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Atomic Dark Matter Capture in the Earth

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Atomic Dark Matter (aDM) is a well motivated class of models which has potential to be discovered at ground based Direct Detection experiments. The class of models we consider contains a massless dark photon and two Dirac fermions with different masses and opposite dark charge (dark protons and dark electrons), which will generally interact with the Standard Model through a kinetic mixing portal with our photon. The dark fermions have the potential to be captured in the Earth. Due to the mass difference, evaporation efficiencies are lower for dark protons than dark electrons, leading to a net dark charge in the Earth. The captured charge has the potential to alter the incoming flux of aDM in complex ways, due to interactions between the ambient dark plasma and the dark charged earth. The altered flux modifies event rates in ground based direct detection experiments compared to the standard DM expectation. I will describe our ongoing effort to calculate aDMs interaction with, and subsequent capture in, the Earth through the dark photon portal. We identify regions of the aDM parameter space where there will be significant accumulation of aDM in the Earth, and elucidate the effect on the incoming velocity distributions of both species.

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