

SCIENCE MEETS DHARMA - Research Astronomy Universe

In this research (March 2005), we compared the Buddhist view of the Universe with the scientific view. Our focus was on the formation and destruction of the Universe. I took notes of what was discussed during class. I'm aware of the fact that I don't fully understand the Buddhist view and, therefore, there will, in all probability, be some mistakes in this summary.

1. **Zhoe and Kalachakra**

Zhoe (Abhidharma) and *Kalachakra (Dhuekor)* are Buddhist scriptures which deal with Astronomy.

Zhoe (Abhidharma) was written by a single person, Lhopon Yoenyi. It's a book of the 'lower school' of Buddhism. It's part of our monks' curriculum. In the first year, the monks get some kind of an experimental basis (similar to Physics). They mostly focus on the individual. In the second year, other people are included in their studies, and in the third year all living beings of this world. In addition to this world, the monks learn about the Universe in the fourth year. Similarly to science, the lower school believes in what can be seen and verified.

Kalachakra (Dhuekor) is a book of the 'higher school'. Once the monks obtain their *Geshe* degree, they start their *tantric* studies. They reach a higher spiritual level and conduct mental experiments. Meditation plays an important role at this stage.

The monks compared the two schools with the following situation: 'When you're sick, you follow your doctor's advice concerning your diet, you don't eat what the doctor tells you not to eat. Once you're healthy again, you can decide yourself what to eat. Similarly, a student of the lower school has to strictly follow the scriptures, a student of the higher school has more mental power and he can therefore verify things himself, he's more independent. He still has to follow some guidelines, but there's room for 'individual interpretation'.'
The views of the two school often seem to be contradictory.

Obviously, our monks are more familiar with *Zhoe* than with *Kalachakra*. We therefore focussed on this scripture for our research. (Some of the information given in this text, however, is extracted from *Kalachakra*.)

2. 'Universe' in *Zhoe* - Comparison with science

According to some of the monks, the formation of the Universe and the evolution of human life doesn't seem to be considered very important. *Zhoe* was written approximately 1'500 years ago and it has never undergone any changes. The view of the Universe, as explained in *Zhoe*, had been established before Lord Buddha's life on Earth. Buddhists had accepted this view and they included it in their scriptures without verifying it. There isn't too much emphasis on the formation of our Earth and the evolution of human life, the description of the formation of a universe seems to be quite 'vague'. Different scholars have expressed (and published) their 'own personal view' on the topic. Our students felt that they couldn't get all

the necessary information out of a single chapter, they collected pieces of information from different sources (mostly chapters of *Zhoe*) and they put the pieces together 'like a puzzle'. It seemed to me that one or the other monk had their doubts concerning the content of the 'Astronomy part' in *Zhoe* [?]. One of the monks, however, seems to be very convinced that everything mentioned in this scripture shows reality, often at a level scientists are not able to explore or understand. According to him, the amount of knowledge conveyed by *Zhoe* is immense. Nothing should be changed. He believes that the scientists' knowledge is very limited ('they generally don't go further than from here to first camp...'). Even the most advanced telescopes don't have enough 'power' to unveil the full scope of reality. The scientists who use a telescope don't have enough mental (or spiritual) power to 'see beyond the obvious' (e.g. the 'King of Mountains' [see also sections 4 and 5], our Earth as an 'island' in a huge ocean, etc.). - The view of the higher school, however, is completely different; there is, for instance, no 'King of Mountains' in *Kalachakra*.

The same student (as mentioned above) gave another example for the limits of science: Scientists find minerals, oil, etc. when they explore the oceans on our Earth, but they're not capable of recognizing the existence of *klu* (animals such as snakes, fish, frogs, mostly in oceans, lakes, rivers, creeks, ponds, etc.; ordinary people see them as such, but in reality, they are half human and half snake). *Klu* can, amongst other things, cause rain; if they are, for instance, angry, we won't get any rain when we desperately need it. They don't necessarily live on Earth, they can also be found above, e.g. in the sky. - Science often only scratches on the surface of reality.

Despite modern technology, space travel will always be limited, so scientists will, in all probability, never be capable of solving all the mysteries of our Universe. Buddhist scholars who have established enough mental power are, according to our students, experts in exploring and verifying phenomena and facts by conducting (mental) experiments; there seem to be no limits for (human) minds. It therefore seems to be feasible for someone's mind to travel through space. One of our monks strongly believes that a great deal of Buddhist knowledge about our Universe has been gathered that way. Most of the others, however, admitted that they didn't have any detailed knowledge about this. Similarly to last year's students, I was told that mind travels at a higher speed than light. (Last year, a Tibetan monk with a University degree in Buddhist philosophy [*Acharya*; similar to a Geshe] had explained me that, when I, for instance, think about a family member, a room back home or when I imagine being there, my mind travels to Switzerland and back to India faster than light. When I mentioned this example, some of my students disagreed strongly and argued that my mind doesn't actually travel in such a case, I just activate my memory. Otherwise, the monks explained further, I could see the present situation back home, which is, without a doubt, not the case. This reasoning made sense to me. Human beings with a high spiritual level, however, are, according to the monks, capable of seeing the present situation as well.) One of the students explained that mind needs to be connected with small air particles (air molecules [?]) in order to be able to 'travel'. In the absence of air, this is impossible. (After we die, our minds are, according to the 'higher school', always surrounded by air on their 'journey' to the next reincarnation.) When this was mentioned, the monks started a debate on whether travelling minds always stuck to the same air particles or whether they just travelled *through* air. A student of the latter group argued that air particles travelling with minds would imply that matter could travel faster than light, which would be in contradiction with Physics (modern science, however, doesn't rule out the possibility of mind [or thoughts] being capable of travelling faster than light). The other group countered that this type of air (which is not known to scientists) could not be considered as being made of matter (there are, according to Buddhist scriptures, at least five different types of *lung* [air], and not all of them are believed to consist of matter). After this, all the students seemed to agree that the first group was right...

Advanced meditation techniques seem to make it possible for someone's mind to travel through and explore space. One of the students told us, that, using a different type of meditation, a scholar with a high level of mental power could see 'images' of different 'worlds' without his mind actually travelling there.

The monks gave me some examples of human beings who travelled in space. They told me about a non-Buddhist *sannyasin* or *sadhu* (they didn't know his religion) who had meditated in order to make a 'fulfilling ghost' appear, a ghost who grants wishes. In order for wishes to be granted, the person who meditates has to grab hold of this ghost's tongue, which is a sword, as it sticks it out. If they fail to grab the sword, their throat will be cut. The *sannyasin*, however, managed to catch hold of the sword and the ghost turned into gold. The *sannyasin*'s servant, a Buddhist, asked him to use the sword, and it enabled him to leave our 'continent' (Earth) and to see the 'King of Mountains' and the other 'continents' in our 'world'. After he had returned, the servant built a temple in the shape of the 'King of Mountains'. The monks referred to these events as a 'story', so they aren't sure either about the source or whether it is true.

Guru Rinpoche (Tibetan name Lhopa Pema Juney; founder of the oldest sect in Tibetan Buddhism, *nyingma*) may have been another human being who left our Earth, saw the 'King of Mountains' and built a temple shaped like the 'King of Mountains' at *Samye* monastery in Tibet. This monastery is of great significance for (Tibetan) Buddhists. Every human [?] being (or rather their soul / mind) goes there before they die in order to breathe their last breath; it's like the 'gate to their next life'. There's a dark room, similar to a dungeon, at this monastery which is only opened once a year. A rope and a butcher's knife are put there (to 'cut the dead body into pieces'), and every year they have to be replaced because they're worn out and they've apparently been used. Human voices and the breath of dying beings can be heard in the room. According to our students, the Chinese government doesn't interfere and leaves this monastery untouched because they also believe in its significance. *Samye* monastery is considered a 'world wonder'. There are no pillars inside the building and there was no blueprint for its construction. Buddhists believe that Guru Rinpoche was able to overcome gravity (by means of meditation which enabled him to control the air in his body). He 'hovered' above the ground and gave instructions to the construction workers on how the foundation and the rest of the temple were supposed to be built. Apparently, the plan was in his mind and the workers followed his instructions. The monks believe that, during the day, the temple was being built by human beings, whereas ghosts and gods continued the construction work at night. One of the monks emphasized that he didn't believe in all this. Anyhow, it seems to be widely believed amongst monks and, as I've been told on different occasions, amongst laypeople as well.

In this context, my students also mentioned gods from other 'worlds' or '3000 world realms' who travelled through space in order to hear Lord Buddha's teachings about emptiness. This seems to be written in Buddhist scriptures and is therefore considered a fact.

There seem to be numerous monks / scholars who can travel at a very high speed within this 'world'. Some of them can also be found at Sera monastery, but they won't tell you about it, because, according to a monk, 'they don't want to show off'. In this case, it's not necessarily someone's mind that travels, but both mind and body. Those human beings can, for instance, 'ride the wind like a horse'.

I had thought that it was considered an undisputable fact (for Buddhists) that mind can travel through space in order to find out more about our Universe... – until I discussed this topic with our advanced class. This supposedly 'undisputed fact' triggered a rather heated and very interesting debate. Two of the monks (of the advanced class) believe that somebody's mind only leaves its abode (the body) after they die. Others think that space travel is possible for the minds of Buddhist scholars who are on a particularly high spiritual level. It sometimes

seems to be a matter of interpretation: Does a Buddhist scholar with a lot of mental power 'simply' see or know what, for instance, outer space looks like or is his mind actually capable of travelling there? (When I asked the question: *Is it possible for human minds to travel [during the lifetime of a human being]?* two of the questioned monks said, as mentioned above, *No*, two said *It's only possible for 'enlightened ones'*, one answered *Yes* and one *I can't say*.)

The 'opponents' of the belief that human mind can travel argued that the minds of 'spiritually gifted' human beings simply know more, for instance about outer space, without actually going there. 'Predictions' they make are often (mis)interpreted as 'mind travel'. 'When I look at a nearby object', they explained, 'my mind doesn't go there. The same is true for objects which are far away.' According to these students, it's all a matter of practice. They compared it with our eyesight: 'If you practise, you can see further and clearer. The same is true for your mind and you can understand more.'

During our discussions about mind travel, we got, at times, a bit carried away and wandered 'off the beaten track'. Such 'excursions' were, however, very interesting. One of the monks, who strongly believes in 'mind travel', told us about a girl who supposedly lives near Sera. She is, according to the monk, a very kind-hearted person who takes care of her mother; but, every now and then, she suddenly behaves in a very rude manner and starts scolding her mother. It's believed that the mind, or maybe rather the spirit [?] of another girl from Tibet enters her body at times like these. When he heard about this, one of our translators got involved and gave a similar example of a man who sometimes seems to be 'out of his mind'. 'When this is the case', the translator explained, 'he actually looks completely different.' Even though he emphasized that this cannot be considered a 'physical transfer', he (and other Tibetans) believe that the man's body is taken over by his father's spirit. To prove that somebody's mind / spirit enters another person's body, some Tibetans tie, according to our translator's explanations, a thread around this person's finger (in order to prevent the spirit from leaving the body) and they question them.

On the one hand, Buddhism has, without a doubt, gathered more knowledge in the realm of spirituality. One of the monks mentioned that science, on the other hand, focussed more on matter and has therefore established a more detailed insight in this realm. The monks agreed that, basically, the main goal of Buddhism and science was the same, i.e. to find out more about truth / reality. Only the approaches, the background and the bases are different. It is therefore, according to the monks, not necessary to replace anything in Buddhist scriptures, the findings of both Buddhism and science ought to be taken into account. They often complement each other. If we include information from both sides, we will get a broader picture of reality.

The students felt that, in this particular case, they were not in a position to compare Buddhist and scientific views. (*However, they still came up with some highly interesting thoughts and comparisons.*) Their knowledge of neither Astronomy (scientific view) nor Buddhism (*Zhoe*) seems to be profound enough to do so. We are indeed still teaching science at a very basic level, and the monks haven't started studying Astronomy in *Zhoe* yet. But one of the major goals of *Science meets Dharma* is to encourage the monks to reflect upon what they learn about science in connection with Buddhism, even at a basic level. If they develop eagerness to do so, sooner or later they will be capable of joining the dialogue between science and Buddhism on a more sophisticated level.

3. Karma

'Karma' is obviously essential in order to understand the (partial) formation and destruction of the Universe. We have to distinguish between individual and collective karma. The monks agreed that karma can be considered some kind of a 'total' of all the good and evil deeds. Of course, this is a simplified explanation. According to the monks, karma has different 'layers' and it therefore seems to be far too complex for a layman to fully understand it. The time of destruction and the new formation of the lower levels of the Universe depend on the collective karma.

Karma is based on cause and effect. Whatever we do has an effect on our future, in this life as well as in future lives. If, for instance, two farmers sow seeds with the same conditions (same place, same amount of rain, same soil, same seeds, etc.), the farmer with the better individual karma will get better results, his plants will grow faster and they'll be stronger and healthier. If we are compassionate, this will be positive for future reincarnations. If, for instance, we are generous and give money or food to beggars, we may be rich in our next life. Bad or good karma doesn't necessarily have an effect on our next life, maybe only after 10, 100... lives. Our present life's karma will 'add up' to the karma of our previous lives. (Depending on their karma, different beings will perceive a glass of water in a different way: For a god, the water is nectar, for a human being and an animal, it's water; for a hungry ghost, it's dirty blood and pus.)

Our individual karma is part of the collective karma of all living beings (human beings, animals, gods, demigods...). If the collective karma is bad, i.e. it has reached a certain 'stage', the lower levels of our Universe will be destroyed. – If somebody doesn't fully understand karma, they cannot believe what *Zhoe* teaches about the Universe.

I've found some useful information on this topic in the book 'Kindness, Clarity and Insight' (based on a collection of talks given by the Dalai Lama; translated and edited by Jeffrey Hopkins):

'Pleasure and pain come from your own former actions (*karma*). Thus, it is easy to explain karma in one short sentence: If you act well, things will be good, and if you act badly, things will be bad. - Karma means action. From the viewpoint of how actions are done, there are physical, verbal, and mental actions. (...) Whether (...) actions become good or bad is mainly based on my motivation. If I speak from a good motivation out of sincerity, respect, and love for others, my actions are good, virtuous. If I act from a motivation of pride, hatred, criticism, and so forth, then my verbal and physical actions become non-virtuous. Karmas, therefore, are being made all the time. (...) Buddha's teaching is that you are your own master; everything depends on yourself. This means that pleasure and pain arise from virtuous and non-virtuous actions which come not from outside but from within yourself. (...) The important point is that such presentations of Buddhist theories about actions can make a positive contribution to human society. It is my hope that whether religious or not, we will study each other's systems to gather helpful ideas and techniques for the betterment of humankind.'

According to the lower school of Buddhism, there is a 'higher power' which decides what is going to happen to an individual after death (reincarnation depending on individual karma) or to a universe (depending on collective karma). This 'creature' named Shingyal Choegyal is often depicted on paintings of the 'Wheel of Life'. (The monks are not sure whether it can be considered a god; maybe it only exists in the imagination of people shortly before they die. The painting is often 'used' for funerals, the people hope for a favourable reincarnation of the deceased...?) It holds the wheel and the depiction generally illustrates that Shingyal Choegyal is everywhere, keeping account of everybody and everything we do.

According to the higher school, the existence of such a ‘higher power’ or ‘creature’ is nothing but illusion. The future of an individual or a universe depends solely on the individual and collective karma respectively.

4. General information about the Universe - Structure of the Universe

According to Buddhist belief, the Universe neither has a beginning nor an end, i.e. when parts of the Universe are destroyed they are only destroyed up to a certain ‘level of heaven’, the Universe as a whole has always existed and it’ll never be destroyed, even though it continuously undergoes changes. We could say that the lower levels of what we compared with ‘a cluster of galaxies’ (a ‘3000 world realm’ = 1 billion of ‘worlds’) will be destroyed and then re-formed, depending on the collective karma of all the living beings of the previous ‘3000 world realm’.

Structure of the Universe:

The Universe is infinite. (‘You could place a grain of sand in our world, another one in a ‘world’ 1000 ‘worlds’ apart from us, another one 2000 ‘worlds’, etc. and you wouldn’t have enough sand on this Earth to travel all across our Universe.’) It consists of an infinite number of so-called ‘3000 world realms’ (*thong sum gyi jigtenkham*), each with one billion of ‘worlds’. (1000 ‘worlds’ form a ‘1000 world realm’, 1’000’000 [1000x1000] ‘worlds’ a ‘2000 world realm’, 1’000’000’000 [1000x1000x1000] a ‘3000 world realm’.) Different ‘3000 world realms’ are different in both shape and size.

There are four so-called ‘continents’ (our Earth is such a continent), subcontinents (our Earth is believed to have two subcontinents), planets, stars, a sun and a moon in each ‘world’. Our ‘world’ is called *mee jey ki jigtenkham* (this may also be the name of our ‘3000 world realm’; the monks were not 100% sure). The shape of all the ‘worlds’ in our ‘3000 world realm’ is the same – or at least similar (see illustration), the shape of the ‘worlds’ in other ‘3000 world realms’ is different.

In each ‘3000 world realm’, or even in each ‘world’, there are six types of beings (*migrators*): Gods (*Sanskrit: deva*), human beings (*manusya*), demigods (*asura*), hell beings (*naraka*), hungry ghosts (*preta*) and animals (*tiryah*). Human beings of different ‘worlds’ (or even within one ‘world’) are different in shape and size, but they all have a lot in common (individuals who can think, who have desires, etc.). It seems as if there were some relation (resemblance?) between the shape of a ‘3000 world realm’ and the shape of its human beings. Human beings in different ‘worlds’ adapt (in shape, behaviour, etc.) to conditions of their surroundings (e.g. temperature). The head of a human being resembles the shape of the ‘continent’ they live on.

The monks described the planets (and stars) as ‘heavenly objects’, i.e. they are above (and not on) the ocean and the ‘continents’ and can be seen from all of the four ‘continents’ (the students believe that they are ‘located’ in a distance half way the height of the ‘King of Mountains’; some Buddhists [e.g. some of the monks of last year’s ‘Astronomy group’], however, argue that they float on the ocean). Interestingly, the names of the days of the week (as mentioned in Buddhist scriptures) are derived from the names of the five visible planets and Sun and Moon, similarly to various other languages, such as French, Italian, English, German, etc. (*Sunday, Sonntag* – Sun; *Lundi, Monday, Montag* – Moon; *Mardi* – Mars; *Mercredi, Mercoledì* – Mercury; *Jeudi* – Jupiter [?]; *Vendredi* – Venus [?]; *Saturday* – Saturn). Sun and Moon are considered planets, but not the Earth (which is, as mentioned before, a ‘continent’). The planets are considered gods or rather residences of gods. (*Dawa*,

for instance, is the name of the god who resides on the Moon and not, as it's used nowadays, the name of the Moon itself.) The planets which are not visible to the naked eye (Uranus, Neptune and Uranus) don't seem to be mentioned in Buddhist scriptures.

A 'world' consists of three realms: the so-called 'realm of desire' (*dhoe kham*) [our Earth is part of this realm; 'layers' mentioned in point 3 - formation; including the 'King of Mountains' – illustration: 1 and 2, and four levels of heaven, illustration: levels 3-6], the 'realm of form' (*suig kham*) [four higher levels of heaven, three of them subdivided into 3, one into 8 – illustration: 1-4] and the 'formless realm' (*suit mey kham*). Greed, lust and jealousy can be found in the 'realm of desire'. The creatures in the 'realm of form' are similar to us, but they can't smell and taste (even though they have nose and tongue). The 'formless realm' is the world of spirits. They don't have to eat, drink or sleep and they don't have a form or body. The 'formless realm' is shared by all the 'worlds' of a '3000 world realm' (it has no form and it can be anywhere; it therefore doesn't make sense to depict it in a painting). Gods reside in all three realms ['worldly' gods: some of them reside, for instance, in level 2, 'King of Mountains'].

Our students believe that Earth, Sun, Moon and the planets and stars scientists know about face the blue side of the 'King of Mountains' ('South'). Our sky therefore appears blue. The big ocean on which our Earth floats contains salty water, whereas the water in the ocean around the 'King of Mountains' is pure. This water would be very healthy for us, but it's out of our reach. The 'King of Mountains' is so far away from us that we cannot see it.

The four continents are located East, South, North and West of the 'King of Mountains'. According to Tibetan folk tales, beings who live west of the 'King of Mountains' (facing its red side) are made of butter. We wonder why they don't melt, but they may also wonder why beings made of flesh and blood on our Earth don't go rotten. The monks, however, emphasized that the existence of beings made of butter was not mentioned in Buddhist scriptures. One of the students, who had conducted some more thorough research, gave me the following explanations:

- The Southern Continent (*zambuling*) is our Earth. The human beings of the Southern Continent named to the other continents. The name *zambuling* was derived from a plant called *zambu* whose seed had fallen into the southern ocean. In our 'world', all Buddhas will be born on the Southern Continent. All human beings on our continent have the seed of Buddha within them.
- The Eastern Continent is called *shar lue papo* (east, body, taller [double size]). Human beings are taller than on our continent (double height) and their lifespan is 200 years. There aren't many animals.
- On the Northern Continent *jangdamenyind* (north, 'not good for your ears'), human beings are not selfish and have a lifespan of 1000 years. One week before they die, they 'hear' that their life is coming to an end and they suffer a lot during that time.
- The name of the Western Continent is *bhalangchoe* (west, depending on cattle). The human beings solely depend on cattle and, therefore, they have a lot of them.
- Human beings on the Western and the Eastern Continent are good at 'business'.

We tried to find the Buddhist equivalents (if there are any) of the Universe, a cluster of galaxies, a galaxy and a solar system. Even though it's a far cry from being clear, we decided to keep the name 'Universe' for both the Buddhist and the scientific view; a '3000 world realm' seems to be similar to a cluster of galaxies, a 'world' similar to a galaxy. Our solar system is part of such a 'world'.

5. Formation of the lower parts of the ‘worlds’ in a ‘3000 world realm’

5.1 General information

We’ve decided to focus on the formation of the ‘realm of desire’ because it would be too complicated to include the formation of the lower levels of heaven.

The better the collective karma of the previous ‘3000 world realm’ (living beings of the ‘3000 world realm’) was, the better the newly formed ‘3000 world realm’ will be.

The formation starts at higher levels (heaven) and ‘moves’ down to lower levels (‘realm of desire’) because it’s caused by good karma. Within the ‘realm of desire’, however, the formation goes from bottom to top. All the ‘worlds’ of a ‘3000 world realm’ are formed at the same time.

5.2 Formation of the ‘realm of desire’

When we dealt with the structure of the universe, a heated discussion started because one of the monks (of group 1) presented his personal view on the topic and the monks of group 2 felt this was contradictory to what they had found out. Once again, it was interesting to see how the monks discuss different views and opinions. Individual interpretation always plays an important role when monk students debate the content of Buddhist scriptures. Eventually, we reached an agreement in order to give a group presentation (which isn’t too complex) without contradicting ourselves.

5.2.1 Wind mandala

The wind mandala is formed by smooth wind. It contains all four elements (wind, water, fire and soil) and the qualities of the four elements (can be felt, seen, smelled and tasted), but the percentage of wind is the highest. The formation is caused by the collective karma of all the living beings of the ‘3000 world realm’. The wind mandala is oval in shape (somewhat like a long egg), the colour is sky-blue. It’s 600’000’000’000 *pak-tse* thick, the diameter is 1×10^{59} *pak-tse* (1 *pak-tse* equals between 7 and 8 kilometres; 1000 arm spans = 1 *jangthak*, 4 *jangthak* = 1 *pak-tse*). The wind mandala can be considered some kind of a foundation: It holds the ‘King of Mountains’ and the upper layers of the realm of desire. It can only be destroyed by the four elements. (The monks believe that there’s only one huge wind mandala for all the ‘worlds’ of a ‘3000 world realm’, but this issue seems to have triggered some debate amongst Buddhist scholars [it’s also possible that each ‘world’ has its own wind mandala...].) [*The wind mandala is depicted as the outer ring in the illustration.*]

5.2.2 Water mandala

Golden clouds are formed above the wind mandala (they contain gold, but mainly they’re made of water). It rains for a long time. Many large ‘dew drops’ (diameter: 1’120’000 *pak-tse*) are formed on the wind mandala (each of them will become a ‘world’ later on). Either air or the collective karma keeps the drops in a round shape (two different views).

5.2.3 ‘Individual’ wind mandalas

‘Individual’ wind mandalas are naturally formed underneath the dew drops in order to prevent the drops from spreading and mixing.

5.2.4 Gold mandala

A smooth wind separates the (pure) gold from the water (the drops contain all four elements, but the water element is dominant). A big ocean is formed in each world. The gold floats on the surface of these oceans. The gold mandala is the base for the ‘King of Mountains’.

5.2.5 Big Ocean

Above the gold mandala, clouds which contain all (or most of) the elements (not the four elements of the Buddhist view, but the elements of our periodic table) are formed. Heavy rain falls, a big ocean forms on the gold mandala (84’000 *pak-tse* deep).

5.2.6 The ‘King of Mountains’

Wind on the ocean causes the formation of the ‘King of the Mountains’. It’s made of the two most precious stones (red and sky-blue) and two precious metals (gold and silver) [see illustration: four sides, four different colours]. Its height is 168’000 *pak-tse* (84’000 *pak-tse* underneath the surface of the water, 84’000 above).

5.2.7 Seven mountain ranges

Seven mountain ranges are formed (out of ‘semi-precious’ materials) around the ‘King of Mountains’. The water between these mountains has eight good qualities and is very good for one’s health. Outside the ranges, the water is salty. (The monks believe, but they are not sure, that the ocean around the ‘King of Mountains’ and the ocean which surrounds our Earth are the same. They are, however, referred to as ‘inner and outer ocean’ in Buddhist scriptures.)

5.2.8 The four ‘continents’

The remaining materials are used to form the four ‘continents’, all at the same time. (The formation of both the seven ranges of mountains and the four ‘continents’ is caused by wind.) The four ‘continents’ are like islands in the ocean, their ‘foundation’ is the gold mandala.

5.2.9 Mountain fencing

A fence of mountains (made of iron) is formed around the ‘world’. It’s not explained why and how this is formed.

(Different layers [from bottom to top; see illustration]: wind mandala, water mandala, big ocean, gold mandala, ocean)

The monks wondered why, nowadays, scientists travel in space but still can't see the 'King of Mountains' and what lies beyond. They couldn't come up with an answer, but these reflections show that they try to compare Buddhist and scientific 'knowledge'.

6. Destruction of the lower parts of the 'worlds' in a '3000 world realm'

6.1 General information

If the collective karma is bad, i.e. it has reached a certain 'stage', the lower levels of the 'worlds' in a '3000 world realm' will be destroyed (all the 'worlds' at the same time). Other '3000 world realms', however, won't be affected. Living beings with a good individual karma won't be harmed much. Only gods on the highest levels of heaven (and, of course, 'Enlightened Ones' [who 'live' at a place near the highest levels of heaven]) will never be harmed at all. Due to their long lives, they've seen the lower levels of our '3000 world realm' being destroyed and newly formed many times. Gods on the lower levels of heaven and 'worldly' gods (e.g. Hindu gods such as Ganesh, Shiva, Vishnu, Brahma) will also be affected. ('Worldly' gods are similar to human beings. They eat and 'they generally do what we do..'. Gods in the 'realm of form' and in the 'formless realm' don't have to eat.)

When human life came into existence, people didn't have to eat, there was no craving, no attachment. Light emerged from their bodies. Then they started to eat, they became weak and dependent on food. At that time, they didn't have to cultivate land because there was food in abundance. Over the years, people have started to store things and to pile up their belongings and properties. They've developed more and more attachment. Human life has become less and less harmonious. The collective karma has deteriorated.

At the beginning of human life in a '3000 world realm', the people's lifespan is 80'000 years. Then it goes down to 10 years. This development repeats itself 20 times before a '3000 world realm' is destroyed. (The monks believe that this is to be considered an 'average'; depending on the collective karma, the cycle can be longer or shorter. They don't know where [in this cycle] we are at the moment. The fact that people live longer nowadays than they used to 100 years ago is, according to the monks, 'man-made' and not 'natural' [due to advances in medical science]). The students mentioned that it was difficult to determine the exact lifespan of a '3000 world realm', i.e. to convert 'Buddhist time' into years. The conversion of distance units seems to be a lot easier.

Wind is not connected with the highest level of a '3000 world realm', i.e. the highest level of heaven. Wind (and the other elements) cannot reach and destroy the highest level of heaven. It has always existed and will never be destroyed.

During the destruction and the new formation of the lower parts of a '3000 world realm', the souls (minds) of the living beings are 'transferred' to higher levels of heaven. Living beings are not necessarily reborn in the same 'world' or even in the same '3000 world realm', the reincarnations can take place anywhere. If, for instance, someone's mind is not worth being taken to a higher level of heaven (during destruction and new formation), it can also be 'transferred' to another '3000 world realm'. (The monks gave a simplified description of reincarnation as follows: Our mind changes bodies similarly to our changing clothes; the body can be considered a 'temporary residence' for our mind.)

Living beings who are on a high spiritual level can hardly be harmed by the four elements (e.g. people who meditate in order to overcome pain caused by fire or ice).

The destruction starts at the lowest level and ‘moves’ up to higher levels because it’s caused by bad karma.

6.2 Destruction of the ‘realm of desire’ and parts of the ‘realm of form’

(It seems as if the destruction of the lower parts of a ‘3000 world realm’ were not described in very much detail in Abhidharma. According to the monks, Kalachakra offers a more ‘in-depth view’ of the Universe. It deals with the relation between our body and the Universe. The body is somehow considered an ‘image’ of the Universe. Distances are measured in the human body and, by means of imagination, calculations are made for distances in the Universe.)

According to *Zhoe*, the lower parts of a ‘3000 world realm’ are destroyed by fire, water or air (wind). The ‘worlds’ are mostly made of soil, but they’ll never be destroyed by this element. Fire destroys the whole ‘realm of desire’ and the first level of heaven in the ‘realm of form’. Water reaches up to the second level, wind to the third level of heaven. The fourth level of heaven (in the ‘realm of form’) and the ‘formless realm’ will never be destroyed. The destruction of our ‘world’ follows a cycle (simultaneously with all the other ‘worlds’ of our ‘3000 world realm’). First, it’s destroyed seven times by fire, then once by water. This cycle repeats itself seven times ($7 \times 8 = 56$ times). After 56 times, the next destruction will be caused by wind. Afterwards, it starts all over again – seven times fire, once water, seven times fire, etc. Each time, the ‘3000 world realm’ is re-formed after it’s been destroyed.

The lifespan of gods on the first level of heaven (‘realm of form’) is seven times shorter than the lifespan of gods on the second level because the latter have a better karma. The second level is therefore only destroyed (by water) after the first level has been destroyed seven times (by fire). Accordingly, gods on the third level of heaven are only affected after 56 ‘destructions’. – The gods in the fourth level of heaven (‘realm of form’) are, as a monk put it, ‘experts in meditation’, they cannot be harmed by the four elements. (The seventeen levels of heaven in the ‘realm of form’ are also referred to as ‘meditation realms’. Similarly, people on our Earth with a high level of spirituality are, while meditating, capable of ‘creating their own world’ which protects them from the destructive effects of the elements.)

The monks are convinced that our present ‘world’ will be destroyed by fire, even though they don’t know exactly where we ‘are’ at the moment (within the above cycle).

Destruction by fire occurs in seven steps:

- i) The temperature of the Sun rises fourfold. Plants, animals and human beings die.
- ii) The temperature is doubled (i.e. 8 times higher than normal). Rivers dry up.
- iii) The temperature is tripled (i.e. 24 times higher than normal). Big rivers and all the water sources dry up.
- iv) The temperature reaches four times the above (i.e. 96 times higher than normal). Big lakes go dry.
- v) The temperature reaches five times the above (i.e. 480 times higher than normal). Oceans dry up.
- vi) The temperature reaches six times the above (i.e. 2’880 times higher than normal). The soil is baked, smoke arises.
- vii) The temperature reaches seven times the above (i.e. 20’160 times higher than normal). Everything (up to the first level of heaven [‘realm of form’]) is burnt up without any trace.

(Interestingly, the number 7 seems to be of special significance in Buddhism [7 times destruction by fire; fire/water cycle repeats itself 7 times; destruction by fire occurs in 7 steps; ... powers of 7, instead of powers of 10 in western science, are used for measurements of small particles such as atoms, etc.] The monks, however, couldn't confirm my assumption of the number 7 being 'special'. [Last year, a monk explained that our world would be burnt up by 7 suns, but this seems to be a misinterpretation of the scriptures...])

Destruction by water: Heavy rain falls and the 'worlds' are flooded. The soil is dissolved (as salt in the water).

Destruction by wind (air): A strong storm destroys everything and turns solid matter into dust.

(The destruction [and re-formation] of other '3000 world realms' occurs independently from the cycle of our '3000 world realm'. The monks are not sure whether the above description could also be used for other '3000 world realms'.)

7. 'Buddhist cosmology' by W. Randolph Kloetzli

The book 'Buddhist cosmology' offers interesting insights into the Buddhist view of the Universe and its connection with science. Even though it deals with Buddhism in general, and not Tibetan Buddhism in particular, it helped me considerably to understand the Buddhist view. I shared some of the information, especially about similarities between the two views, with my students. It caught their undivided attention, they showed a great deal of interest and they mostly agreed with the author's explanations, suggestions and opinions. (I had asked the monks about similarities before I told them about the book, and they'd come up with several similar ideas to the ones mentioned by the author!)

Three facts seem to be apparent:

- There are two discrete strands within Buddhist cosmological materials; those emphasizing time or motion as the basic cosmological metaphor and those emphasizing images of space and light.
- All phases of Buddhist cosmological speculation are closely related and each cannot be understood apart from the other.
- The cosmologies of Buddhism haven't existed in isolation, they've been closely related to the broader scientific and theological speculations of the entire classical world – particularly the ancient sciences of mathematics and astronomy.

In his teachings, Lord Buddha rejected speculations concerning the beginning and end of the world and the limited or unlimited nature of its extension in space. The Buddha refused to answer such questions because they were vain and had no significance for salvation. *(The monks had already known about this and they felt that it may have been the reason why several of our questions remained unanswered. Certain aspects with no special significance for Buddhists don't seem to be described in detail in Buddhist scriptures.)*

Each of the Buddhist cosmologies seems to be grounded in a particular scientific perception of reality, in each case the scientific basis is interpreted for the benefit of a theological vision, and it's the relationship between science and theology which must be understood. The underlying theology of these cosmologies centres around a drama of salvation. This drama finds its expression in terms of a journey of the soul.

The contemporary Buddhist community has apparently felt the need to make efforts to find the views of modern science reflected in Buddhist cosmologies. In one such effort, we are told that the *cakravala* ('world') is the equivalent of a solar system, while a 'lesser chiliocosm' ('1000 world realm') is equated with a galaxy, a 'middle chiliocosm' ('2000 world realm') with a 'cluster of galaxies' and the 'triple chiliocosm' ('3000 world realm') with a 'metagalaxy' ('supercluster of galaxies'). (*One of our monks rejected this comparison. He explained that, according to his calculations of distances, a 'world' could only, if that was possible at all, be compared with a galaxy. In this context, we discussed questions such as the following: If we compare a 'world' with a galaxy, why is there only one Sun and one Moon? If it's considered a solar system, how can we explain the existence of a great number of stars [and planets] in a 'world'? 'How can we account for the completely different numbers of stars, 'worlds', galaxies, '3000 world realms', etc. which have been calculated by scientists and Buddhist scholars?' Questions like these showed us that a direct comparison is far from being obvious.*)

We are told further that the Buddha's vision of endless time and infinite space correctly anticipated the vision of modern science, a fact which is offered as further proof of the Buddha's omniscience. The countless succession of worlds which the Buddhists posit as arising and disappearing throughout time are also said to support the anticipations of modern science that countless worlds are capable of sustaining life.

'Does not science, with its ever-expanding vision of illimitable worlds, many of which may be inhabited, and its ever-lengthening time-scale, accord with the Buddhist cycle theory? Who can longer speak of our little earth as the one and only 'world' that had an absolute beginning in time? Is it not far more likely that the history of the physical universe is endless, an infinitely long and beginningless process in which matter or energy forms achieve and lose a patterned existence over and over again; that worlds are born and die without cessation? Such a view, says the contemporary Buddhist, is both Buddhistically and scientifically true at the same time.' [p. 15] (*The monks had brought up this topic before knowing about the book...*)

The relationship between mathematics and Buddhist cosmology is clear. (*Several calculations had been presented by the monks.*)

Because 'cosmos' refers to those structures of space and time which transform chaos into a 'world', i.e. structures which support and sustain life, it must not be understood primarily as the physical universe, but rather as structured reality at every level, whether physical or spiritual. As such, 'cosmos' is the world at every level, whether universe, village, domicile, body or soul. Moreover, the meanings of each of these levels are frequently interrelated. Thus, the body may be understood as the abode or domicile of the soul while the universe may be regarded as the body of the deity. The interchangeability of self and world is a commonplace of both the Hindu and Buddhist traditions.

The astronomical themes of motion and light are transformed into the mytho-philosophic themes of journey and soul and integrated into a great drama of salvation... It is light which 'fixes' the Buddhist saints in the path of enlightenment. Apparently, Buddhist cosmologies contain the suggestion that man too possesses an interior light, a divine spark, a particle of light containing within it the Buddha-nature, the seed of rebirth and transformed being. The power of mathematics which allows the astronomers to measure the motions of the heavens also enables the faithful to comprehend the theological and mystical implications of these measurements.

8. Our Universe - Short overview (scientific view)

Beginning / end of our Universe

- Scientists believe that our Universe is up to 20 billion years old (stars which are at least 15 billion years old have been found).
- Nobody knows exactly how the Universe began.
- The *Big Bang Theory* is the most widely believed theory and there's strong evidence which supports this theory (e.g. the expansion of the Universe which can be observed).
- All the matter was suddenly created. It has expanded and cooled down ever since.
- *Big Bang Theory*: After a huge explosion, matter began to fly apart and slowly gathered (due to gravitational forces).
- The end of our Universe depends on how much matter there is in it. If there is 'not enough' (dark) matter, the Universe will keep expanding and cooling down. If there is 'enough', the expansion will come to a halt, the Universe will collapse and there may be a new *Big Bang*.

Evolution of our Universe from the beginning to the formation of our galaxy

- Billions of years ago, all the matter which exists now was packed together in the volume of a small ball.
- After the *Big Bang*, the Universe began to expand and cool. Quarks combined to form protons and neutrons, the protons attracted electrons and atoms were formed.
- Gravity slowly drew matter together. After hundreds of millions of years, this matter formed a gigantic 'web'.
- Two billion years later, clouds of gas and dust 'condensed' and formed large groups of stars called galaxies (different sizes and shapes; disks, spirals of stars, gas and dust). (Even though such galaxies are grouped in so-called clusters, there are large gaps between them.)
- Approximately ten billion years later, our galaxy, the *Milky Way* (diameter approximately 100'000 light-years), was formed. Some scientists estimate that there are approximately 100 billion stars in our galaxy and approximately 100 billion galaxies in our Universe. Different estimations, however, vary considerably.

Life cycles of stars

- Stars are made of gas. Due to nuclear fusion, enormous amounts of energy are released.
- Our Sun is a star. There's evidence to suggest that not only our Sun has planets with the appropriate conditions for the evolution of life.
- Due to gravity, stars are formed in clouds of gas called *nebulae*. As soon as the newborn stars get hot enough, nuclear reactions begin.
- Stars die when their fuel runs down. The Sun was formed approximately 4.5 billion years ago, and in 5 billion years, it will begin to die. It will expand, cool down and become a *Red Giant*. Later on, it will contract into a small, cold star called a *White Dwarf*, which will cool down and end up as a *Black Dwarf*.
- Larger stars die in a more dramatic way: The collapse of a *Red Giant* triggers a violent explosion called a *Supernova*, which results in the formation of a huge cloud of dust and gas. Such a cloud contains heavier elements (not only Hydrogen and Helium). Our Sun and the inner planets contain heavier elements as well; we can therefore conclude that the material must have gone through the life cycle of another

star, which means that the formation of our Earth took place a long time after the beginning of our Universe.

- The four inner planets (Mercury, Venus, Earth and Mars) are made of rock and they all have metallic cores. The outer planets (except for Pluto) are larger and they're made of very light substances (Jupiter, Saturn, Uranus and Neptune). They can be considered giant balls of gas with small solid cores.

The origin of our solar system

- Scientists suggest that our Sun and the nine planets were formed roughly at the same time (approximately 4.5 billion years ago).
- It's widely believed that our solar system was formed from a *nebula*. This cloud of gas and dust rotated and got smaller (due to gravity). Parts of the cloud 'condensed' to form the Sun and the orbiting planets.
- As the *nebula* was contracting, it became very hot. In the hottest area, the centre, our Sun was formed. In the outer part, the coolest region, the outer planets were formed. The cooled gases of the *nebula* 'condensed', tiny particles of dust stuck together and formed larger pieces, and that way the planets, or rather the inner planets and the cores of the outer planets, were build up.
- ***This is only a theory which hasn't been verified.***

9. Comparison of the two different views - 'Outcome'

Apparently, the Buddhist and the scientific view of our Universe often seem to be completely different. Anyhow, we had some highly interesting and intensive discussions. The students put a tremendous amount of effort into both the research into Buddhist scriptures and the comparison with science. Their reflections not only showed a great deal of interest but also an exemplary eagerness for a thorough analysis of the subject matter. Given their limited knowledge of both the scientific and the Buddhist view [about the Universe], the monks came up with some intriguing thoughts on how the two could be connected. At times it was difficult to assess to what extent the two views could be considered similar. It may therefore be argued that some of the similarities listed below are rather far-fetched.

- In all probability, the most significant similarity we found between the two views we derived from one of Lord Buddha's quotes:

***'Nothing is lost in the Universe.
Matter turns into energy,
Energy turns into matter.'***

This seems to imply that Lord Buddha had already known what scientists found out and, at least to a certain extent, verified more than 2000 years later! The law of conservation of energy states that **energy** (or its equivalent in **mass**) can be neither created nor destroyed. In his Special Theory of Relativity, Albert Einstein used 'his' equation $E = mc^2$ (where **E** is energy, **m** is mass, and **c** is the constant speed of light) to explain that mass and energy are equivalent. Mass and energy are now known to be different forms of the same thing, called *mass-energy*. For instance, if an object's energy decreases by an amount **E**, its mass also decreases by an amount equal to E/c^2 . The mass-energy does **not** disappear, however, but is released in another form, called radiant energy. (It goes without saying that we didn't consider it sensible to teach

Einstein's Special [or General] Theory of Relativity in detail at this early stage. The monks don't have the necessary scientific background, but still we could briefly explain it in connection with this topic.)

Scientists believe that, shortly after the *Big Bang*, an enormous number of both particles made of matter as well as antimatter were formed and collisions between the two types of particles took place. It is very difficult to tell whether particles, for instance in distant galaxies, are made of matter or antimatter. Gravitational force does not distinguish between matter and antimatter – each attracts the other. Anyhow, when a particle collides with its antiparticle, they annihilate each other. This, however, doesn't mean that they disappear into 'nothingness', they are simply converted into radiant energy. Some physicists speculate that right after the *Big Bang*, the early Universe had billions of times more particles than it has now, and that near total extinction of matter-antimatter left 'only' the amount of matter now present. It seems as if there hadn't been a considerably greater amount of matter (than antimatter), our Universe would mostly consist of radiant energy with hardly any matter. Hence, the scientists findings strongly support what Lord Buddha had taught.

It is rather difficult to say whether we can say that, at the moment of the *Big Bang*, only some kind of energy, which turned into matter, existed. Under the conditions which existed at that time, all the laws of science, and therefore all ability to predict the future, would break down.

Another example of matter turning into energy is radioactive decay (which we also discussed, rather briefly, with the monks.) Radioactive matter is undergoing a gradual conversion into a pure energy gamma radiation. As this energy radiates away, the radioactive object loses weight. Apparently, this also seems to be in accordance with Lord Buddha's teaching.

(On the other hand, the so-called *Steady-State Theory*, which is by far less widely accepted as the *Big Bang Theory*, suggests that the density of the Universe remains constant, requiring the *continuous creation of new matter* that compensates for the expansion of the Universe.)

- Scientists believe that, after the *Big Bang*, quarks were formed, then neutrons and protons which attracted electrons in order to form Hydrogen and Helium atoms. This seemingly happened within an extremely short time. Afterwards, however, it took millions of years until stars and galaxies were formed and heavier elements came to existence. It seems as if the Buddhist view suggested a similar formation: the smallest particles slowly form larger particles and objects. The formation of the / a Universe occurs step by step, it is not formed in an instant. Both the scientific and the Buddhist view consider **life cycles** (formation, life and 'death' of stars, galaxies ['worlds', '3000 world realms' etc.] or the Universe) as being very long (even though calculations made by scientists are often completely different from those mentioned in Buddhist scriptures).
- It seems to be an undisputed fact for both scientists and Buddhists that **our Universe continuously undergoes change.**
- When we focussed on **gravity**, we found some interesting similarities, even though it's not always easy to assess to what extent the two views are similar. The students learnt, when I taught Astronomy, that the formation of atoms, stars, planets, etc. was only possible because of the effect of gravitational forces. Some of last year's monks from Mundgod told us that Buddhists scriptures mention some kind of a force ('gravity'?) which attracts particles and causes heat to build up, reactions to be triggered (like nuclear fusion) and explosions to take place (like *Supernovae*). They also believed that the (scientific) facts that particles gather due to (gravitational) forces to form atoms and molecules and that the density of matter increases, etc. were in

accordance with Buddhist belief. This would, obviously, reveal some significant similarities between Buddhism and science. This year's students, however, admitted that they hardly had any knowledge about such similarities and I'm therefore not sure how well the opinions and beliefs which were expressed last year had been researched (with the help of Buddhist scriptures) or how much these monks were influenced by what I had taught them.

The monks all agreed that, from a Buddhist point of view, there's a 'tendency' of particles to gather or even to attract each other, but we weren't sure whether this phenomenon could be directly connected with gravitational forces. Some of them believe, from what they've read in Buddhist scriptures, that temperature plays an important role ('heat separates and cold attracts'). Others explained that, according to Buddhist belief, lighter particles gather due to the force of wind / air (I'm often a bit confused when monks talk about *lung*, which can, as far as I know, be translated as *air* or *wind*, depending on the context. *Lung* undoubtedly plays a central role in Buddhism, particularly with regard to the formation and destruction of the Universe.) One or the other monk expressed their doubts regarding this belief: 'Air is made of particles, how can it hold particles together?'

When they compared gravitational forces with their Buddhist knowledge, the students mentioned that our Earth or rather the element 'earth' has 'a capacity to hold matter, stick one object to another or attract things'. This led to a discussion about what matter is made of. According to Buddhism, everything which surrounds us contains a combination of the four elements earth, water, air and fire. This view of the 'nature' of all objects seems to be very similar to Aristotle's ideas. The Greek philosopher, scientist and educator asserted that so-called 'natural motion' of an object depends on the combination of the four elements the object contains. In his view, every object in the Universe has a proper place, determined by its 'nature'; any object not in its proper place will 'strive' to get there. Being of the earth, an unsupported lump of clay properly falls to the ground; being a mixture of earth and air but predominantly earth, a feather properly falls to the ground but not as rapidly as a lump of clay. This apparently sounds quite similar to the above mentioned 'capability of the element earth to attract things'. The monks agreed with this but emphasized that Aristotle's view and the Buddhist view were not identical. The question remains: Was early Buddhism influenced by Aristotle's ideas and observations?

Despite the progress science has made over the centuries, many questions concerning forces remain unanswered. A lot of scientists believe that gravity is carried by particles called *gravitons*, but these have yet to be found in any experiment. Are forces interactions where tiny particles are exchanged between the particles which make up matter? Physicists are attempting to show how the fundamental forces may, in fact, be derived from a single fundamental force. Maybe some answers to these questions could also be found in Buddhist scriptures...

- Both science and Buddhism agree that matter is made of tiny particles. As we discovered, a comparison between **atoms / subatomic particles** and the particles as they are described in Buddhist scriptures is possible and some similarities can undoubtedly be found. Our students told me about the description (in *Zhoe*) of tiny particles (6?) which revolve around larger particles in the centre (it's very difficult to determine the size of these different particles). This may be similar to protons / neutrons which are surrounded by electrons. The monks also explained that there was, according to Buddhist belief, 'a lot of empty space' between the central and outer particles as well as between different 'atoms', which is also in accordance with the scientific view. This 'model' of atom-like particles, however, seems to be rather controversial among scholars of the 'lower school', and it's totally opposed by the

‘higher school’. Even our students started debating on these particles and the ‘empty space’ in between. Some of them believe that there’s no such thing as ‘completely empty space’. Others argued that there was a force which kept the surrounding particles away from each other and from the particle in the centre.

- Similarly to scientists, Buddhists believe that there’s an enormous amount of ‘**empty space**’ between celestial bodies. Again, the monks raised questions about the ‘emptiness’ of this space, such as the following: ‘How is it possible that mind can travel across space which is completely empty?’ (as mentioned before, it’s believed that mind cannot travel in the absence of *lung* [see section 2]).
- Buddhists are convinced that **the Universe is infinite** with regard to both time and space. It neither has a beginning nor an end (which is also suggested by the *Steady-State Theory*). Even according to the *Big Bang Theory*, it seems to be feasible that our Universe may be the result of an earlier Universe. As many scientists believe, our Universe may, if there is ‘enough’ matter and therefore enough gravitational force, collapse and a new *Big Bang* can’t be ruled out. So why shouldn’t our Universe undergo an infinite number of life cycles, similarly to those of different ‘3000 world realms’? Of course, from a scientific point of view, this can only be considered speculation. As a scientist, one may say that time had a beginning at the *Big Bang* (and would therefore be finite), in the sense that earlier times would simply not be defined. If there were events earlier than the time of the *Big Bang*, they could not effect what happens at the present time. Their existence can, as many scientists argue, be ignored because it would have no observational consequences.

When we talked about the ‘smallest’ particles, the monks were convinced that, according to Buddhist belief, the existence of smaller particles is always possible. Extensive research into the existence of particles which are smaller than quarks is also carried out by scientists. Regarding space, both ‘inner space’ (‘microcosm’) and ‘outer space’ (‘macrocosm’) are, according to the monks, believed to be infinite. Science has gathered a wide knowledge about our Universe, but ‘only’ up to a certain limit – what lies beyond, scientists cannot say. Can they rule out that there are other universes ‘out there’ or that the Universe, or rather space (?) is infinite?

- As mentioned before, the lower parts of a ‘3000 world realm’ will always be destroyed by the elements fire, water or air (wind). In our particular case, they will be **destroyed by fire**. According to scientists, our Sun will begin to die in approximately 5’000’000’000 years. As it will start to run out of fuel, it will become larger. As a so-called *Red Giant*, it may expand as far as the orbit of Mars. Mercury and Venus will undoubtedly be melted and engulfed by the Sun. Even though our Earth may not be engulfed, the extreme heat will render the Earth lifeless, i.e. the Earth will also be destroyed by heat or fire. Our students found that this could also be considered a similarity between the two views.
- As scientists found out, the ‘cloud’ of dust and gas (*nebula*) which forms after the explosion of a large star (*Supernova*) can contain the **heavier elements** that cannot be produced by nuclear fusion. The dust and gas can form new stars. Since the Sun and inner planets contain these heavier elements, they must have evolved from such a *nebula*. The students discussed whether this kind of *nebula* could possibly be compared with the wind mandala (which contains the four [‘Buddhist’] elements and their qualities [see 5.2.1]) or the clouds that are formed above the gold mandala (containing the heavier elements, i.e. ‘most of the elements of our periodic table’ [see 5.2.5]). This link between the two views was, however, rather vague.
- According to Buddhist belief, our Universe consists of an infinite number of ‘3000 world realms’, which also means that there must be an infinite number of ‘worlds’ or ‘planets’ where life such as life on our Earth exists. A great many of scientists strongly

believe that there are other planets which are capable of sustaining life. In our solar system, however, this only seems to be possible on Earth. (Research is currently being conducted, for instance on Mars, and strong evidence has been found that there is [or has been] liquid water which could have sustained simple life forms.) Distant stars with ‘planetary systems’ have been discovered and it seems highly probable that the conditions on some planets in such systems are similar to those on our Earth. Many scientists put a great deal of effort into proving the existence of **extra-terrestrial life**. Given the great number of stars and galaxies in our (infinite?) Universe, we may ask ourselves why (human) life should only be possible on one single planet... - Nowadays, most scientists don’t seem to rule out the possibility that life exists on other planets.

- Different galaxies and clusters of galaxies are **different in shape and size**, the same seems to be true for different ‘worlds’ and ‘3000 world realms’.
- One of the students felt that the main similarity between the two views consisted of the **‘non-existence’ of a Creator God**. I explained him that science didn’t deny the existence of a Creator God. It can simply neither verify nor falsify the existence of such a ‘higher power’. There are scientists who support the *Big Bang Theory* but still believe that there is ‘room’ for a Creator God, whereas others insist that everything can be explained solely by means of science. The same student pointed out that a basic difference between Buddhism and science was the reason for the formation and destruction of parts of our Universe. Buddhists believe that these are caused by karma, whereas science is, in his opinion, not capable of coming up with an explanation.

10. Conclusions

When the monks told me about the Buddhist view on different topics (not only in the realm of Astronomy) I often wondered how they deal with the fact that science teaches them, on many occasions, facts, laws and theories that seem to be completely different or even contradictory in comparison with what they had learnt from Buddhist scriptures or their Dharma teachers. I never wanted to give the students the impression that science offers the ‘absolute truth’ or to raise doubts amongst them regarding Buddhist beliefs.

In this final section of my report I would like to list examples of interesting answers our students have given to the following question [*the answers are not always to be considered word-by-word translations; some of the ‘quotes’ are summaries of similar answers or opinions that have been expressed by several students*]:

How do you deal with the numerous differences between Buddhism and science?

- ‘Things are often contradictory only at first sight. Science, for instance, teaches us that the Sun is in the centre of our solar system, whereas Buddhist scriptures describes the Earth as being in the centre. It only depends on your reference frame whether you consider the Sun or the Earth to be in the centre. When you take the Earth as a reference, the Sun **does** go around it...’
- ‘I accept that the Sun is in the centre of the solar system. A scientist has proven that, in order to make correct calculations, one could place either the Earth or the Sun in the centre. Lord Buddha taught this according to the people’s perception. When the Earth is taken as a reference frame, it’s placed in the centre and the other planets (and Sun / Moon) travel around it.’

- ‘It all depends on your perspective. Many things are relative. When you are sitting on a train, the trees are moving. As an outside observer, you will say: “The train is moving.”’
- ‘Science and Buddhism are like two different lanes on the same road. They both lead us to a wider knowledge and a deeper understanding of ourselves and our world on our search for truth / reality.’
- [*A student once drew two little men on the whiteboard, one representing Buddhism and the other science, and gave the following explanations:*] ‘These two men may have different features, opinions, characters, etc. but they are both basically the same. We shouldn’t only talk about differences and similarities. There are also realms (or aspects) one looks into but the other doesn’t. One man wears a hat, the other one wears shoes. Buddhism could learn considerably from science in certain areas and vice versa. Afterwards, both men would wear shoes **and** hats. The hats may be different from the original one: If science, for instance, did some research into an aspect which is described in the Buddhist scriptures, new knowledge could be gathered and an agreement could be reached. In an ideal case, we could draw a third man who represents a synthesis of Buddhism and science.’
- ‘I sometimes tend to believe in the scientific view in case of contradiction. I feel that Buddhism can learn from science in certain areas. [*This coincides with the views of His Holiness, for instance in the realm of Cosmology.*] This doesn’t mean that I don’t believe in what Buddhism teaches me. Buddhism mostly deals with spiritual aspects and doesn’t always take physical aspects into account. Together, science and Buddhism can often offer us a more accurate view of an object. We see the “front of the Earth”, whereas science sees “the back” (or vice versa) - together we see it all.’
- ‘Scientists will say something, Buddhists will say something different; similarities will be found, a dialogue takes place and we get a broader picture of reality.’
- ‘I have many doubts regarding the scientific view of the evolution of our universe (*Big Bang*, expanding Universe, black holes, etc.). However, most of the time I consider the scientific view another possible explanation of phenomena or nothing but a different perspective on the same reality, even if the scientific findings and the Buddhist beliefs are somewhat contradictory. I accept different opinions and I often try to combine the two views.’
- ‘Science and Buddhism simply use a different approach in order to find out more about reality. Buddhists use their mind to explain phenomena and they conduct mental experiments, whereas scientists conduct experiments, make measurements and calculations. A different type of knowledge will be established. If we bring the two together we can both profit.’
- ‘I’m quite convinced that most of the “facts” I’ve learnt about in the last two weeks are true and I think that Buddhism can get more detailed information about the Universe from science. I think if “outer space” is infinite, “inner space” may as well be.’
- ‘I feel that there remain plenty of question marks in both the scientific and the Buddhist view of the Universe, maybe too many for any conclusive explanations of such things as the origin of our universe...’

During this research, I was, as many times before, amazed how the students got involved and I enjoyed ‘witnessing’ some more rather heated discussions or debates. After all, that’s how they the monks are used to gather and / or consolidate their knowledge. I believe it’s a very effective learning approach and should also be included in future *Science meets Dharma* lessons.

Apparently, the students appreciated that we provided time for an exchange like the one described in this report and they would also like to have similar opportunities in future. In this particular case, we encouraged all the students to do research, to reflect upon what they'd learnt and to compare the two seemingly completely different views. However, most of the monks don't need to be encouraged to do so (in whatever topic is being taught), they do it automatically, without being told.

I was highly interested in the information the monks gave me about the Buddhist view of the Universe. When they told me about the six types of beings (*migrators*) in our 'world' and about the cycle of reincarnations, I even decided to buy a *thangka* of the *Wheel of Life!* During that time we changed our roles and the students were my teachers. I have undoubtedly learnt a lot from them.

When I was teaching Astronomy, I often touched ground where I'm far from being an expert. I was often challenged by the students' questions and, by looking up answers I couldn't give 'on the spot', I also learnt more about the scientific view. The students had to do a lot of extra research as well. Nevertheless, a fruitful dialogue took place and, once again, it was really rewarding to see that Science **did** meet Dharma.