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Anomaly-free Model with an extra Abelian gauge Dark Symmetry and Dirac Type II Seesaw

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One of the most intriguing problems of the SM is the masslessness of neutrinos, which is contradicted by the experimental evidence. It has been established that neutrinos have a small mass, but different from zero, therefore the first experimental proof of new physics beyond the SM has been achieved. Also, it is very important mencionate that cosmology requires a heavy neutral stable particle that is suited to be a viable dark matter candidate. Therefore, we need a viable dark matter candidate and an explanation for neutrino masses.

We propose a model to obtain the small neutrino masses and dark matter candidate by extending the visible content of the Standard Model (SM) with a hidden sector composed of one scalars singlet S, two charged Dirac chiral fermions under dark symmetry, the lightest of which is the possible candidate for dark matter, and at least two right-handed singlet neutrinos $(\nu_R 1, \nu_R 2)$. These right-handed neutrinos are charged under a new symmetry $\mathrm{U}(1)_D$. In addition, it is necessary to add a heavy scalar doublet to play the role of messenger between the visible sector (SM) and the "hidden"sector.

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