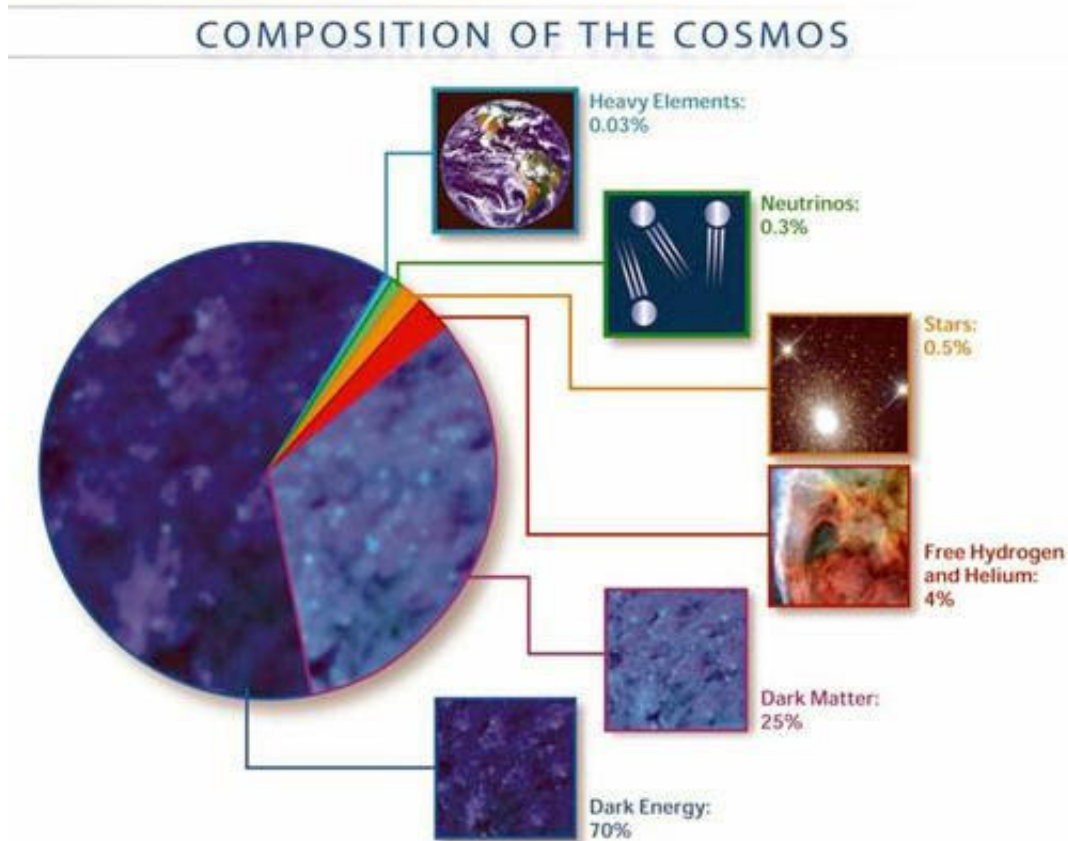


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??????? ?????-???? (Murray Gell-Mann) From the Book Stephen Hawking's Universe



The Composition of the Cosmos

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Dark Matter & Dark Energy

Dark Matter is matter that emits or reflects minimal to no light, but does have a gravitational influence. Evidence for dark matter appears to be present in

- the motion of stars in galaxies.
- the orbits of galaxies in galaxy clusters.
- the temperature of intracluster gas in galaxy clusters.
- the gravitational lensing of distant galaxies.

Some possible types of dark matter include:

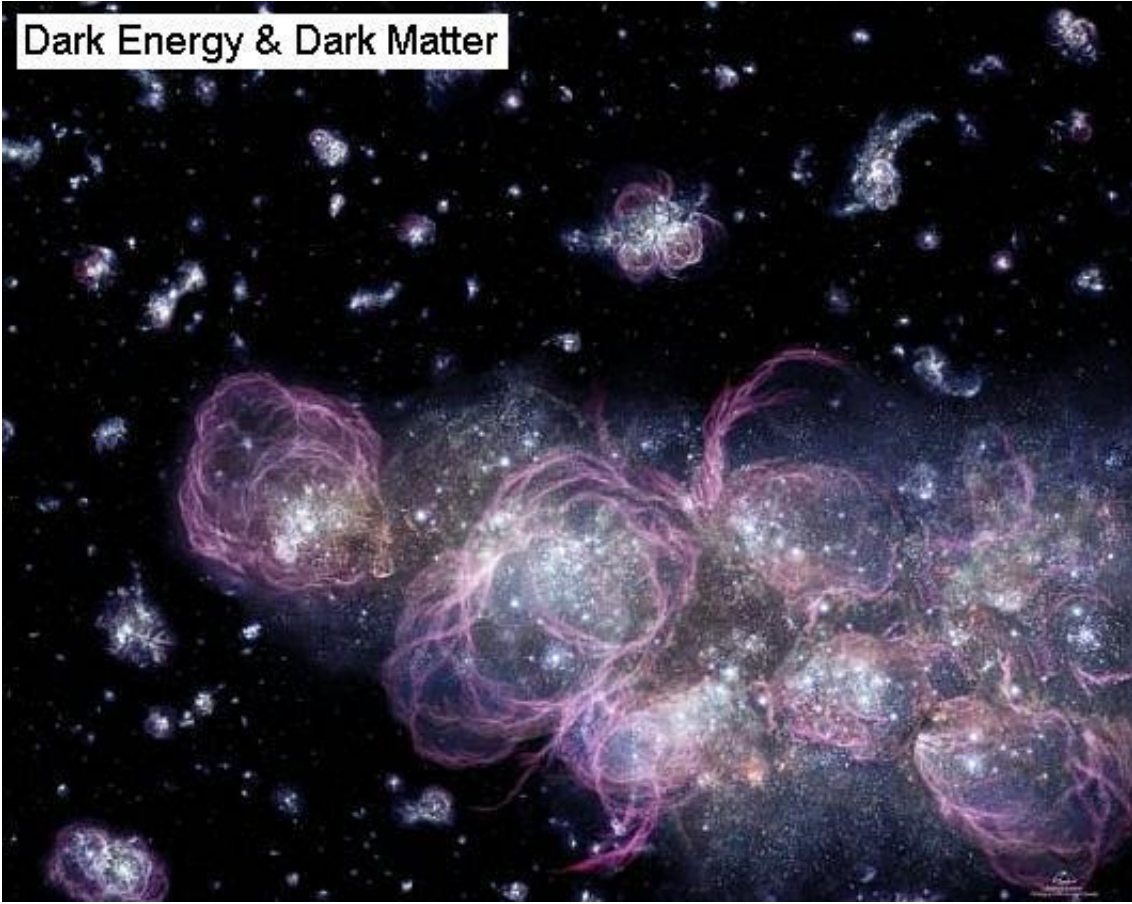
- Massive compact halo objects (MACHOS) – These are large objects, like brown dwarfs and Jupiter-sized planets, that exist in the halos of galaxies.
- Weakly interacting massive particles (WIMPS) – These are subatomic particles that have extremely small masses, but exist in great quantities. Neutrinos are an example of a such a particle.

Dark Energy is the term used for a possible unseen influence that may be causing the universal expansion to accelerate. Recent observations of supernovae have produced a value for an acceleration that implies a universe that is about 70% dark energy.

????????? ??????? ?????? ????????????????? 75% ??????? ?????? (Dark Energy), 21% ???????
 ??????? (Dark Matter) 4% ??? ???? ??????? ?????? ?????? ?????????? (Normal Matter). ?????
 ?????????? ?????????? ?????????? ?????? 65%, ?????????? ?????????? 30%, ?????????????? 0.5% [Stars],
 ??????? ??????????, ?????????? ?????????? 4% [Free Hydrogen & Helium], ?? ?????????????? 0.03%
 [Heavy Elements], ?? ????????????????????? 0.3% [Ghostly Neutrinos]. ?????????? ??????????
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Dark Energy & Dark Matter

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1930 ??? ??? ????????? ???? ???? ?????? (Jan Oort) ?????????? ?????????? ??????????????????
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(Galaxies)????????????????????????????????????????????????????????????????????????????????????????????????
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S. Jayabarathan (jayabarathans@gmail.com) May 12, 2016 [R-1]