

Precise predictions of stellar occultations by Pluto, Charon, Nix, and Hydra for 2008-2015

M. Assafin, J. I. B. Camargo, et al.

Tópicos de Ocultações no Sistema Solar, 2017 B

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Introdução

Stellar occultation predictions: astrometric rationale

Observation at ESO

Astrometry

The catalog of star positions along Pluto's 2008-2015 sky path

Pluto's ephemeris offsets

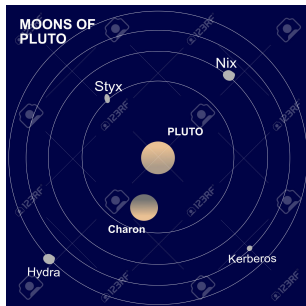
Search procedure for candidate stars

Predictions of stellar occultations by Pluto and its satellites

Discussion

Objetivo

Predição precisa de ocultações estelares por Pluto e seus satelites Caronte Hydra e Nix.



Introdução

- The first consistent efforts for the prediction of stellar occultations by Pluto are described in Mink & Klemola (1985) and cover the period 1985-1990.
- McDonald & Elliot (2000a,b) prediction, now covering the period 1999-2009.

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Two important common limitations were the **astrometric precision of about only $0''.2$** and the lack of **stellar proper motions** leading to uncertainties on the order of the Earth radius for the predicted shadow paths. Also, these earlier predictions were degraded by **poorer precision of older ephemerides**, an issue which changed with the constant feed of new Pluto positions.

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Two important common limitations were the **astrometric precision of about only $0''.2$** and the lack of **stellar proper motions** leading to uncertainties on the order of the Earth radius for the predicted shadow paths. Also, these earlier predictions were degraded by **poorer precision of older ephemerides**, an issue which changed with the constant feed of new Pluto positions.

To overcome these and other problems, we carried out an observational program at the ESO2p2/WFI instrument during 2007

- Estudar as propriedades de Pluto e suas luas é essencial para entender os Transnetunianos. Os quais são importantes para compreender a estrutura e evolução do Sistema Solar.
-

Color styles

These are some useful pre-defined color styles.

- This is **alert**.
- This is **Alert**.
- This is **ALERT**.
- This is **comment**.
- This is **Comment**.
- This is **COMMENT**.

Some colors like **FlipGreen** and **FlipSand** will automatically change tint when when you define light or dark backgrounds.

This makes it easier to swap between light/dark backgrounds by just modifying one option and recompiling.

The 'comment' styles are automatically footnote-sized.

Absolute placement

This slide demonstrates

- **absolute placement** of images using the `put` command in the `picture` environment.
- Note the overlap. Further, note that the particular depend on where the picture is defined.

If you define the picture at the top of the slide, then it will have fixed coordinates (using the `[t]` alignment). The cost is that the image is then behind all the text.

- Beamer respects `png` and `pdf` transparencies.

Image: <http://www.smbc-comics.com/index.php?db=comics&id=2109>

Some alternatives for placing images: [http:](http://www.texample.net/tikz/examples/transparent-png-overlay/)

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Absolute placement

This slide demonstrates

- `absolute` positioning using the `put` command in the `pic` package.
- Note that the particular depend on where the image is placed. If you place the image on the slide, then it will have fixed coordinates (e.g. `(10,10)`). The cost is that the image is then behind the text.
- Beamer requires transparency.

Image: <http://www.smbc-comics.com/index.php?db=comics&id=2109>

Some alternatives for placing images: <http://www.danabell.net/dikz/examples/transparent-png-overlay/>

<http://www.danabell.net/dikz/examples/transparent-png-overlay/>

Columns

Sometimes it's useful to split the screen

Test why is it gray?

Here's a column where I can write a bunch of things.

There are all sorts of things I can do in paragraph form.

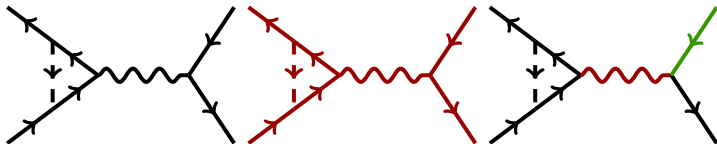
- Here's a column
- where I can itemize
- a bunch of things.

Blocks

...work in here too.

Sample Feynman Diagrams

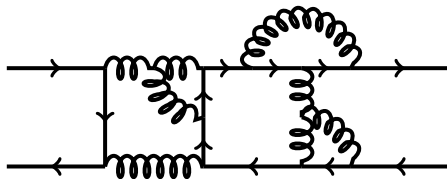
Using `tikzfeynman.sty`, you can draw Feynman diagrams with ease. The default color follows the normal text, so it automatically changes color when you swap from a light to a dark background.



This makes it easy to copy and paste TikZ code from your paper! You can also import diagrams as images. Be sure to use an empty background and pdf/png format to ensure transparency.

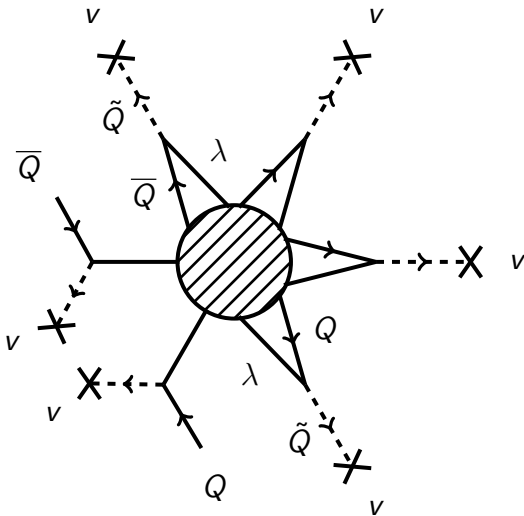
More Feynman Diagrams

Note that TikZ code is preferred because it will automatically change colors and its easy to modify.

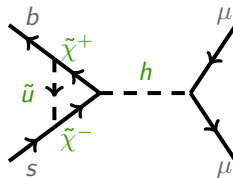
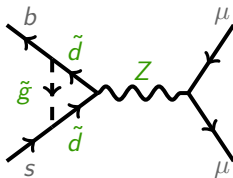
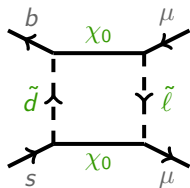


More Feynman diagrams

't Hooft operator



Even more diagrams



TikZ and Beamer are both built on PGF, so they play together very nicely.

Feynman diagrams and overlays

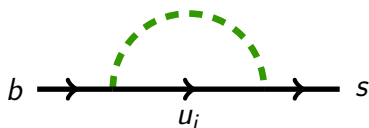


Penguin diagram

Allows FCNC sub-diagram to occur on-shell.

Here's an example where a sequence of overlays can be used to illustrate some useful physics.

Feynman diagrams and overlays

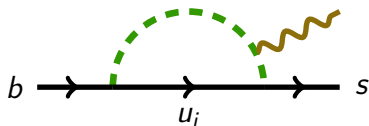


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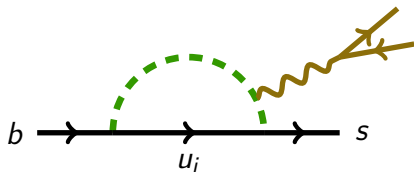


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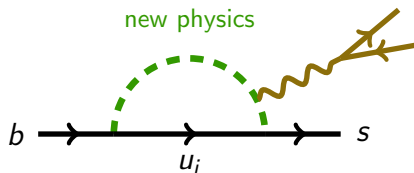


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Feynman diagrams and overlays



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Here's an example where a sequence of overlays can be used to illustrate some useful physics.

Other diagrams

Here's a nice picture illustrating Seiberg duality:

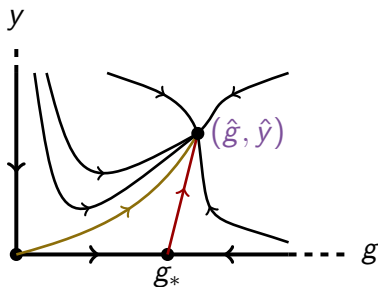


Image based on Strassler's 'unorthodox' review of SUSY gauge theory.

Including a table

Here's how you include a table.

Channel	Expt.	Bound (90% CL)	SM Prediction
$B_s^0 \rightarrow \mu^+ \mu^-$	CDF II	$< 4.7 \times 10^{-8}$	$(4.8 \pm 1.3) \times 10^{-9}$
$B_d^0 \rightarrow \mu^+ \mu^-$	CDF II	$< 1.5 \times 10^{-8}$	$(1.4 \pm 0.4) \times 10^{-10}$
$B_s^0 \rightarrow \mu^+ e^-$	CDF II	$< 2.0 \times 10^{-7}$	≈ 0
$B_d^0 \rightarrow \mu^+ e^-$	CDF II	$< 6.4 \times 10^{-8}$	≈ 0

Some equations

As if you didn't think Beamer could typeset equations...

$$\left(\frac{\Lambda}{m}\right)^b = \left(\frac{\Lambda_L}{m}\right)^{b_L} \Rightarrow \left(\frac{\Lambda_{N,F}}{m}\right)^{3N-F} = \left(\frac{\Lambda_{N,F-1}}{m}\right)^{3N-(F-1)}$$

$$G_k(z, z') = \frac{(R')^2}{R} G_y(x, x') = \frac{(R')^2}{R} \frac{xx'}{y} \frac{T(x, y) T(x', y)}{S(wy, y)}$$

$$f_c = \sqrt{\frac{1 - 2c}{1 - (R/R')^{1-2c}}}$$

Design Notes

Watermarking

- Watermarks need to really be **transparent** or else the background won't show through, e.g. if your background color is not plain white. Fortunately, PGF respects png transparency so watermark images can be saved as png images. Alternately, if you have a nice vector representation in TikZ, you can use the “opacity” option to make it semi-opaque.
- The second problem with watermarks is that even once you have a transparent image, how do you stick it **behind** the main text of each slide? This is surprisingly subtle. The solution is to put all watermarks the “sidebar right” region controlled by the outer theme style. Anything placed here will remain **behind** the main text of the screen.
- At the moment this is not implemented in this theme.

Aesthetic use of arrows and nodes

The WIMP Miracle

Contains factors of $M_{\text{Pl}}, s_0, \dots$

$$\Omega_{\text{DM}} h^2 \approx 0.1 \left(\frac{x_f}{20} \right) \left(\frac{g_*}{80} \right)^{-\frac{1}{2}} \left(\frac{\langle \sigma v \rangle_0}{3 \times 10^{-26} \text{ cm}^3/\text{s}} \right)$$

$$\sim \left\langle \frac{\alpha^2 v}{(100 \text{ GeV})^2} \right\rangle$$

<http://www.texample.net/tikz/examples/beamer-arrows/>

Node decorations, arrows

The new scalar interactions take the form

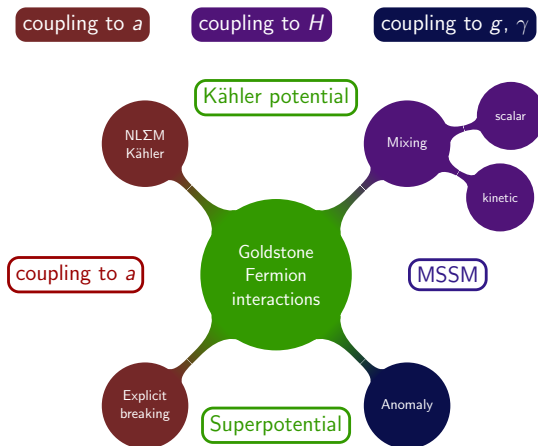
$$\mathcal{L} \supset \left[\frac{1}{2}(\partial a)^2 + \frac{1}{2} \bar{\chi} \not{\partial} \chi \right] \left(1 + c_h \frac{v}{f} h + \dots \right)$$

c_h depends on c_i and the Higgs mixing angles.

c_h controls direct detection

Mind Maps

```
usetikzlibrary{mindmap}
```

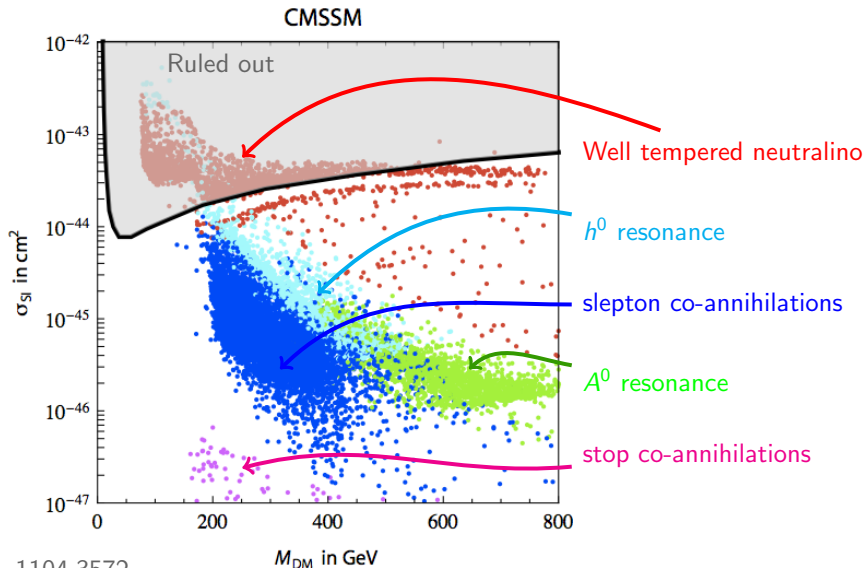


Fonts

Some comments on fonts.

- I use *XeLaTeX* and `fontspec` to specify local fonts. I try to only use readily available fonts on OS X and Adobe, but occasionally I will use a silly font like.
- To mitigate incompatibility with users without these fonts, I include them as user-specified commands in the main file:

Drawing arrows onto a plot



1104.3572

Miscellaneous

- Use `\only<2>` to only show something for one overlay
- Can also use `<2->`
- For example, can highlight a word
- If you use `\uncover<3->` you get a ... see?
- Protip: use `\textbackslash` to get a backslash

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- Protip: use `\textbackslash` to get a backslash

Problems and Kludges

Things to work on

- There seems to be a bug in Beamer where the footnote color (defined using `setbeamercolor{footnote}` and `setbeamercolor{footnote mark}`) contaminates the normal text color. For now I suggest not using footnotes. They're of questionable use in a talk, anyway.
- Even though comment text is footnote-sized, it still has normal text line spacing. The `setspace` environment can fix this, but it forces a newline and it seems to make footnotes disappear.
- Make color theme more uniform and based on palette colors.

Problems and Kludges

XeLaTeX, LuaLaTeX

XeLaTeX doesn't allow one to use `setbeamertemplate[background canvas]` multiple times (e.g. to have one slide with a different background). A fix is to include `\def \pgfsysdriver{pgfsys-dvipdfmx.def}` before the `documentclass`, but this ends up breaking the arrows pointing to nodes.

In principle, LuaLaTeX can solve this, but that also requires some work since it only looks at Open Type Fonts (e.g. Gill Sans is not available by default).

<http://tex.stackexchange.com/questions/29497/>

`xelatex-preventing-beamer-from-using-different-backgrounds`

Acknowledgements

I have borrowed heavily (and learned much) from Marco Barisione's **Torino theme**, which can be found on his blog. I have also learned and borrowed from Shawn Lankton's Keynote theme.

These can be found at

- <http://blog.barisione.org>
- <http://www.shawnlankton.com/2008/02/beamer-and-latex-with-keynote-theme/>

I've tried to maintain lots of comments in the .tex and .sty files to help other template-designers. At the moment it's all a jumbled mess, though!

Extra page: Additional hints

Look, it doesn't add to the total page count!

- Be sure to turn off any auto-notifiers (e.g. GMail)
- Consider using a PDF-to-keynote program; <http://www.cs.hmc.edu/~oneill/freesoftware/pdfkeynote.html>.
- Don't ever go over time.
- TikZ transparency trick: <http://www.texample.net/tikz/examples/transparent-png-overlay/>
- Use `addtocounter{framenum}{-1}` for extra slides (like this one) to prevent it from screwing up the page numbering.