

CONSTRAINTS ON DARK MATTER DENSITY AND AXION MASS FROM THE LARGE-SCALE
STRUCTURE OF SPACETIME

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On the basis of general properties of the large-scale structure of spacetime, we present new and general theoretical upper limits on the density of dark matter in the Universe, assuming a 90% content for the dark matter, and lower limits on the mass of the axion, assuming the dark matter to be made up of axions. These limits are derived in terms of the possible lower limits to the age of the Universe and the Hubble parameter. We find that for the age in the range $(8 - 24) \times 10^9$ yr, the maximum density of dark matter is in the range $(1.25 \times 10^{-28} - 1.38 \times 10^{-29}) \text{ g cm}^{-3}$ and the minimum value of axion mass in the ranges $(0.36 - 2.39) \times 10^{-5} \text{ eV}$ and $(1.44 - 9.51) \times 10^{-5} \text{ eV}$.