Out of this world

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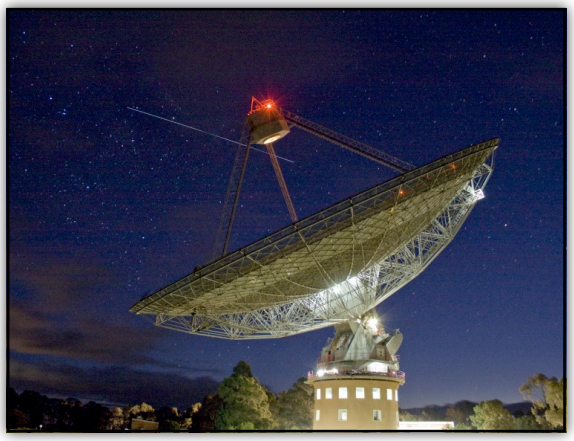
2011

Photos from apod.nasa.gov

Adding dimensions

Imagine looking up in the sky in a clear moonless night. You have now added one extra dimension. This dimension allows you to spot stars, planets and even galaxies. It is the most humbling feeling to realise how small our world is. We are made of stardust coming from the explosions of earlier stars. Earth and ourselves are made by recycled material!

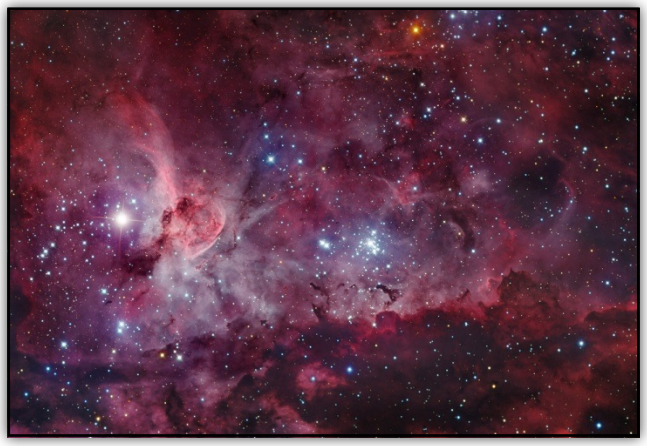


Let's now add one more dimension, by looking deeper and deeper into matter. Remarkably, we discover that stars, planets, oceans and humans share the same elementary constituents. These have funny names such as quarks and leptons. The new dimension, we just added, is not a space type dimension, but rather a mathematical one. The beauty of Nature is in the fact that She reveals her secrets using an elevated but universal language, Mathematics. In and out of our world the laws of nature are identical and the building blocks are the same, or are they?

Dark

Any kid looking at the sky thinks that the universe is a collection of stars and planets immersed in empty space. This is what we all believed till very very recently. Cosmological observations have proven our intuition to be wrong. The empty space contains, at least, two distinct types of substances, dark matter and dark energy. The ordinary matter, the one which makes us, stars, planets and oceans is known as bright matter. Dark matter and dark energy are exotic substances not made by the same constituents as the bright matter. Little is known about the origin of the dark side of the universe, but we do know that we owe

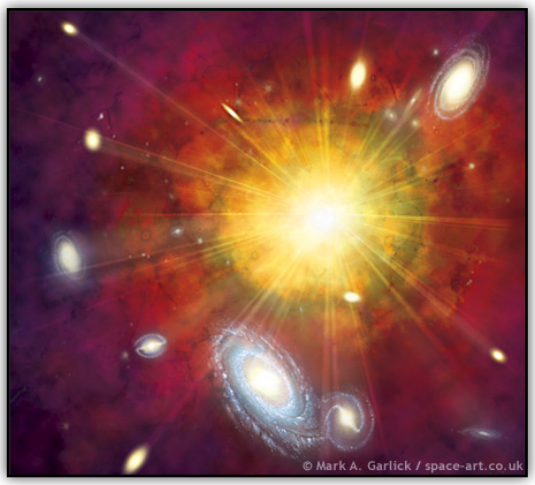
our own existence to it. Without dark matter and energy, for example, our galaxy would not yet have been formed. By learning about the dark side we will shed light on the bright side.



Bang? Almost

There is dark and there is bright, but where does it all come from? From a primordial bang. But how do we know that there has been a bang? Galaxies are going away from each other at incredible speed. By simply turning the arrow of time backwards the galaxies would merge in the far past, matter would melt and at one point the universe must have been as small as an apple! Beyond this point the laws of Nature, as we understand them, fail.

It is like reading an excellent thriller with the last few pages, the ones holding the keys to unravel the mystery, missing.



End

Will the universe end? The one, as we know it, most certainly will. The universe could, for example, keep expanding till all the stars stop burning. The universe would become a cold dead place. Another possibility is that it stops expanding and then contracts, the big crunch. Perhaps fuelling another bang. New worlds would then form afresh. Our universe might even be hit by yet another universe subject to different laws of nature. And from the impact a different universe would suddenly emerge.

Whatever the end, our universe is the canvas on which our existence is painted. We are looking for the fundamental colors from which the rainbow of natural phenomena emerge.

The painter and the painted stare at each other.