

THE WORKING OF THE STARS ON THE SUBSTANCES OF THE EARTH  
Four Lectures and drawings given by WILLI SUCHER to the Bio Dynamic Experimental Circle  
Given at Peredur, East Grinstead, Sussex, 9-12 January 1956

LECTURE ONE - 9 January, 1956

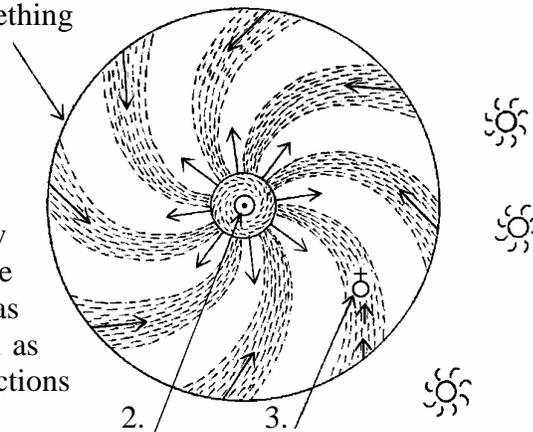
Dear Friends,

In order to speak about the working of the cosmos and its impact on the substances of the Earth, it is first necessary to develop a picture of the universe in which we live. The central focus of our cosmos, our solar universe, is obviously the Sun, and I believe that if we work with a conception of the Sun in an anthroposophical sense we will have all that we need for building up a cosmology that will enable us to develop some idea of the working of the cosmos in earthly substances. What is the Sun? We have all probably learnt at school that the Sun is either a solid or gaseous body. Fashions are constantly changing so that sometimes it is gaseous and sometimes it is solid! Anyhow, a body of material composition which is, so to speak, burning away on its surface. And the burning of this large lump of coal, as it were, provides the solar universe in which we live, including the Earth, with light and warmth. This, more or less, is the idea held by modern science. Of course the latest fashion is in accordance with the atomic age. The Sun is imagined to be a solid body with numbers of atomic explosions taking place on its surface, and these are considered to be the source of light and warmth which we experience on the Earth.

Rudolf Steiner has spoken about the Sun and has pointed out that these ideas of a solid or gaseous Sun are incorrect. He said that if scientists had the opportunity to go to the Sun they would find nothing, indeed not only nothing but less than nothing! He indicates in a number of places the nature of the Sun as he conceives it on the basis of spiritual science, by means of that spiritual perception which he has endeavored to demonstrate in almost all his books and lectures. (Ed. *Helioseismology* has now found that the core of the Sun is probably mass-less. See *Scientific American; Exploring Space*. Special Issue 1990, Vol. 2, No 1.) He speaks of the Sun as a “non-spatial entity”, a place where space comes to an end. I am sure all this will also be relevant to the reading and discussion of the lecture cycle you have chosen for the morning sessions, in as much as the concept of space is closely connected with matter. (*The World of Senses and The World of the Spirit*, 6 lectures given by Rudolf Steiner, 27 Dec., 1911 - 1 Jan., 1912 - GA 134.)

We experience three-dimensional space in our earthly existence; however, we do not only experience it in matter. Matter is certainly three-dimensional, but air and water are also three-dimensional. All these substances are, so to speak, built into the skeleton of three-dimensional space. If we take away that space we are faced with a peculiar situation. It is one that is very difficult to imagine; in fact, we can only experience it by means of mathematical calculation. Rudolf Steiner uses an example that is rather drastic but will give you an idea of what he means by non-space, empty or negative space. If you have money in your purse you have substance or, if you like, three-dimensional space. Then you spend the money, and you have no money left in your purse—no substance. But you can also have debts, which means you have something less than substance, less than space, and it is somewhere along these lines that we have to imagine non-space or negative space.

Let us imagine the Sun here in the cosmos (Fig. 1), a non-spatial entity, a hole in space. Such a point in the cosmos would act like a vacuum; indeed, we should even have to consider it as a super-vacuum for it exceeds any vacuum we meet on Earth. Now you know how a vacuum works here. We make use of a vacuum in the principle of the vacuum pump. Into the cylinder of a pump from which air has been evacuated we can draw all kinds of liquid substances. The Sun as the super-vacuum which we are imagining would draw from all directions of space some kind of substance, whatever it may be.



Thus you would have a streaming in of this substance from the direction of the periphery. We now have to find out where the periphery of that activity would be and what the nature of the substance is. (Arrow 1: Periphery;2: Sun; 3: Earth)

There is also another problem. We know that anything that is contracted into a limited space is compressed. Let us imagine that near the surface of the Sun (center), the compression is strongest. What is being compressed is some kind of cosmic substance, energy, or whatever it might be. In this way, you see, we arrive at a picture of the Sun which can be reconciled with the current idea that processes of disintegration are taking place in its outer layers. However, in our picture we need not think of processes in any way similar to the disintegration we find on Earth. Furthermore, we can imagine that this disintegration, or dissolution, is the source of the Sun's radiation, of the light that we experience and also of its warmth. Besides light and warmth, naturally, there are other influences originating there that are radiated back into space.

There is also a third aspect to be considered. Something must disappear into that "hole" of the Sun. If space shrinks, as it were, and finally enters a point which has no extension, it returns to the periphery. That is a mathematical law. We cannot now go into the details, but the substance or energy that disappears, whatever its nature, returns at the periphery. We are thus faced with a kind of metabolism, a kind of transformation. Something is brought in from the periphery of the solar universe and is led through certain processes of condensation and densification. During the next phase, processes take place on the surface of the Sun which are the source of the light and the warmth which it radiates back into the solar universe. Then the disintegrated substance disappears through that point of non-space and comes back at the periphery of the solar system. Thus we have a perfect process of breathing, of metabolism, a kind of digestion of cosmic substance which, for the moment, we may call sidereal substance.

We will now attempt to find out what this process means, why it was instituted in the cosmos, and who inaugurated it. Again, we can come to definite conclusions with the help of indications given by Rudolf Steiner. He has told us in various lectures and lecture cycles that the Sun has been, and to some extent still is, the dwelling place of the Exusiai—the Elohim of the Book of Genesis. The Elohim mentioned in the first chapter of Genesis built a focus of their activities in the cosmos, and that focus was the Sun. The Elohim or Exusiai built and created the solar universe to which the Earth belongs. There we are on familiar ground. The Sun would have been the tool of the Elohim. It was they who brought about the kind of breathing of which we have been speaking. Through it the solar universe was built up stage by stage.

We may ask: Is there anything in human nature by which we can also gauge the activity of non-space in the cosmos? Yes, there is. There is something in human nature which is akin to that emptiness which we find in the place of the Sun, something in the realm of the human I, the human ego. Rudolf Steiner has spoken much of the nature, capacity, and cultivation of the ego. He has reminded us in a great many lectures and in his books of the need to develop the inner capacities—Imagination, Inspiration, and Intuition—which humanity must attain in order to find new sources for organizing and reviving earthly human existence in a healthy fashion.

I should like to remind you of some of the advice which we have been given with regard to the attainment of those capacities of Imagination, Inspiration and Intuition. In a book such as *Knowledge of the Higher Worlds* by Rudolf Steiner, we find a precise description of the preparation and attitude necessary if we are to achieve the opening of the gate to these new faculties of inner spiritual perception. We must, in a sense, withdraw from the external world, and find a place of inner peace, of inner concentration and inner development. At least for a brief time we must emancipate ourselves from our entanglement in the spatial world. Stage by stage we then create an inner world. If we are then to advance, for instance, from Imagination to Inspiration we must learn to practice a more advanced faculty. In the world of Imagination we hold ourselves in a state of "picture" consciousness. The facts and reality of the spiritual world reveal themselves to us in a symbolic fashion. We do not perceive the spiritual world directly but, as it were, behind a curtain. We see the shadows of what is played on the stage of the spirit, falling onto a curtain still closed. The shadows speak to us in symbolic language of the reality of the spirit which is still hidden from us. Just as in a dream, we can have an awareness of external facts in a symbolic form, so too on the level of Imagination we may have a fully conscious perception of events and beings in the spiritual world. It can be a very beautiful world, an enlivening experience. However, in order to penetrate that curtain of Imagination, of symbolic representation of the spiritual world, which hides the beings of that world from our perception, we must then renounce all that we have so far achieved on the level of

Imagination. That is sometimes very painful, for experiences at the Imaginative level can be wonderful, can be truly enlivening. If we renounce our Imaginations we enter a world of complete emptiness. Nothing—no thoughts, no feelings—must enter the sphere of emptiness which we have consciously brought about. Only when we are prepared with the totality of our soul life to receive quite objectively what is still outside us, can Inspiration be achieved. At that moment, spirit can speak to our soul. The breath of spirit beings can permeate us.

The greatest difficulty is to hold that emptiness without going to sleep, for that is a great temptation, arising from natural causes. In fact, our sleep is, in a sense, simply an experience at the level of Inspiration, except that in sleep we lose our self consciousness. However in trying to advance consciously to the level of Inspiration we must hold that emptiness without falling asleep.

We have now, from quite a different direction, approached a condition which seems similar, at least to some extent, to what we would find on the Sun, as indicated by Rudolf Steiner. The emptiness on the Sun and the self-created emptiness in our soul seem to be akin. The human being achieves it through the cultivation of the forces of the I, the ego. It may, therefore, be at the level of egohood, of selfhood, that the emptiness we can produce in our own soul is akin to the emptiness of the Sun. However, we realize that in our cosmos the Sun is the organ not of a human I but of a cosmic I, So now we seem to have found a basis on which to stand.

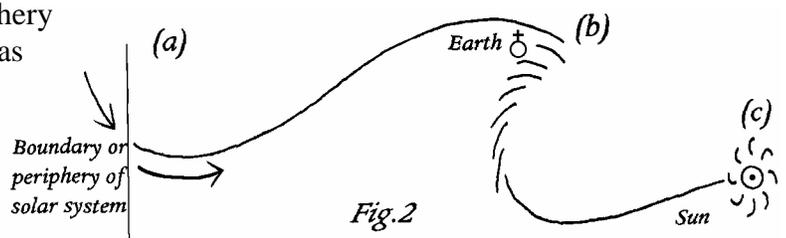
The indications given by Rudolf Steiner tell us that the Sun is the dwelling place of the Elohim or Exusiai, whose head was the Christ in pre-Christian times. We also know that the Exusiai were the beings who endowed us at successive stages with receptivity for the self. Finally, when Christ entered the earthly world, humanity was endowed with the capacity to develop the higher self, the cosmic self. This is the all-embracing self that does not know egotism in the human sense but which can embrace the whole cosmos in love.

In the Sun we have therefore an element which is quite close to us, whose image we can find within ourselves. I believe that such bridges between cosmic nature and human nature are most important and can help us form concrete conceptions about the universe in which we live, conceptions with which we can work. They may also help us in practical work, such as agriculture.

It is our task to find out more about the in-streaming from the periphery, and also about the radiation from the layers of the Sun. It is easy to perceive that the in-flowing essence is lit up by the rays of the Sun. For instance, let us imagine the Earth as being here (Fig. 1). Its own movement allows it to be anywhere. There is no need for us to think of it as going around a fixed central Sun as in the Copernican world-conception. Let us imagine the Sun and Earth in their relative positions. Wouldn't the essence flowing in from the periphery also affect our planet? It would, as it were, strike the Earth here. (Arrows pointing to Earth in Fig. 1). What is the condition of that side of the Earth that receives the impact? The place where the rays or streams of cosmic essence enter is obviously turned away from the Sun. In other words, that place or part of the Earth is plunged into night, for the Sun is not shining there. True, we do not, in fact, see anything entering the Earth during the night, it is clearly a substance or essence of an invisible nature. It is "invisible sunlight". From a point of view such as this we can perhaps draw closer to an understanding of what Rudolf Steiner often referred to as the "Midnight Sun" in his lectures. Anyway, something which is of an invisible nature strikes the Earth and it comes from the outer cosmos.

From the opposite side, the Earth is then lit up, as it were, by the rays of the Sun. Two forces meet. From the one side comes the "invisible light" of the Sun and from the other that which we sometimes call visible light. Naturally, it is not quite correct to call it visible light. It is light which makes objects visible. The Sun itself lights up what it has drawn in, and somewhere at this point we may perhaps imagine the coming into being of matter.

How can we imagine the flow from the periphery coming in? Would it be wise to think of it as consisting of straight streams? That would probably not be correct. It would not do justice to the nature of a cosmic essence. A different picture may be suggested, something like a wave. You know how a wave starts, rises, reaches a crest and then breaks (Fig. 2). Here is a wave breaking. I believe this is the tendency which such a



stream of cosmic substance coming into the solar universe would have. Here would be the beginning (a), at the outermost point of the cosmos, and this would be the direction in which the cosmic substance would move. Here would be the crest (b), and here it would recede and finally disappear again out of space through the “hole” of the Sun. Let us now imagine that the agent of such a movement is here in the Sun (c), while the crest is here where the Earth is (b). We can then understand that here at this point (b), or wherever the Earth is at a particular time, it receives cosmic or sidereal substance. It would accumulate it, densify it, break it up, and in the process it becomes matter.

If we can accept such an idea, where would we imagine the origin of the cosmic essence or substance to be? Somewhere out here we would have to imagine a periphery (Fig. 1). Couldn't this be the Zodiac with its twelve constellations, the extra-solar world, lying beyond our solar universe? It could be the world beyond the planets and this means, in a sense, that which is beyond Saturn.

With the help of such a picture we should be able to understand many things which on Earth we find “broken up” into matter. You know, of course, that there have been many attempts, in accordance with Rudolf Steiner's indications, to find a type of cosmic order in the mineral world or the plant and animal world. A number of our friends have endeavored, quite justifiably, to find twelve great groups in the mineral world and likewise in the plant world. These attempts have perhaps not always been successful. But twelve great groups of animals have definitely been found—not species but groups—and there are articles about them in various publications. Why twelve? In the plant world a seven-foldness can also be detected. This seven-foldness is also found in the mineral world. The twelvefold mineral world would then consist of seven times twelve groups, eighty-four groups, as would also be in the animal world. Twelve and seven—but why?

If we can accept the picture of the cosmos we have worked out, then we are close to a solution. What is it that lies out there, beyond the periphery, outside our solar universe? It is the Zodiac, the stars. Since very ancient times the stars of the Zodiac have been divided into twelve groups or constellations. You know them as: Ram, Bull, Twins, Crab and so on, altogether twelve. We can now see the origin of the twelve main streams coming from the extra-solar periphery. The Zodiac which surrounds our solar universe forms twelve great streams.

The twelve great streams would pass through the Earth, and because the relative positions of the Sun and Earth change in the course of the year, the Earth would be exposed in turn to all those twelve streams from the periphery—from the Zodiac. Everywhere on Earth, in all the kingdoms of nature, we ought to find a twelvefold order. The kingdoms of nature have a material composition, it is true, but there is something else: there is spirit, spirit which has been “broken up”. In other words, something is broken up which comes from the periphery and which is of a twelvefold nature; for what comes from the periphery would maintain its original cosmic nature of twelve-foldness. Yet there is also another aspect. The Earth is not the only planet in our solar system, there are more. You know that we generally speak of seven planets—five planets plus Sun and Moon. (I discount those planets discovered in the last 200 years.) So, there we have a seven-foldness related to time. Out there along the periphery we have a space-element as the background of the cosmos. This is the sidereal world, the world of the Zodiac, and this is a static element; in a sense, a static twelve-foldness. But the streams coming in from the periphery would in time pass through a seven-foldness. First through Saturn—the outermost planet—and the sphere of Saturn and then through Jupiter, and so on. They would descend through seven spheres. That process in time, as the streams move in toward the Earth, would also maintain its character and thus express itself in the seven-foldness which you certainly find in the kingdoms of nature. You can detect this seven-foldness in the structure and organization of a plant, or indeed any other single being in the kingdoms of nature. [This process of seven-foldness is explained in greater detail in the author's *Isis Sophia - Introducing Astrosophy*.]

What then is the purpose of the solar universe in which we live? What, to put it crudely, is the game all about? From one point of view—the viewpoint of the Sun—it appears to be a building-up process. It is there on the Sun that those great cosmic beings lived, the Elohim or Exusiai, who created the solar universe and who built and created all that exists within its boundaries.

This was reliable for as long as the Sun was, in a sense, the great guide in the cosmos. We know that conditions have changed since the time of Golgotha. The Sun is no longer what it had been before. True, it carries on its task of creating, so to speak, in accordance with the law of inertia. If it did not, we could not exist in the world of matter. Nothing would “break up” into material existence on the Earth. The in-streaming from

the periphery still has to take place and is inaugurated by the Sun. But we know that the great Leader of the Sun spirits, the Christ, the Head of the Exusiai, has descended to the Earth. Christ incarnated on the Earth and, during those three years, united the spirit principle of the Sun, step by step, with the Earth. First, Christ amalgamated more and more with the body of Jesus, and finally in the Event of Golgotha, united with the very planet on which we live.

Thus we would have to imagine the Earth bearing within itself something of the Sun nature in a functional sense. Spiritually, it is that principle of inner emptiness which we may experience when we do the exercises suggested by Rudolf Steiner for the attainment of spiritual perception. It is the element of emptiness in respect of personal thought, in a sense, an external emptiness. But in a spiritual sense it is a spiritual fullness, the consciousness of Inspiration. That principle has united with the Earth and has surely changed the character of the whole solar universe.

The building-up of the “house” of the solar universe is carried out from the viewpoint of the Sun. This has been done chiefly by the Elohim or Exusiai. On the other hand, the spirit principle of the Sun has united with the Earth and has introduced something quite new into the cosmos. What is this? We know that the Christ has opened the gate for humanity through which we can enter into an awareness and realization of the higher self within the individual human being. This can awaken in every human being who turns his heart toward the Christ Impulse and to Christ.

Therefore, we can safely say that there is something on the Earth, an element within it, that can realize the cosmic principle which used to dwell on the Sun. In times to come, this principle will certainly also work as a creative power in the cosmos but with one great difference. On the Sun and from the Sun it was working as a cosmic principle which was entirely the affair of the divine hierarchies. But from now on it can become a principle of humanity. In the future, humanity will have the opportunity to bring about what the hierarchies used to do, to realize it at the human level. It will be experienced at the level of the human I, of a human self. The whole purpose of the development, of the evolution of our solar universe is, I believe, contained within these two aspects. Creation, which we sometimes call the old creation, the creation inaugurated by the hierarchies, has come to an end. Through and since the Mystery of Golgotha, something has been inserted into it which is a new creation, creation at a different level. It is not at the level of the hierarchies but at the level of humanity, of the realization of the self or I. I believe this aspect is important.

We still have the task of finding out the nature of the extra-solar world. What do we know about that extra-solar world, i.e., the world of the stars? We see single stars; for instance, in the constellation of Twins we see Castor and Pollux, and in the constellation of Bull we find the bright star Aldebaran. We also perceive stars like Sirius, but Sirius is below the Zodiac; we shall have to speak about that world too. Those stars, what are they? What does modern astronomy tell us about them? We are told they are suns, that the stars are suns. Very well, how far can we get with this concept? We have tried to acquire a definite concept so far, with the help of Rudolf Steiner, by attempting to create an imagination of the Sun—of its being. It is a hole in space, an emptiness, a vehicle, so to speak, of cosmic individuality, of cosmic intelligence. Very well, if the stars are suns, perhaps they are suns in the sense of ours, namely vehicles of divine hierarchies. So where are we now? Out there in cosmic space, all around our solar system (Fig. 1), we would have suns. These suns would be the chariots of divine selves, divine intelligences, in other words divine hierarchies.

Thus what is drawn into our solar universe would be a substance which these hierarchies had prepared in the dim past. We can regard it as energy, or astral substance, perhaps simply as sidereal substance. The words don't matter. As long as we are aware of the possibility that the essence which exists out there is a world of emanation from the divine hierarchies, then we would seem to be on the right track. That essence is taken into our solar system, where it undergoes the process we have been describing. Thus the world out there, the world of the stars, would be something like the ground of all existence in a spiritual sense. It would be the Father-ground of all existence. On the other hand, the processes inaugurated by the being of the Sun within the solar universe were obviously designed for a progressive evolution. Step by step and stage by stage the essence coming from the Father-ground of existence has been brought nearer and nearer to the realization at the level of cosmic selfhood. Thus we have a progression from the Father through the Being of the Son (the I AM). Finally, when it is experienced in humanity at the level of the individual I, we can imagine that the essence which was originally in the realm of the Father wakes up in the realm of the spirit of humanity, of the Holy Spirit. Thus we can see,

perhaps, that our solar universe is really a process of tremendous importance in the total universe—in the greater universe.

We could, of course, argue and say, “Well, just as our solar system has seven planets—five plus Sun and Moon—perhaps those suns out there also have created similar planetary systems, competitors, so to speak, of our own solar universe.” So far nothing of the kind has been discovered. No rival planetary system in the sidereal worlds, no planets racing around those suns out there in the extra solar space have been detected. It seems that our solar system is in quite an extraordinary position; it may indeed have the unique purpose of leading the Father element through the Son element to the experience of the Holy Spirit at the level of the Self, the I. We have been speaking about the solar universe as if it were a plane, a disc. There is a tendency to imagine it as a sphere; however, it is a fact that all the planets and the Earth, and even the Earth’s Moon, are all moving more or less in one common plane. It is not the case that one planet moves in one particular orbit (Fig. 3a) and another planet at an angle to it. The planets move, more or less, in one plane on a disc (Fig. 3b), with slight deviations which are of great importance. The solar universe is a sphere which has the tendency to shrink, as it were, into a plane. Hence, its periphery touches only a relatively narrow band of stars, and that is the Zodiac and its twelve constellations.

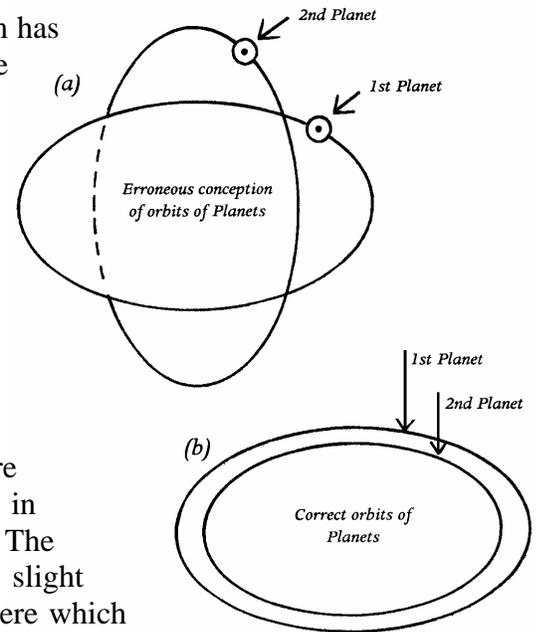


Fig.3

There is yet another question which we ought to discuss, and that is the question very often asked about the stars beyond the Zodiac. You know that above and below, there are also stars bordering on our solar universe. What about them? An intensive study of the Zodiac, of the effects of it and of the outer constellations, can lead to the conviction that the outer constellations are, in fact, connected with the Zodiac. In order to explain what I mean I would like to give as an example the constellation of Fishes.

Directly above Fishes you find the constellation of Andromeda—indeed the whole complex of the Andromeda-Perseus myth. They are all extra-zodiacal constellations. Perseus is there, a bit further back, above Ram. Further toward Waterman and above the Zodiac stands Pegasus. Still higher up in the northern sky is Cassiopeia, the mother of Andromeda, and Cepheus, her father. You probably know the myth: Andromeda was their daughter. Cepheus was king of Ethiopia, and Cassiopeia, her mother, boasted that her daughter was more beautiful than any of the daughters of the God of the Sea. (Much more time would be needed really to elaborate on a myth of this kind, for it is quite wonderful, a storehouse of spiritual truth; however, we cannot do so now.) The God of the Sea was enraged and he sent a terrible monster, Cetus or the Whale, to Ethiopia. This monster was sent by him to destroy the coast of Ethiopia in revenge for this insult. The destruction was so great that they consulted an oracle. The answer was that there was only one possible way out. Andromeda, daughter of the royal couple, had to be sacrificed to the monster, to Cetus. So she was brought down to the coast and was chained to a rock. The Whale approached her from beneath Fishes. Just at that moment Perseus came flying through the air, returning from an expedition. He had killed the Medusa, another monster, and he was carrying her head in his hand. This head had the devastating power of turning everything to stone that looked into her face. Even Perseus had to walk backward and only look at the image of the Medusa in the mirror of his shield, the back of which was burnished metal. He could not attempt to look at her face or he would have become a statue. In this way he had cut off her head, which he was now carrying as he came through the air. In an instant he saw what was going on below and realized the plight of Andromeda. He held up the Medusa’s head, and the Whale was transformed into a huge block of stone. Thus Andromeda was saved.

Andromeda is usually depicted on ancient star maps with the chains falling from her arms at the moment of her rescue. What does the female figure in celestial constellations signify? In mythological representations it is usually connected with the soul element, for instance, the soul of humanity. In the case of Andromeda the soul of humanity is bound to a rock. She is above the Fishes. You will recall what Rudolf Steiner says about the Fishes, especially in connection with our present age and the precession of the vernal point.

Our present age, which started in 1413 AD., is ruled or inspired by the cosmic impact coming from the direction of Fishes. Above that is Andromeda chained to the rock. This is a perfect description of our present age—the soul of humanity chained to the rock of materialism. All this, of course, is connected with the capacity for thinking. The drama dates back to the Greek civilization. It was then that thinking was born in humanity as a brilliant and progressive capacity. It was only much later that it deteriorated into an intellectualism estranged from reality. From those fetters Andromeda must be freed. That is the task of the age of Fishes. At the moment of her rescue, another constellation above Waterman, Pegasus, comes into prominence. The constellation of Pegasus is directly above the head of Andromeda. In fact, the two constellations of Andromeda and Pegasus have one star in common, and that star lies in the forehead of Andromeda.

Pegasus is the winged horse deeply connected with the Muses. What is the horse in Mythology? It is always associated with intelligence, a picture of a kind of intelligence. At the moment when Andromeda is freed, when her chains fall, the winged horse (winged intelligence) rises as if it were from her forehead, from her brain. This is a description of the drama of our present age. Present-day humanity is chained to materialism which has permeated our thinking; the thinking that in Greek times was something glorious but which has deteriorated in the course of time into materialistic world conceptions. It must be freed, and once it is freed it can rise again as “winged” intelligence. It will then become the instrument for the perception of spiritual truth. This story demonstrates how the constellations and stars outside the Zodiac are deeply connected with the Zodiac itself. In a sense, they are even interpretations of the Zodiac. If we want information about the constellation of Bull, for example, we can be quite sure that we can go to the constellations bordering Bull—on either side, below and above it—and that in those constellations we will find certain aspects that will help us to understand Bull.

This lecture has been no more than an attempt to create a very sketchy picture of the solar universe, one which we shall have to work with during the next few days. It is essential to have a foundation of this kind, so as to find a practical approach to cosmic forces and to their impact on the Earth and on the substances distributed among the kingdoms of nature. Also, it seems essential to remove, as far as possible, the impasse caused by a picture of the universe based on materialism. With regard to astronomy this materialism is rather crude, and we shall have to make great efforts in order to break through to a conception of the cosmos which allows us to see as clearly as possible the working of cosmic forces in earthly substances.