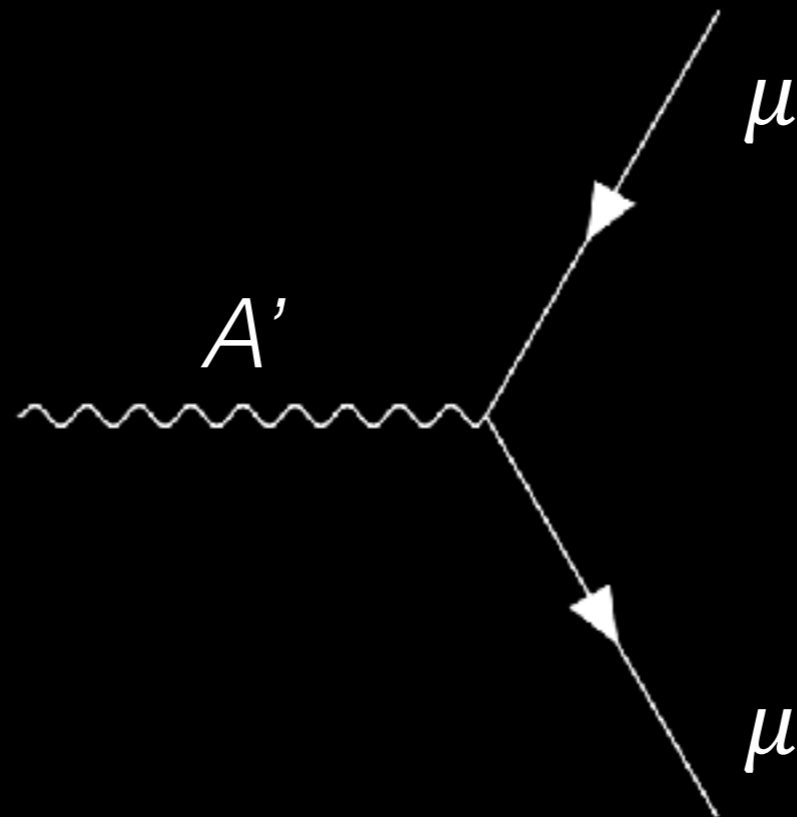


Dark Photons at LHCb



Constantin Weisser, MIT

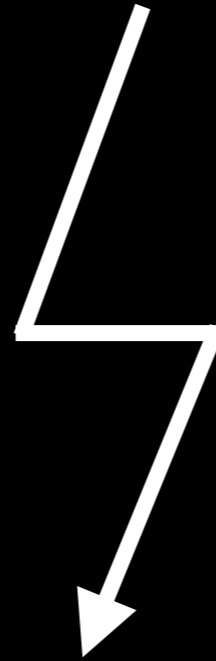
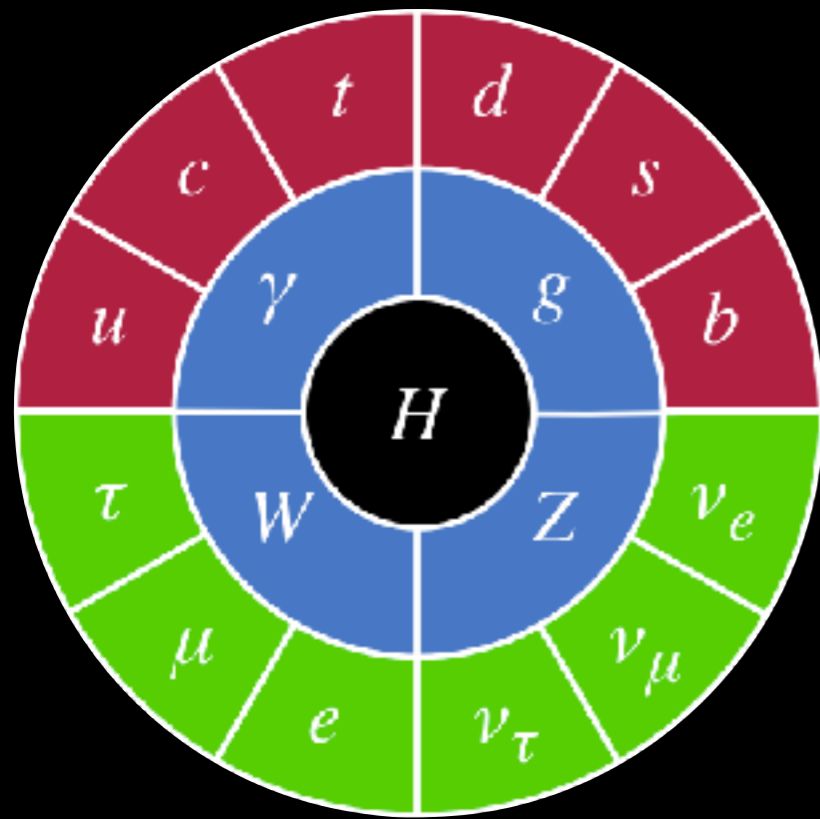
US LUAM

October 26 2018

Slides adapted from Mike Williams



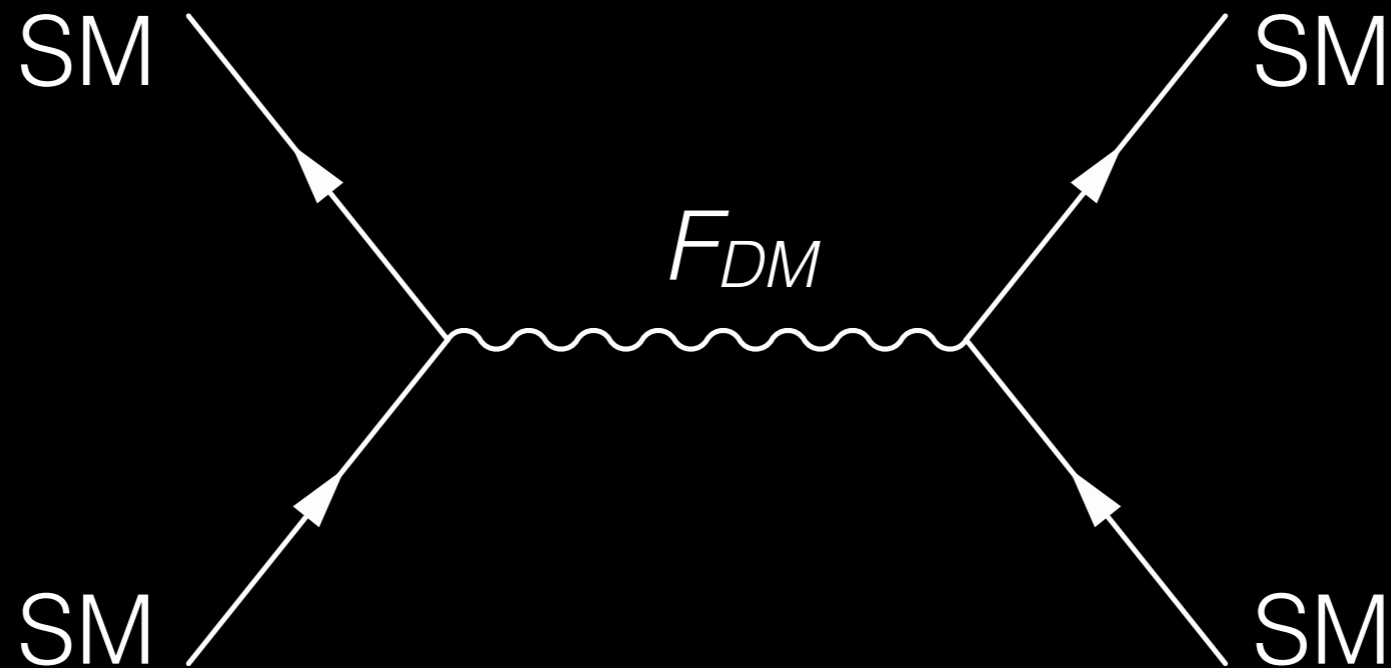
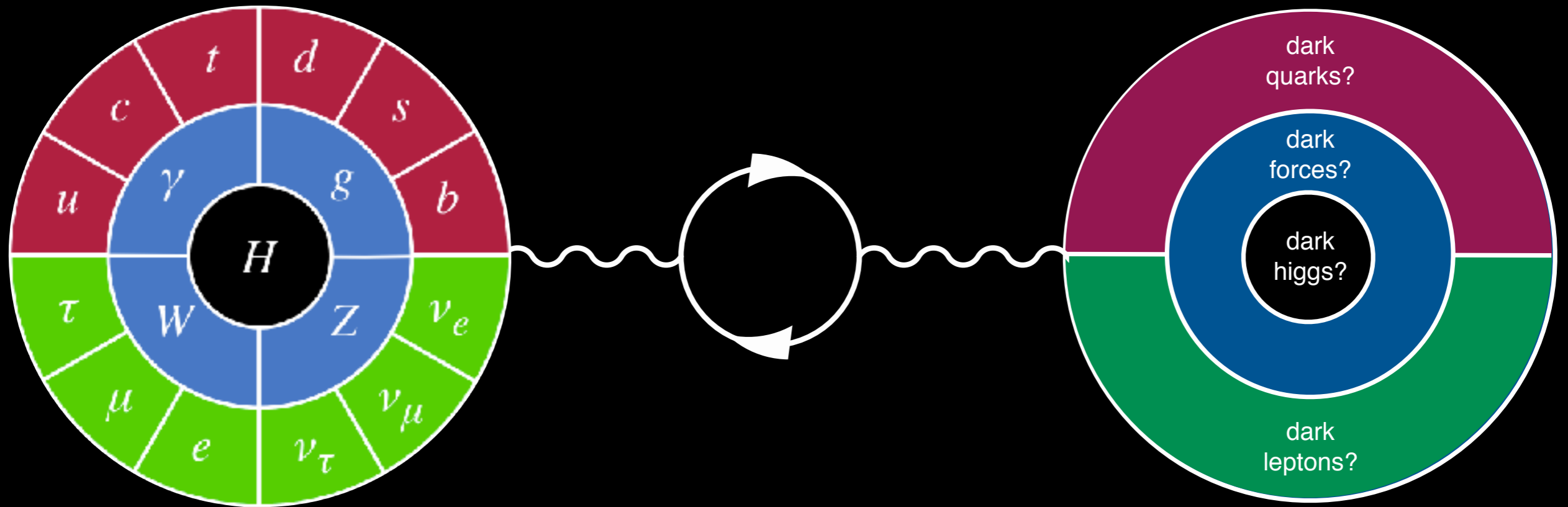
Dark Forces



lightest DM particle could be stable because it's (dark) charged

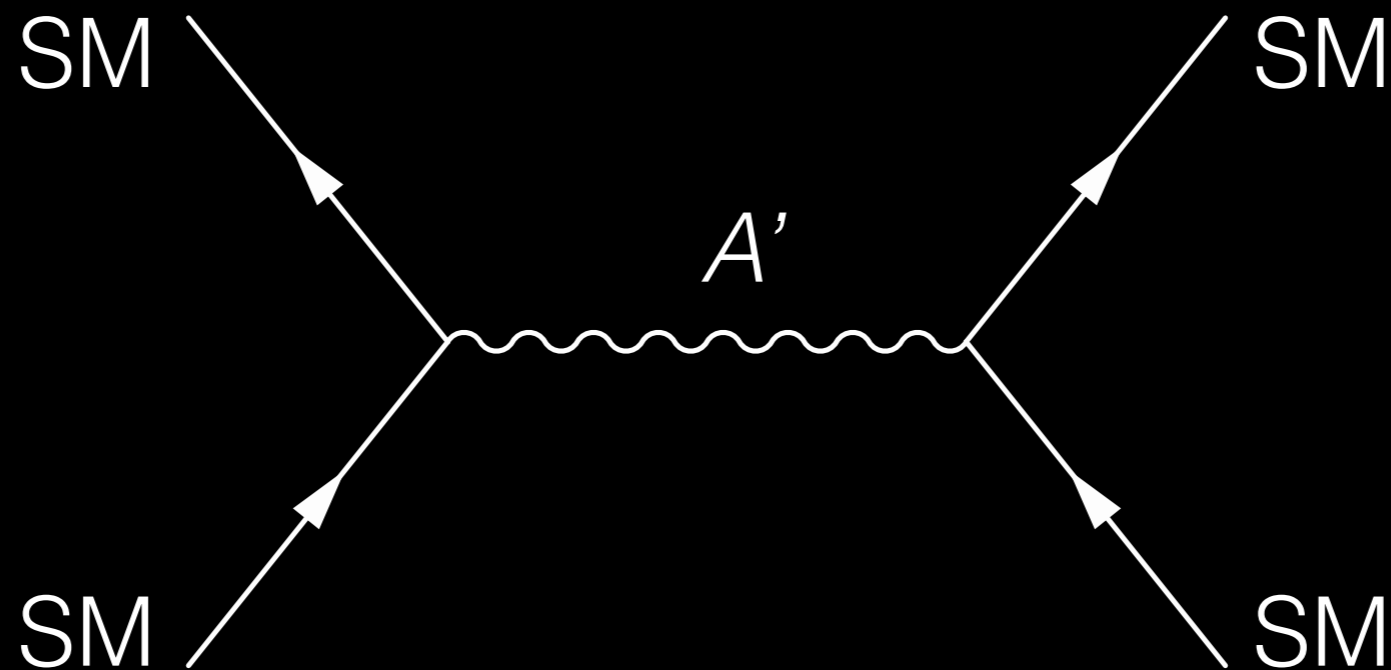
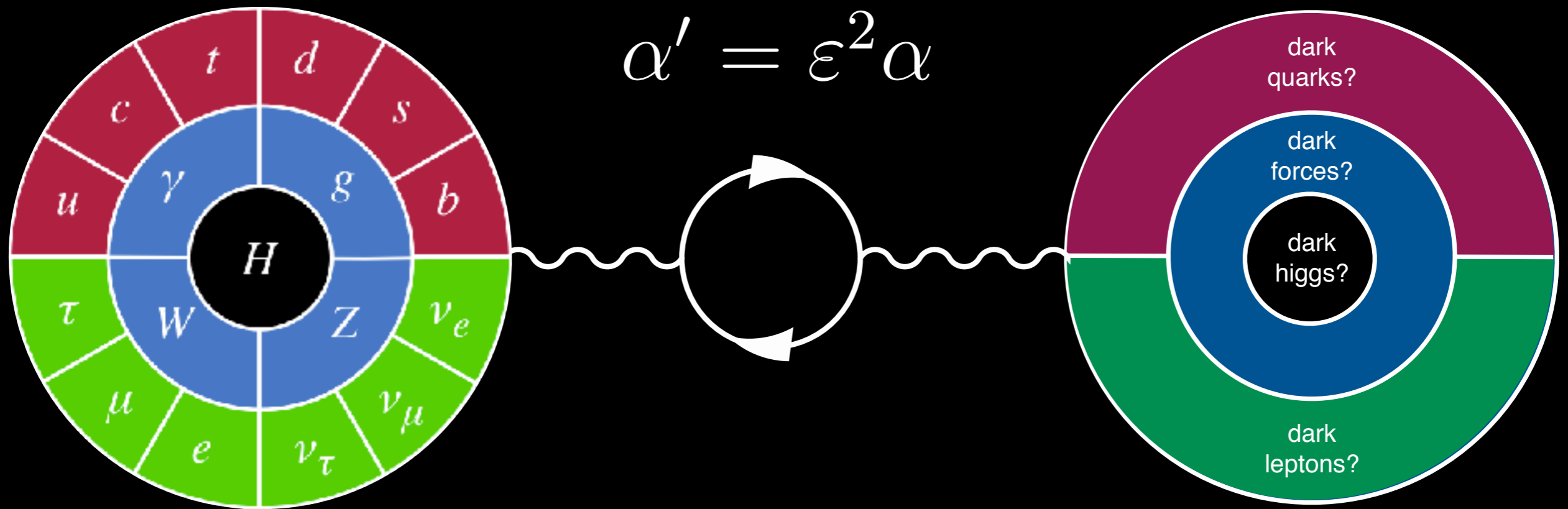
What if there is no connection between the SM and dark sector up to the Planck scale?

Dark Forces



DM force carriers can couple to SM via a Portal.

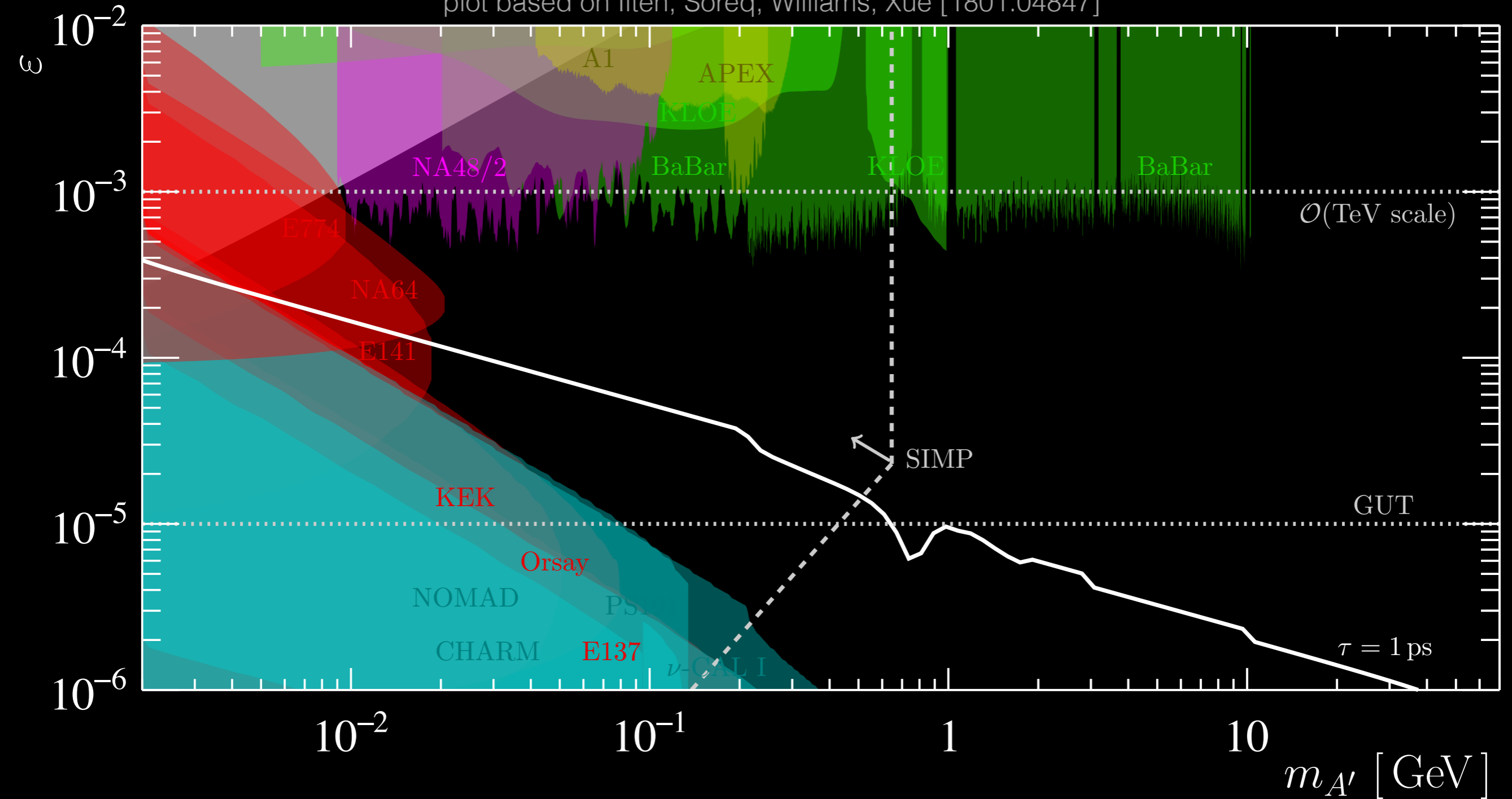
Dark Photons



The A' establishes a well motivated portal.

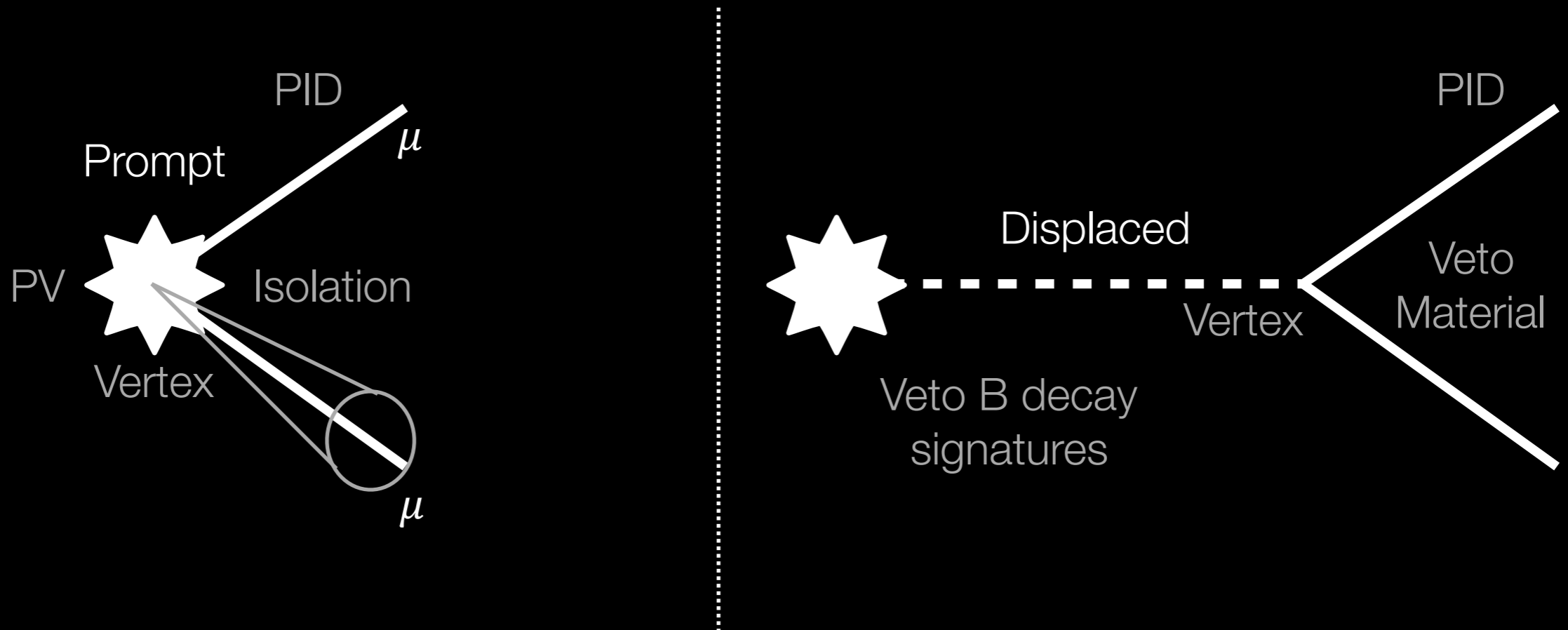
Visible A' Decays

plot based on Ilten, Soreq, Williams, Xue [1801.04847]



If $m_{A'} < 2 m_{\text{DM}}$ then visible decays to SM.

LHCb Inclusive $A' \rightarrow \mu^+ \mu^-$



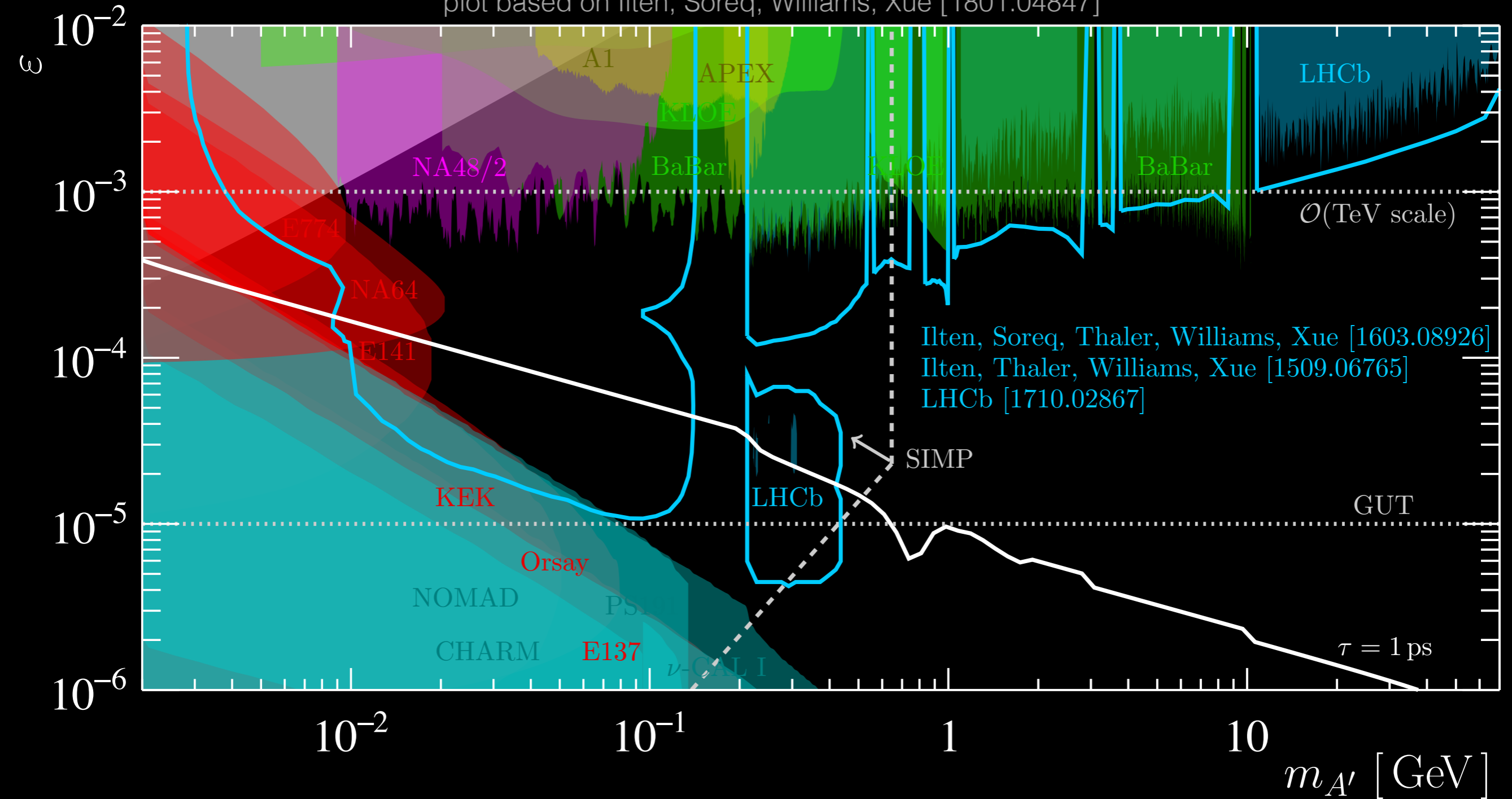
Count A' Candidates

Compare to prompt γ^*

\Rightarrow Set Limits

Visible A' Decays

plot based on Ilten, Soreq, Williams, Xue [1801.04847]



Shaded blue: 2016 results; Light blue lines: Predicted Run 3 (2021 - 2023) reach;

LHCb Run 2 Extensions

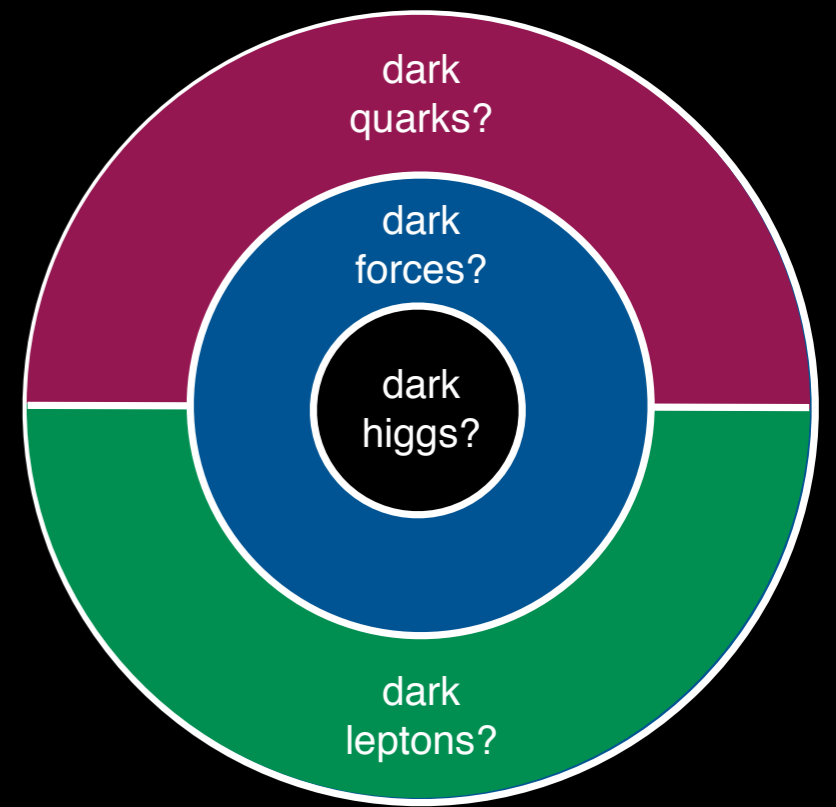
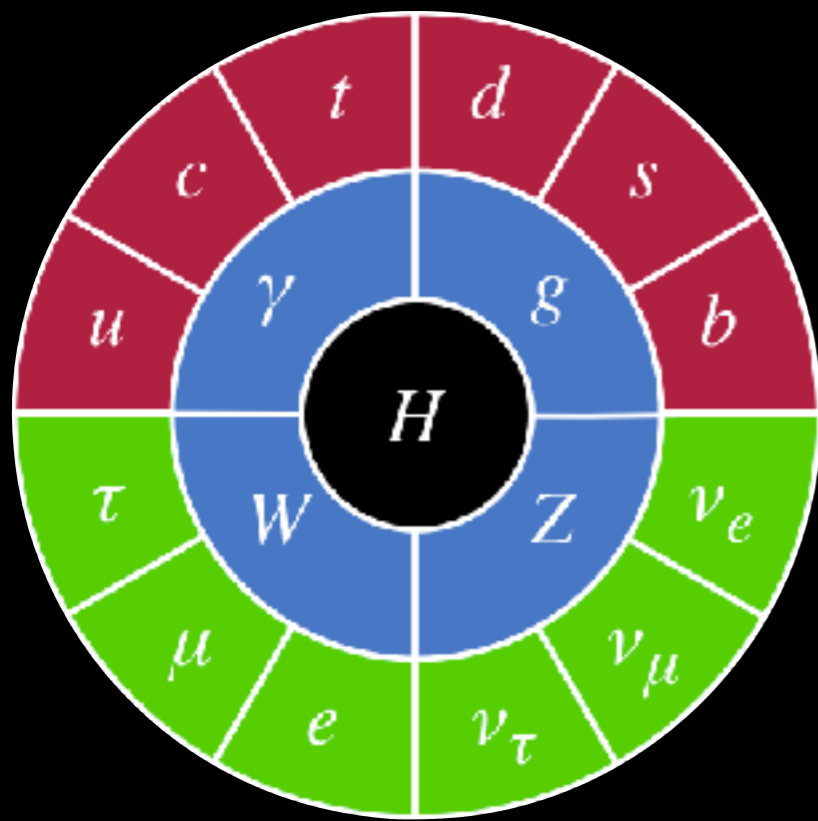
Update

$$A' \rightarrow \mu^+ \mu^-$$

No Iso

b tag

$$A' \rightarrow e^+ e^-$$



Can the portals help us discover dark matter?

Backgrounds LHCb Inclusive $A' \rightarrow \mu^+ \mu^-$

- Irreducible $\gamma^* \rightarrow \mu^+ \mu^-$
- Resonant decays to dimuons
- For each muon:
 - Misidentification of a prompt hadron as a muon
 - Misreconstruction of a muon produced in a heavy-flavour decays
- Photon conversions to mu mu in the silicon-strip vertex detector (the VELO)
- B-hadron decays producing two real muons
- Low-mass tail from $K^0_S \rightarrow \pi^+ \pi^-$, where both pions are misidentified as muons