



Contribution ID: 138

Type: Talk

Top-philic Scalar DM with a Vector-like Top Partner

Thursday, 7 July 2016 15:00 (20 minutes)

We consider a scalar top-philic Dark Matter (DM) S coupling, apart from the Higgs portal, exclusively to the right-handed top quark t_R and a colored vector-like top partner T with a Yukawa coupling y_{ST} which we call the topVL portal. When the Higgs portal is closed and y_{ST} is perturbative (< 1), $TS \rightarrow (W^+b, gt)$, $SS \rightarrow t\bar{t}$ and $TT \rightarrow (q\bar{q}, gg)$ provide the dominant annihilation contributions to obtain the correct thermal relic density in light, medium and heavy DM mass range, respectively. However, large $y_{ST} \sim \mathcal{O}(10)$ can make $SS \rightarrow gg$ dominate via the loop-induced coupling C_{SSgg} in the $m_S < m_t$ region. In this model it is the C_{SSgg} coupling that dominates DM-nucleon scattering in the direct detection, which can be large when $SS \rightarrow gg$ dominates the DM annihilation. The current LUX results can exclude the $SS \rightarrow gg$ dominating scenario and the expected sensitivity of XENON-1T may further test $y_{ST} > 1$, and $0.5 < y_{ST} < 1$ may be covered in the future LUX-ZP experiment. The indirect detection results from Fermi gamma-ray observations can also exclude the $SS \rightarrow gg$ dominating scenario and play a complementary role to direct detection in the heavy DM mass region, of which one order of magnitude of sensitivity improvement will push DM mass to be heavier than about 400, 600, 1000 GeV for $y_{ST} = 0.3, 0.5, 1.0$, respectively. The colored top partner T and its anti-particle can be produced in pair at the hadron collider. They will decay 100% into $t\bar{t} + E_T^{miss}$ signal when kinematically open and receive constraints from the corresponding CMS measurements at 8 TeV. We found that the top partner mass in the range 300 (450)-850 GeV can be excluded for $m_S = 0$ (200) GeV.

Primary author: WU, Peiwen (Korea Institute for Advanced Study (KIAS))

Co-authors: Prof. BAEK, Seungwon (Korea Institute for Advanced Study (KIAS)); KO, pyungwon (Korea Inst. for Advanced Study (KIAS))

Presenter: WU, Peiwen (Korea Institute for Advanced Study (KIAS))

Session Classification: Dark Matter and Particle Astrophysics

Track Classification: Dark Matter and Particle Astrophysics