of files needed for integration with LMS or Canvas
2) Creation of latex files using the exam class
3) Creation of latex files with answer keys
4) Spellchecking

1.2 Installation

There is no installation needed as this is a simply Python script.

Just make sure to have:

1. A working LaTeX environment in place
2. Python installed

If you use specific Latex packages in your mathematical formulas, you will need to edit the python script directly (work in progress to make this process simpler).

CHAPTER

TWO

BASIC USAGE AND CONFIGURATION FILE

run the python script in a directory where the `config.yaml` file described below is located.

2.1 Configuration file

All information is provided in the `config.yaml` input file. The file reads as:

```
yamlfile: quiz20.yaml
spellcheck: no
createLMS: yes
createLMS_text: no
base: "http://homepages.rpi.edu/~meuniv/Images/TSM_F20/"
dir: "THERMO"
title1: 'PHYS {4420}: Thermodynamics and Statistical Mechanics (Quiz 20)'
title2: "Dr. Vincent Meunier, Fall 2020"
solutionKey: yes
```

The various keywords (ending with a `:`) are mostly self-explanatory.

1. `yamlfile` provides the actual file with the list of questions (see here: *YAML Format (input)*)
2. `spellcheck` is a *yes/no* input (more information can be found here: *Spellchecking*)
3. `createLMS` and `createLMS_text` are *yes/no* answers (see here: *LMS Output*)
4. `base` is only used if the `createLMS: yes` is used. It is also described in *LMS Output*.
5. `dir` is only used if the `createLMS: yes` is used. It is also described in *LMS Output*.
6. `title1` and `title2` are used to assemble the PDF files (both the raw exam and the version with answer keys when requested)
7. `solutionKey` is a *yes/no* input. This provides the answer Key in a PDF file with highlighted answers (see here *Portable Data File creation*)

Note: This configuration file was used to create the examples shown in *Example of multiple questions*.

CHAPTER

THREE

PORTABLE DATA FILE CREATION

By default, *yaml2lms* always creates a PDF file, using latex processing and the exam class. The output file name (**<prefix>.pdf**) is built based on the *yaml* file name provided using `yamlfile: <prefix>.yaml` in *config.yaml*.

The document will have a two-line title, provided by the tags `title1` and `title2` in the *config.yaml* file.

An example of PDF file output is shown in *Example of multiple questions*.

Two additional PDF files can be created if requested in the *config.yaml* files as described below.

3.1 Answer Key PDF file

If `solutionKey: yes` is specified, in addition to the questionnaire itself, a file, named **<prefix>_solutions.pdf** is created where the *correct* asnwers are highlighted. (See *Example of multiple questions* for an example).

3.2 Spellchecked PDF file

If `spellcheck: yes` is specified, *yaml2.lms* performs a rudimentary spell checking of the input. This feature is described in details at *Spellchecking*.

Note: It is recommended to carefully check the PDF files before starting the process of creating LMS files. The `createLMS: yes` option can take a few minutes or so to process, depending on the number of questions. And it is best to perform this once you have checked the spelling and the correctness of the answer keys. Note, also, that the spellchecking is time consuming and once you are done spellchecking, it is best to turn that option off.

CHAPTER

FOUR

LMS OUTPUT

One of the major goals of *yaml2lms* is to create an interface between a list of questions you create locally to a format that can be directly imported into an online teaching platform such as Blackboard. It is called Learning Management System (LMS) at Rensselaer Polytechnic Institute. However, the same format is used widely in systems such as *canvas*.

It is possible to import questions on LMS but the format is somewhat difficult to handle. The format can be found at various places online, such as as on the Blackboard website.

The primary goal of this script is to translate the *yaml*-formatted questions into a file readable by Blackboard.

4.1 Text only

If you only have unformatted text in your questions, this is the option you need to use in the *config.yaml* file (`createLMS_text: yes`), as described in *Basic usage and configuration file*. In this case, all the information is stored in a file that can be directly uploaded onto lms.

Note: the name of the output file is built from the <prefix> of the input file name provided in *config.yaml* under `yamlfile: <prefix>.yaml` to which "_LMS_text.txt" is appended.

Example:

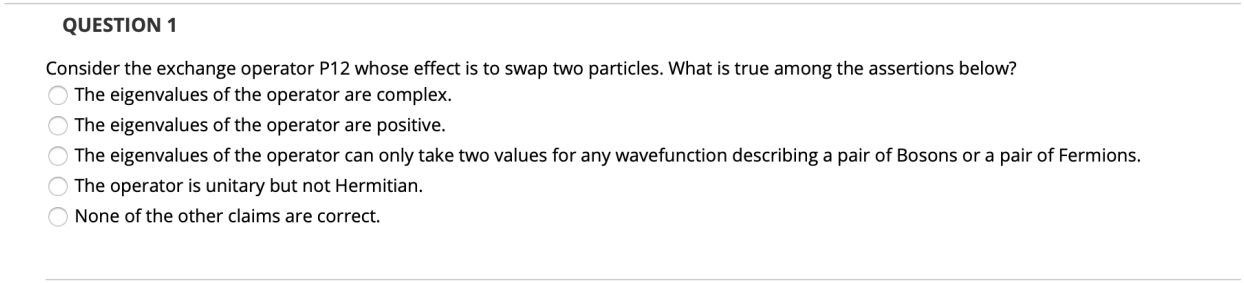
If the input is:

```
- Type: MC
  Text: >-
    Consider the exchange operator P12 whose effect is to swap two
    particles. What is true among the assertions below?
  Answers:
  - Choice: The eigenvalues of the operator are complex.
  - Choice: The eigenvalues of the operator are positive.
  - Choice: >-
      The eigenvalues of the operator can only take two values for any
      wavefunction describing a pair of Bosons or a pair of Fermions.
    Validity: correct
  - Choice: 'The operator is unitary but not Hermitian.'
  - Choice: 'None of the other claims are correct.  '
  Note: lecture 29
```

The output becomes:

```
MC Consider the exchange operator P12 whose effect is
 to swap two particles. What is true among the assertions below?
 The eigenvalues of the operator are complex.  incorrect The
 eigenvalues of the operator are positive.  incorrect The
 eigenvalues of the operator can only take two values for any
 wavefunction describing a pair of Bosons or a pair of Fermions.
 correct The operator is unitary but not Hermitian.  incorrect
 None of the other claims are correct.  incorrect
```

You can upload the file `<prefix>_lms_text.txt` on LMS when creating a new test (or adding a question to an existing test) and you obtain a result like this:



QUESTION 1

Consider the exchange operator P12 whose effect is to swap two particles. What is true among the assertions below?

- The eigenvalues of the operator are complex.
- The eigenvalues of the operator are positive.
- The eigenvalues of the operator can only take two values for any wavefunction describing a pair of Bosons or a pair of Fermions.
- The operator is unitary but not Hermitian.
- None of the other claims are correct.

Note: In this example, we only used one question but if the *yaml* file contains multiple questions, they will be included into the test on LMS.

4.2 LMS using images

The method described above works very well and is very fast in terms of processing time. However, it does not allow for fancy formatting and, while possible, the inclusion of math symbols is neither straitghforward nor totally satisfactory. Here, I describe the second method to create an LMS test using more advanced formatting. In this case you need to use this option: `createLMS: yes`.

It is **important to note** that this mode uses a collection of small images to assemble the questions (each image is created by LaTeX). So, the only caveat with this method is that you need a place where you will copy the images and that place has to be accessible on the web.

Important: The *LMS using images* mode is only possible if you have a place where you can copy the images to be accessible on a browser.

The place where the images will be copied is provided in the keyword `base: <httpsite>` provided in file *config.yaml*, as described in *Basic usage and configuration file*.

Note: the name of the output file is built from the <prefix> of the input file name provided in *config.yaml* under `yamlfile: <prefix>.yaml` to which "_LMS_png.txt" is appended.

Let's describe the process using an example. The example is similar to the one we use for the text-only option but in this case, we added some latex codes and also some formating code.

If the input is:

```
- Type: MC
  Text: >-
    Consider the exchange operator $\hat{P}_{12}$  whose effect is to swap two
    particles. What is \textbf{true} among the assertions below?
  Answers:
  - Choice: The eigenvalues of the operator are \textit{complex}.
  - Choice: The eigenvalues of the operator are positive.
  - Choice: >-
      The eigenvalues of the operator can only take two values for any
      wavefunction describing a pair of Bosons or a pair of Fermions.
    Validity: correct
  - Choice: 'The operator is unitary but not Hermitian.'
  - Choice: 'None of the other claims are correct.  '
  Note: lecture 29
```

When using the option `createLMS: yes`, *yaml2lms* creates a file `<prefix>_lms_png.txt` along with a directory with a collection of images The output stored in `<prefix>_lms_png.tx` looks something like this (though you will probably never have to look at it, as the idea of the script is to avoid it!)

```
MC <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0.png"
height="33" /></p> <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0_0.
↪png"
height="33" /></p> incorrect <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0_1.
↪png"
height="33" /></p> incorrect <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0_2.
↪png"
height="33" /></p> correct <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0_3.
↪png"
height="33" /></p> incorrect <p><img
src="http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3/Q0/Q0_4.
↪png"
height="33" /></p> incorrect
```

You can see from the example that the script tells LMS that the various image files are stored, in this example, at "http://homepages.rpi.edu/~meuniv/Images/TSM_F20/Questions_THERMO_test3".This address was created using the `base: "http://homepages.rpi.edu/~meuniv/Images/TSM_F20/"` provided in *config.yaml* and the directory is built from `dir: "THERMO"`.

Now that you have completed this, you only need two more steps.

1. Copy the image directory to the place where you want to move the file. This can be done easily with a method such as `scp -r Questions_THERMO_test3 meuniv@rcs.rpi.edu:~/public_html/Images/TSM_F20/`. This line is provided for your convenience at the end of the script. Of course you need to change the username and the address of the server where you place the file. Here I use the space provided by my university but using a different repository may not be a bad idea (github or even dropbox).
2. Go to LMS and upload the questions, using the file `<prefix>_lms_png.txt` as described above.

After uploading the question, the exam looks like this:

QUESTION 1

Consider the exchange operator $\hat{P}_{12}$ whose effect is to swap two particles.
What is **true** among the assertions below?

- The eigenvalues of the operator are *complex*.
- The eigenvalues of the operator are positive.
- The eigenvalues of the operator can only take two values for any wavefunction describing a pair of Bosons or a pair of Fermions.
- The operator is unitary but not Hermitian.
- None of the other claims are correct.

The content is the same as in the example using text only. I personally prefer this approach as it makes for much nicer looking exam, even when no math is required. However, note that the other method is somewhat more straighforward.

Important: Do not turn on the creation of LMS file (either methods) until you have carefully checked the PDF created with the default options. It is also important to check that the asnwers you selected as correct are indeed correct (check the PDF with the answer keys). It is always possible to change that on LMS itself but it is not as easy.

CHAPTER

FIVE

YAML FORMAT (INPUT)

Each question is provided in *yaml* format. The format is somewhat unforgiving as spacings and alignments need to be correct for the file to be readable. Below is an example of simple question using this format. Each line will be described in details.

5.1 Question example

```
1   - Type: MC
2     Text: >-
3      In the screencast we derived an expression for the Fermi-Dirac distribution
4      using the grand canonical ensemble. What is the grand canonical ensemble?
5     Size: Auto
6     Points: 2
7     Answers:
8      - Choice:  >-
9          The ensemble of systems with fixed energy and entropy.
10       Validity: incorrect
11     - Choice: >-
12         The ensemble of systems with fixed energy and chemical potential.
13       Validity: incorrect
14     - Choice: 'The ensemble of systems with fixed temperature and chemical␣
    ↪potential.'
15       Validity: correct
16     Skip: 'no'
17     Note: question regarding lecture 29
```

5.2 Anatomy of a question

We will now review each line. Basically, all name that are followed by ":" is a key in a dictionary. If you wish to use a ":" in your questions or answers, you need to use quotation marks (or the >- sign – it is usually used for text with multiple lines).

1. New question starts with the type.

```
- Type: MC
```

Each new question starts with a `- Type:` keyword. The options are: `MC` (Multiple Choice), `MA` (Multiple Answers),...

2. Description of the question itself.

```
- Text: 'This is my question'
```

or

```
- Text: >-
   This is a multiline question with various parts in it.
   Try it if you want to.
```

Tip: The advantage of this appraoch is that you can use Latex commands in both text and math modes in all the texts used in the yaml file.

3. For multiple-choice questions, you then have the list of possible answers:

```
Answers:
     - Choice:  >-
         The ensemble of systems with fixed energy and entropy.
       Validity: incorrect
```

Each Choice can be entered in a single-line or multiline format. There is a second keyword called `Validity` (case sensitive) to assign an *incorrect* or *correct* attribute to the choice. Note that you only need to provide the information for a *correct* asnwer as the script will assign an *incorrect* attribute by default.

- Note 1: You can list as many *Choice* lines as you need.
- Note 2: For some types of questions, only one answer can have the `Validity: correct` attribute.

4. You can skip the question from the file without deleting it by using: `Skip: 'no'` (this is an optional keyword)
5. To keep things tidy, you can add a note for each question, using the `Note:` keyword.

Hint: A good habit is to check your *yaml* file using a free online tool such as those provided by onlineyamltools.com (see, here: https://onlineyamltools.com/validate-yaml). After a while you won't make a mistake anymore but early on, this could be frustrating.

CHAPTER

SIX

SPELLCHECKING

Note: This features remains in development but can be useful to identify basic typos.

6.1 Usage

When you use the `spellcheck: yes` in the `config.yaml` file, *yam2lms* will perform a spellcheck of the questions. Currently, the script uses the python library provided in the `spellchecker` module.

The script will check all words in the document and provide a corrected version called `XXX_SPELLCHECKED.pdf` file. Using the example provided in *YAML Format (input)*, we get the result shown below.

6.2 Notes

1. The process is slow. Once you have run this and corrected your mistake, turn this off to avoid lenghty processing.
2. *yaml2lms* does not make any correction; instead it makes suggestions as shown in the exmaple below. In this example, most of the mistakes found are actually **not** mistakes and it is expected each user will look into this separately. Only one word was correctly flagged as incorrect.

6.3 Example

PHYS 4420: Thermodynamics and Statistical Mechanics (Quiz 20)
Dr. Vincent Meunier, Fall 2020

1. Among the following claims, which one is **not** true?
    A. ~~Bosons~~ Sons have an ~~integer~~ inter spin value and ~~Fermions~~ Versions have an half ~~integer~~ inter spin value.
    B. ~~Bosons~~ Sons and ~~Fermions~~ Versions are treated as ~~indistiguishable~~ indistinguishable particles.
    C. Multiple ~~Fermions~~ Versions can occupy the same quantum state.
    D. Multiple ~~Bosons~~ Sons can occupy the same quantum state.
    E. All the other claims are correct.
2. Consider the exchange operator $\hat{P}_{12}$ whose effect is to swap two particles. ~~What~~ That is true among the ~~assertions~~ assertion below?
    A. The eigenvalues of the operator are complex.
    B. The eigenvalues of the operator are positive.
    C. The eigenvalues of the operator can only take two values for any wavefunction describing a pair of ~~Bosons~~ Sons or a pair of ~~Fermions.~~ Versions.
    D. The operator is ~~unitary~~ unity but not Hermitian.
    E. ~~None~~ One of the other claims are correct.
3. ~~At~~ It low energy, ~~Fermions~~ Versions and ~~Bosons~~ Sons follow the same statistical distribution.
    A. ~~This~~ His is always true.
    B. ~~This~~ His is sometimes true.
    C. ~~This~~ His is never true.
4. ~~What~~ That can you say about the chemical potential (μ)?
    A. It is small when the density of matter (n) is small.
    B. It is small when the density of matter (n) is large.
    C. It does not depend on the density of matter (n).
5. ~~At~~ It high energy (large $E - \mu$ values), we can use the Botzmann, ~~Fermi-Dirac,~~ Terms-Lilac, or ~~Bose-Einstein~~ Rose-Einstein disributrions to study any gas of particles (e.g., ~~photons,~~ photius, electrons,...)
    A. ~~This~~ His is true because this corresponds to the low density limit.
    B. ~~This~~ His is false because the three ~~distributions~~ distribution do not converge to one another at high energy.
    C. ~~This~~ His is a very good question. I ~~wil~~ will make sure to read page 598 of the ~~slides~~ sides posted on SLACK to understand the answer.
6. Consider a ~~bosonic~~ masonic particle extracted from a large distribution of the same particles. A specific measurement shows that its energy is ~~1 eV~~ 1 e below the chemical potential of the distribution. ~~What~~ That can you conclude?
    A. The particle is very stable.
    B. The ~~entropy~~ entry of the particle is very small.
    C. ~~Researchers~~ Researches who performed the ~~measurements~~ measurement should sign up for PHYS-2350 at RPI: their measurement is clearly wrong.

CHAPTER

SEVEN

EXAMPLE OF MULTIPLE QUESTIONS

7.1 Yaml input

```
- Type: MC
  Text: 'Among the following claims, which one is \textbf{not} true?'
  Size: Auto
  Points: 2
  Answers:
  - Choice: Bosons have an integer spin value and Fermions have an half integer spin␣
↪value.
  - Choice: Bosons and Fermions are treated as indistiguishable particles.
  - Choice: Multiple Fermions can occupy the same quantum state.
    Validity: correct
  - Choice: Multiple Bosons can occupy the same quantum state.
  - Choice: 'All the other claims are correct.  '
  Note: lecture 29
- Type: MC
  Text: >-
     Consider the exchange operator $\hat{P}_{12}$ whose effect is to swap two
     particles. What is true among the assertions below?
  Size: Auto
  Points: 2
  Answers:
  - Choice: The eigenvalues of the operator are complex.
  - Choice: The eigenvalues of the operator are positive.
  - Choice: >-
      The eigenvalues of the operator can only take two values for any
      wavefunction describing a pair of Bosons or a pair of Fermions.
    Validity: correct
  - Choice: 'The operator is unitary but not Hermitian.'
  - Choice: 'None of the other claims are correct.  '
  Note: lecture 29
- Type: MC
  Text: 'At low energy, Fermions and Bosons follow the same statistical distribution.'
  Size: Auto
  Points: 2
  Answers:
  - Choice: This is always true.
  - Choice: This is sometimes true.
  - Choice: This is never true.
    Validity: correct
  Note: lecture 29
- Type: MC
```

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```
  Text: What can you say about the chemical potential ($\mu$)?
  Size: Auto
  Points: 2
  Answers:
  - Choice: It is small when the density of matter ($n$) is small.
    Validity: correct
  - Choice: It is small when the density of matter ($n$) is large.
  - Choice: 'It does not depend on the density of matter ($n$).  '
  Note: lecture 29
- Type: MC
  Text: >-
   At high energy (large $E-\mu$ values), we can use the Botzmann,
   Fermi-Dirac, or Bose-Einstein disributrions to study any gas of
   particles (e.g., photons, electrons,\ldots)
  Size: Auto
  Points: 2
  Answers:
  - Choice: 'This is true because this corresponds to the low density limit. '
    Validity: correct
  - Choice: >-
      This is false because the three distributions do not converge to  one
      another at high energy.
  - Choice: >-
      This is a very good question. I wil make sure to read page 598 of  the
      slides posted on SLACK to understand the answer.
  Note: lecture 29
- Type: MC
  Text: >-
   Consider a bosonic particle extracted from a large distribution of the  same
   particles. A specific measurement shows that its energy is 1~eV  below the
   chemical potential of the distribution.  What can you conclude?
  Size: Auto
  Points: 2
  Answers:
  - Choice: 'The particle is very stable. '
    Validity: incorrect
  - Choice: 'The entropy of the particle is very small. '
    Validity: incorrect
  - Choice: >-
     Researchers who performed the measurements should sign up for  PHYS-2350
     at RPI: their measurement is clearly wrong.
    Validity: correct
  Note: lecture 29
```

7.2 Latex Output

The latex output for this entry is thus:

PHYS 4420: Thermodynamics and Statistical Mechanics (Quiz 20)
Dr. Vincent Meunier, Fall 2020

1. Among the following claims, which one is **not** true?
    A. Bosons have an integer spin value and Fermions have an half integer spin value.
    B. Bosons and Fermions are treated as indistiguishable particles.
    C. Multiple Fermions can occupy the same quantum state.
    D. Multiple Bosons can occupy the same quantum state.
    E. All the other claims are correct.
2. Consider the exchange operator $\hat{P}_{12}$ whose effect is to swap two particles. What is true among the assertions below?
    A. The eigenvalues of the operator are complex.
    B. The eigenvalues of the operator are positive.
    C. The eigenvalues of the operator can only take two values for any wavefunction describing a pair of Bosons or a pair of Fermions.
    D. The operator is unitary but not Hermitian.
    E. None of the other claims are correct.
3. At low energy, Fermions and Bosons follow the same statistical distribution.
    A. This is always true.
    B. This is sometimes true.
    C. This is never true.
4. What can you say about the chemical potential (μ)?
    A. It is small when the density of matter (n) is small.
    B. It is small when the density of matter (n) is large.
    C. It does not depend on the density of matter (n).
5. At high energy (large $E - \mu$ values), we can use the Botzmann, Fermi-Dirac, or Bose-Einstein disributrions to study any gas of particles (e.g., photons, electrons,...)
    A. This is true because this corresponds to the low density limit.
    B. This is false because the three distributions do not converge to one another at high energy.
    C. This is a very good question. I wil make sure to read page 598 of the slides posted on SLACK to understand the answer.
6. Consider a bosonic particle extracted from a large distribution of the same particles. A specific measurement shows that its energy is 1 eV below the chemical potential of the distribution. What can you conclude?
    A. The particle is very stable.
    B. The entropy of the particle is very small.
    C. Researchers who performed the measurements should sign up for PHYS-2350 at RPI: their measurement is clearly wrong.

7.3 Latex Output with keys

If you used the `SolutionKey: yes` option, you would get:

PHYS 4420: Thermodynamics and Statistical Mechanics (Quiz 20)
Dr. Vincent Meunier, Fall 2020 **Answer Key**

1. Among the following claims, which one is **not** true?
   A. Bosons have an integer spin value and Fermions have an half integer spin value.
   B. Bosons and Fermions are treated as indistiguishable particles.
   C. Multiple Fermions can occupy the same quantum state.
   D. Multiple Bosons can occupy the same quantum state.
   E. All the other claims are correct.

2. Consider the exchange operator $\hat{P}_{12}$ whose effect is to swap two particles. What is true among the assertions below?
   A. The eigenvalues of the operator are complex.
   B. The eigenvalues of the operator are positive.
   C. The eigenvalues of the operator can only take two values for any wavefunction describing a pair of Bosons or a pair of Fermions.
   D. The operator is unitary but not Hermitian.
   E. None of the other claims are correct.

3. At low energy, Fermions and Bosons follow the same statistical distribution.
   A. This is always true.
   B. This is sometimes true.
   C. This is never true.

4. What can you say about the chemical potential (μ)?
   A. It is small when the density of matter (n) is small.
   B. It is small when the density of matter (n) is large.
   C. It does not depend on the density of matter (n).

5. At high energy (large $E - \mu$ values), we can use the Botzmann, Fermi-Dirac, or Bose-Einstein disributrions to study any gas of particles (e.g., photons, electrons,...)
   A. This is true because this corresponds to the low density limit.
   B. This is false because the three distributions do not converge to one another at high energy.
   C. This is a very good question. I wil make sure to read page 598 of the slides posted on SLACK to understand the answer.

6. Consider a bosonic particle extracted from a large distribution of the same particles. A specific measurement shows that its energy is 1 eV below the chemical potential of the distribution. What can you conclude?
   A. The particle is very stable.
   B. The entropy of the particle is very small.
   C. Researchers who performed the measurements should sign up for PHYS-2350 at RPI: their measurement is clearly wrong.

CHAPTER

EIGHT

WORK IN PROGRESS AND FUTURE UTILITIES:

Yaml2LMS is a hack. It is not perfect but it gets the job done in many cases.

THere are many things that can be improved (send your suggestions to me).

Here is a list of things I'm working on:

1) Improved spellchecker
2) Better management of latex packages