



Contribution ID: 56

Type: **not specified**

Enhanced line signals from annihilating Kaluza-Klein dark matter

Wednesday 24 September 2014 16:10 (15 minutes)

Monochromatic gamma ray lines have long been known to provide potential smoking gun signals for annihilating dark matter. Here, we demonstrate that the situation is particularly interesting for Kaluza-Klein dark matter because resonant annihilation is generically expected for small, but not necessarily vanishing relative velocities of the annihilating particles. We calculate the contribution from those hitherto neglected resonances and show that the annihilation rate into monochromatic photons can be significantly enhanced, in a way that is much more pronounced than for the associated production of continuum photons. For favorable astrophysical conditions, this leads to promising prospects for the detection of TeV-scale Kaluza-Klein dark matter. We also point out that the situation may be even more interesting in the vicinity of black holes, like the supermassive black hole at the center of our Galaxy, where in principle center-of-mass energies much larger than the rest mass are available. In this case, annihilating Kaluza-Klein dark matter may show the striking and unique signature of several gamma ray lines, with an equidistant spacing corresponding to twice the compactification radius of the extra dimension.

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Session Classification: Cosmology & Astroparticle Physics A