

The Birds and the Bs

Main title of the talk goes here

Flip Tanedo

Based on [arXiv:0123.4567](#)

In collaboration with Collaborator Name.

Cornell



University

Where the talk is being given

Date of the talk

Frame title

Grayish-white text?

Frame title

Grayish-white text? **Green text.**

Frame title

Grayish-white text? **Green text.**

We can use different colors.

Frame with columns

I can include an image in this box.

- Use “footnotesize”
- ... for smaller text
- to fit cramped areas

We can still add stuff on the bottom under the columned area.

Example of TikZ Feynman Diagrams



Penguin diagram

Allows FCNC sub-diagram to occur on-shell.

TikZ is a powerful tool for drawing figures such as Feynman Diagrams. I've defined a few handy TikZ commands in `tikzfeynman.sty`. It should be easy for you to modify.

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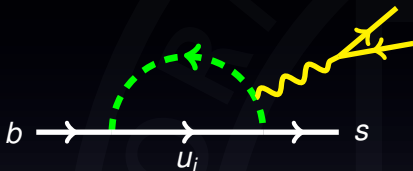


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$B_s \rightarrow \mu^+ \mu^-$: Very little background

The Standard Model background is suppressed by...

- **Loop**: no tree-level contribution, $(16\pi^2)^{-1}$
- **FCNC**: ‘GIM’ suppression, $|V^\dagger V|_{bs}$
- **Helicity**: Lepton mass insertion, m_μ/M_{B_s}

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

That's how you include a table.

More examples with TikZ.

In the MSSM, the **Higgs-penguin** mediated $B_s \rightarrow \mu^+ \mu^-$ diagram is sensitive to $\tan \beta$. Recall: $\tan \beta = v_u/v_d$.

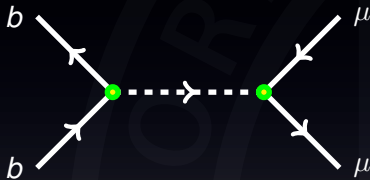


$$(\bar{s}_R \quad \bar{b}_R) \begin{pmatrix} m_s & 0 \\ y_{b \in V_u} & m_b \end{pmatrix} \begin{pmatrix} s_L \\ b_L \end{pmatrix}$$

Note the use of the “uncover” commands.

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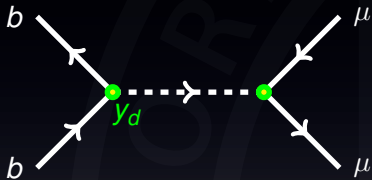
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$$y_{b,\ell} = \frac{m_{b,\ell}}{v_d} \propto \frac{1}{\cos \beta} \xrightarrow{\tan \beta \gg 1} \tan \beta$$

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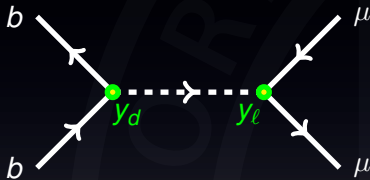
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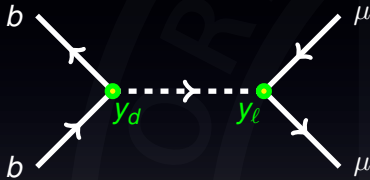
$$(\bar{s}_R \quad \bar{b}_R) \begin{pmatrix} m_s & 0 \\ y_{b \in V_u} & m_b \end{pmatrix} \begin{pmatrix} s_L \\ b_L \end{pmatrix}$$

$$y_{b,l} = \frac{m_{b,l}}{v_d} \propto \frac{1}{\cos \beta} \xrightarrow{\tan \beta \gg 1} \tan \beta$$

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$$(\bar{s}_R \quad \bar{b}_R) \begin{pmatrix} m_s & 0 \\ y_{b \in V_U} & m_b \end{pmatrix} \begin{pmatrix} s_L \\ b_L \end{pmatrix}$$

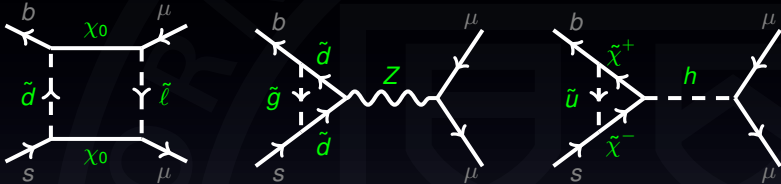
s - b mixing:

$$\sin \theta \approx y_{b \in V_U} / m_b \approx \epsilon \tan \beta$$

$$y_{b,l} = \frac{m_{b,l}}{v_d} \propto \frac{1}{\cos \beta} \xrightarrow{\tan \beta \gg 1} \tan \beta$$

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More TikZ examples



No photon penguin by Ward identity.

- Higgs penguin no longer dominant
- One has to consider interference with other diagrams
- Possibility: cancellation **below** SM prediction?

Conclusion: Lessons

Theory

- There **is** life outside of Minimal Flavor Violation (MFV)
- ... though perhaps only minimal life?
- We can model-build beyond MFV; e.g. 0712.0674, 0712.2074
- Our numerical code is available

Experiment

- Keep an eye out for a measurement of $B_s \rightarrow \mu\mu$
- Non-discovery at SM limit could hit at low $\tan\beta$, beyond-MFV
- Need to think about LHCb upgrade scenarios

Block party

Many examples of blocks.

Block

Block

Example Block

Example Block

Alert Block

Alert

Conclusion

- This is a work-in-progress. I'm still looking for a good color theme. The orange frame titles are nasty.
- The 'cornell' logo in the background is kind of a hack, I need to work on making this a watermark on top of a gradient background. That should shrink the file sizes a bit.
- Feel free to contact me at pt267@cornell.edu if you have suggestions for this theme.

Extra slide

Use the “addtocounter” command to include extra slides that don't count towards your slide count. Otherwise it looks awkward when you finish your talk and your slides say 25/30.