

Dark Matter

Some thoughts by Fritz Schulze
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This is not about what the astrophysicists call dark matter. No, I maintain that the Universe is dark, totally dark, pitch dark. How can that be, ask you, do I not see the world around me, the sun, the stars in the sky? Yes, indeed, you **see** the world around you. But a blind man does not see it, yet it is still there. Let's define what we see, **light**. Light as we understand is when electromagnetic energy impinges on the sensory organs of our eye, the rods and cones of our retina, these emit an electronic signal via the optic nerve to our brain which then tells our consciousness: hey, there is **light**. But that light, and by extension, all we **see**, exists only in our brain, simply a sensation in our brain, literally an *imagination*. Cut the optic nerve, and all is dark. The conclusion is that the Universe is dark unless a sensitive organism with an sensory organ and an interpretive brain is present, which then **thinks** it sees.

Remember the philosophical question: *If a tree falls in the forest and there is nobody there to hear it, does it make a sound?* According to Google, this question is attributed to the Anglican bishop George Berkeley from the 1600s, but it is actually an ancient question. The Ancients could not answer it because they had no understanding of the wave nature of sound. Of course, the falling tree makes a sound, that is, sound waves in the air, pressure waves, that our sensory organ in our ear, via the ear drum, the ossicles, the cochlea, and the auditory nerve transmits to our brain to create the impression of what we call **sound**. An analogy to the seeing process described above. To be physically correct, sound waves need a medium, the air, in order to propagate, electromagnetic waves or radiation do not.

Yet, though the Universe may be dark, it is not empty. Again, I do not talk of the astrophysicist's dark matter. The Universe is filled with electromagnetic radiation like a ocean is filled with water. Dense, completely full. How come? Every star is actually a giant nuclear reactor emitting a wide range of energy, from gamma rays with a wavelength of about 0.1 Å, X-rays with around 10 Å, the ultraviolet < 380nm, the range visible to our eyes (violet to red), the infrared > 780nm, the microwaves of 1 - 10 cm and finally the radiowaves with a wavelength of 1m to 1000m. All this radiation from all the stars criss-crosses the Universe. Every star radiates this energy in every direction, all around in space. So, wherever you position yourself in the Universe, you can see this star, and the one beside, and all the others, if you have a suitable sensor. If not, it's dark! Man has invented artificial eyes to see this radiation: x-ray telescopes, radio telescopes etc. Man has also developed giant telescopes with sensors for wavelengths outside our own eyes' range, for example for infrared (See the James Webb-Telescope) . The amount of all this energy is unimaginable.

Let's look at our sun which ranges in our galaxy, the Milky Way, among the smaller ones. Its diameter is 1.4 million km (rounded up), the distance to our earth is 150 million km. Our earth's diameter is 12.000km (rounded up). Consider now the angle of two rays from the sun to the equator of the earth: it would be $\frac{1}{2}^\circ$. All the energy encompassed by this conical angle keeps our planet warm and suitable for life. Consider that this cone of energy is but an almost infinitely small quantity of what the sun radiates all around into space, every second, every minute, every day, every year and since 4.6 billion years and again as long until it finally dies out. Unimaginable, but true.

Let me interject here a joke I heard over 70 years ago. After a lecture on astronomy a student asked the lecturer how long did you say that the sun will last? Over 4 billion years, answered the lecturer. Thank goodness, said the student, I thought you said 4 **million** years!

Our nearest star is *Proxima Centauri*, over 4 light years distant. One light year is 9.5 trillion km. This star probably no longer exists, while its light is still on the way to us. Its diameter has been measured as over 100.000km. If you are good at math, you can calculate the cone of light from this star to earth and then figure all the energy is disperses into space all around. Beyond comprehension, except perhaps to an astrophysicist.

These are just a few thoughts about our dark Universe. Has it ever occurred to you that the world we see, the trees, the flowers, our fellow men, the blue sky is but an imagination in our brain? A tree does not “see” light, but uses the electromagnetic energy to convert the CO₂ in the air by means of photosynthesis into organic compounds required for its growth. Some old Greek philosophers thought that light emanates from our eyes and is reflected from our world back. When you close your eyes, the world turns dark, black. Not so odd: in the 80s a pseudo-scientist from Hamilton submitted to the University of Toronto his theory of vision - with proof! According to his theory light rays emanate from the eyes to the object and are then reflected back. He did not explain why we can't see in a darkend room!

So, next time you gaze up at the night sky and marvel about the myriad of stars remember that without seeing eyes the sky would be pitch dark.

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