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Fine tuning in the rotation curves?

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We consider a mass model of a disk galaxy made of two components, a dark halo and an exponential thin disk, and we construct its rotation curve. The model has two free parameters, crucial in determining the distribution of the dark matter inside the galaxy: the value of the core radius or the characteristic scale lenght of the dark halo, and the percentual contribution of the dark matter to the rotation velocity, at a given radius. The resulting rotation curves show large effects as a result of the variation of the parameters, namely in their slope and in the maximum values of the circular velocity. The curves are produced from the combination of two independent contributions, due to the luminous and the dark matter, nonetheless the observed rotation curves of galaxies show no trace of the transition between different regions dominated by one component or the other. The issue is to determine wether there is the need of a fine tuning to obtain a smooth, featureless rotation curve, like the ones that are actually observed. We conclude that such a fine tuning is not necessary, since for a wide range of values of the parameters there is no evidence of a transition in the curves between a disk-dominated to a halo-dominated regime. Once the curves are parametrized, we then show that different set of values of the model parameters give raise to curves that are different from one another above the limit error of observations, and we therefore predict that is possible from observations to determine the amount of dark matter and its distribution inside the galaxy with a rather high precision.

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