Dark meson analysis

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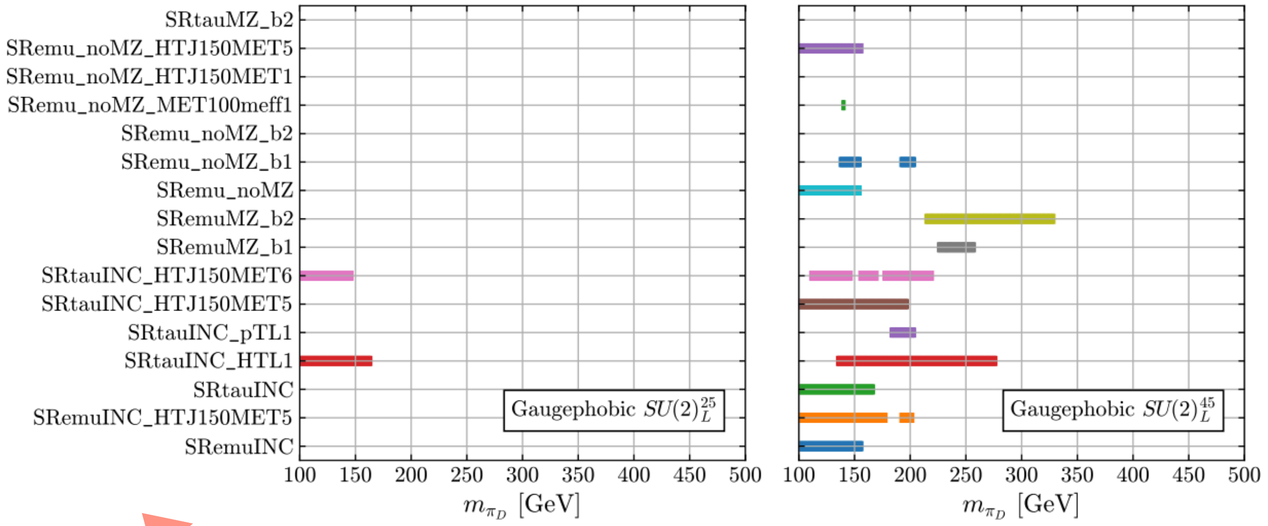
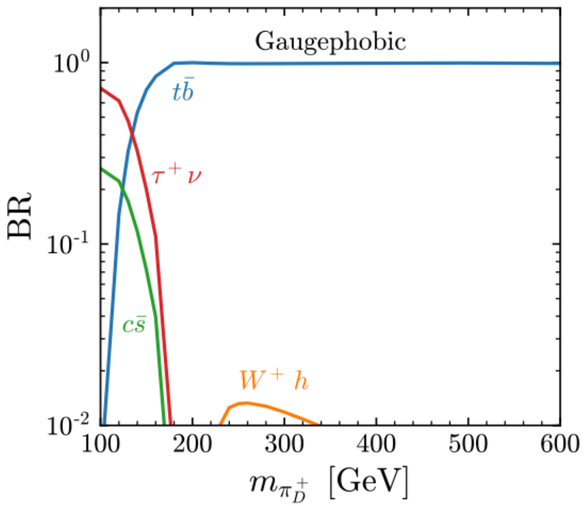
- Many different Dark Matter searches ongoing in the ATLAS experiment
- Dark matter might be explained by a whole new set of particles interacting with each other but with minimal interactions with Standard Model (SM) particles, a Dark Sector
- Out of all the different searches, the Uppsala group, together with the University of Oregon, is focusing on Dark Mesons
- Looking for a new, strongly coupled, confining sector (Dark Sector) following arXiv:1809.10183 and arXiv:1809.10184
- This dark sector preserves an SU(2) dark flavour symmetry and is free of constraints from precision measurements. Higgs interactions break the global (species) symmetries of this dark sector allowing dark pions to decay to SM particles.



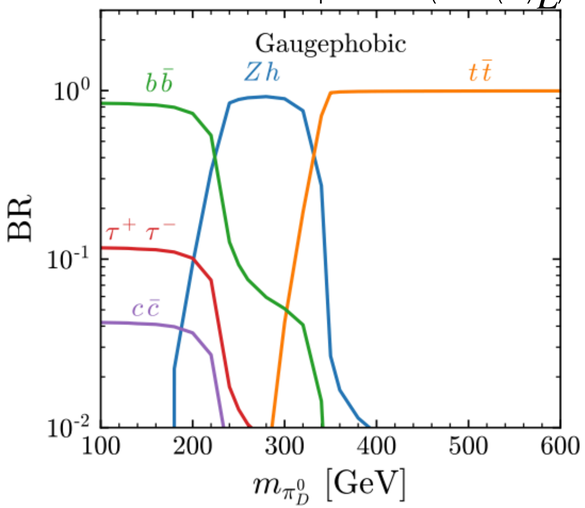
The coloured bars show excluded masses (fig. from arXiv:1809.10184)

Dark pion pair production

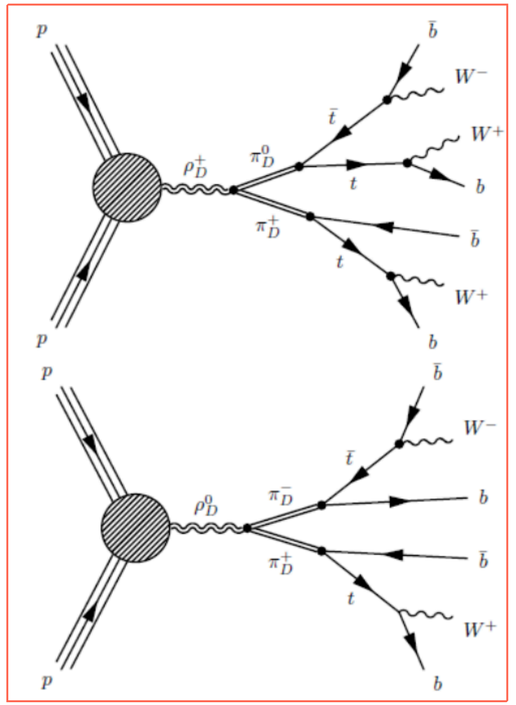
Charged dark pions (SU(2)$_R$)



Neutral dark pions (SU(2)$_L$)



Figures from arXiv:1809.10184)



- Particle content: dark pion triplet π_D^0, $\pi_D^\pm$ and dark vector meson triplet ρ_D^a (dark rho)
- Focus on pair production of dark pions through $pp \to \rho_D \to \pi_D\pi_D$
- π_D decays into SM states
  - The models can be classified into two distinct categories depending on which: gaugephobic and gaugephilic
- This analysis focuses only on gaugephobic: $\pi_D \to ff'$
- Further, there are two choices of kinetic mixing: $SU(2)_L$ and $SU(2)_R$
- The decay of the dark pions depends on gaugephobicness, kinetic mixing, and mass of the dark pions
- Channels explored are $t\bar{t}t\bar{b}$ and $t\bar{t}b\bar{b}$ chosen because of their branching ratio and the constrains obtained from several ATLAS and CMS analyses

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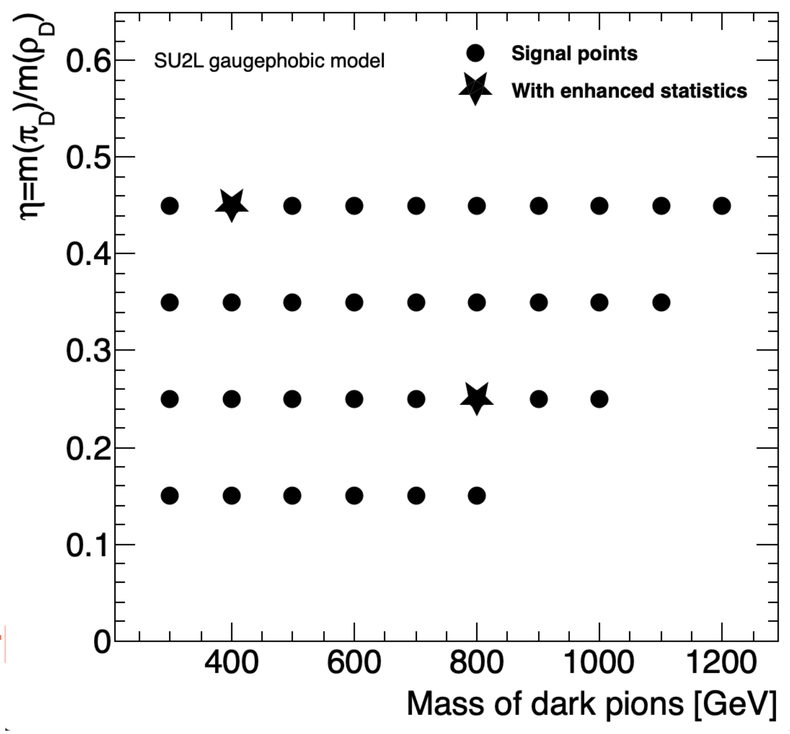
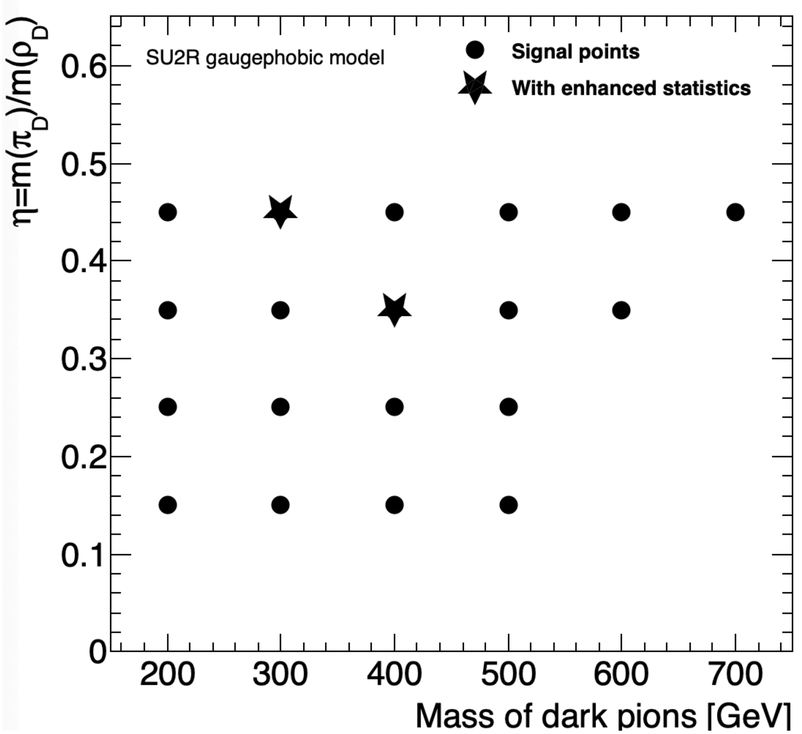
Progress

- Full signal samples produced. Search grid defined by mass ratio of dark pions to dark rhos vs mass of dark pions. One grid for each choice of kinetic mixing — total of 52 signal samples with 10 000 or 100 000 (enhanced statistics) events each





- Full background samples produced
- Developing our own framework for analysing data samples based on AnalysisTop: DarkFramewor
- 1 lepton channel (Uppsala) and all hadronic channel (Oregon)
- Signal region defined in all hadronic channel and underway in one lepton channel

If you want to know more about the analysis (ATLAS internal)

Twiki | Git | Glance | HQT update