Abstract: While there is indisputable observational evidence for a new degree of freedom behaving as a collisionless fluid of particles on large scales, i.e. dark matter, there is no such solid evidence on galaxy scales. On the contrary, the current LambdaCDM model of cosmology is plagued with numerous challenges at these scales, which we review here. These small-scale-problems of cosmology include the mismatch between the predicted and much smaller observed number of satellite galaxies in the Local Group (missing satellite problem), the shape of the inner dark matter distribution in galaxies (core-cusp problem), the concentration of sub-halo potential in satellite galaxies (too-big-to-fail problem), or the phase-space distribution of satellite galaxies (satellite plane problem). These challenges might not directly indicate a failure of the standard model of cosmology since, until recently, baryonic physics has largely been ignored in the simulations, but might be able to alleviate many of the problems. However, we argue that the observational evidence for an intimate connection between the baryonic surface density and the total gravitational field in spiral galaxies presents a severe fine-tuning problem for any particle dark matter interpretation of galactic mass discrepancies. On the other hand, it is obvious that any alternative to the standard model of cosmology must also, in fine, reproduce the successes of this model on large scales, where it is so well-tested that it presents by itself a challenge to any such alternative.

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