



## DARK MATTER: SCIENCE & TECHNOLOGY

**NEWS:** How much do dark matter particles weigh?

### WHAT'S IN THE NEWS?

Recent studies revised the minimum mass of dark matter particles, suggesting they are heavier than previously thought. Observations of the Leo II galaxy highlight the need for heavier particles to explain dense inner regions, challenging earlier assumptions.

### Dark Matter Overview

- Dark matter constitutes five-sixths of the universe's matter and is invisible but detectable through its gravitational effects.
- Essential for forming the universe's dense structures.

### Dark Matter Distribution

- Unevenly spread across the universe, with density varying at different scales.
- Large-scale density:  $\sim 0.0003$  solar masses per cubic light year (equivalent to two protons per teaspoon).
- Distribution can be uniform or lumpy, with particle spacing dependent on mass.

### Revised Mass Limit of Dark Matter

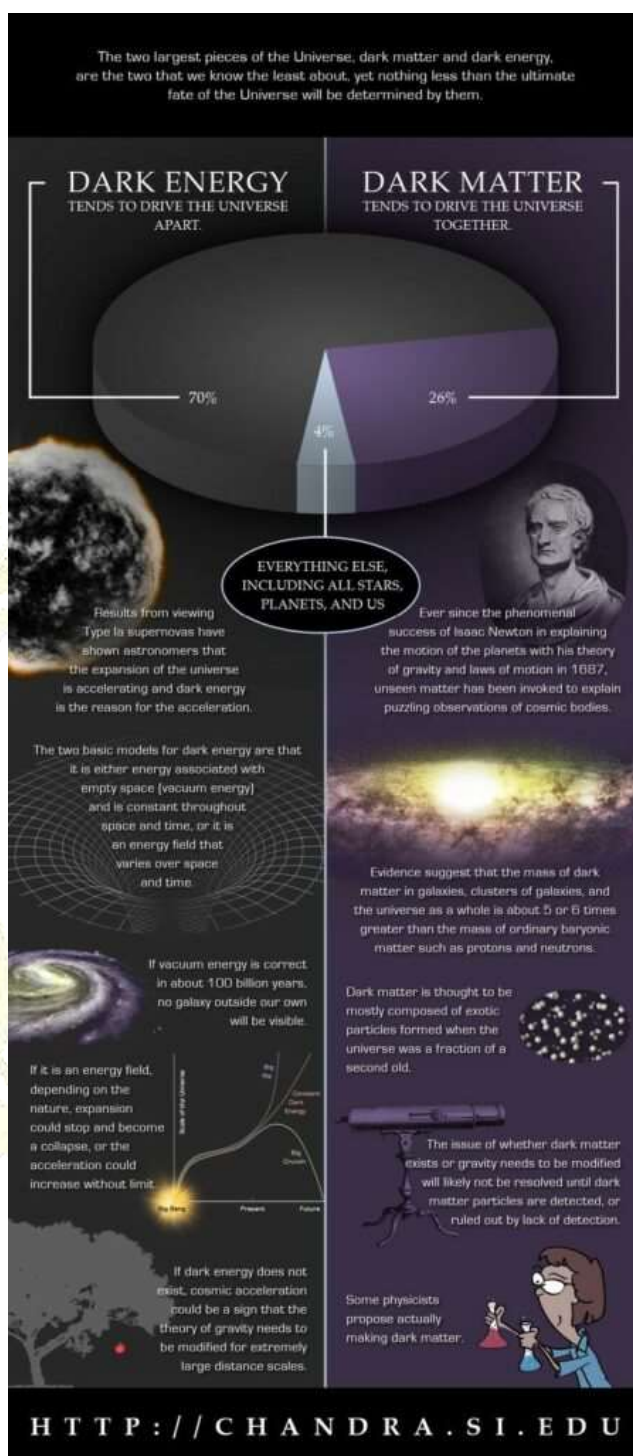
- Earlier minimum mass:  $10^{-31}$  to  $10^{-31}$  times the mass of a proton.
- Revised limit (May 2024):  $2.3 \times 10^{-30}$  to  $2.3 \times 10^{-30}$  proton masses.
- Heavier particles:
  - $100$  proton masses  $\rightarrow$  Spacing  $\sim 7$  cm (could exist in a house).
  - $10^{-19}$  proton masses  $\rightarrow$  Spacing  $\sim 30$  km.
- Lighter particles ( $10^{-31}$  to  $10^{-31}$  proton masses): Larger wavelengths ( $\sim 200$  light years).

### Findings from Leo II Galaxy Study

- Observations of the dwarf galaxy Leo II challenge earlier assumptions.
- Particles with  $10^{-31}$  to  $10^{-31}$  proton masses cannot explain the galaxy's dense inner mass.



- Suggests the need for heavier dark matter particles in such regions.



Source: <https://www.thehindu.com/sci-tech/science/how-much-do-dark-matter-particles-weigh/article69015366.ece>