

ARE WE COMMONPLACE?

Francis Rocard – Are we commonplace or something exceptional? I might say at the outset, with obvious influence from the Roman catholic church, that we were surely unique, Giordano Bruno was burnt at the stake because he claimed, among other things, that the sky was full of stars and that around these stars there were planets and therefore that we are just one more! Galileo had his problems too, all that is well known. And then the astrophysicists took the high ground from religion and placed us within a hypothesis where we are commonplace: that we are a small planet next to a very ordinary star, the Sun, that there are two hundred billion stars in the galaxy and therefore there must be other planets around these stars. And in '95, the first extra-solar planet was discovered; now we know of four thousand and we find heaps of stellar systems and above all we discover that we had not noticed a phenomenon that we call migration! We observe many planets that we call hot Jupiters, extremely close to their star and obviously these planets were not formed there, they have migrated and therefore there must also have been migration where we are! Next, at the beginning of the 21st century, Alessandro Morbidelli at Nice developed two important models of the formation of the solar system, in particular the Grand Tack, the great convergence from the edge, which describes the first hundred of millions of years of our solar system. Jupiter was formed first and Jupiter rapidly began to migrate towards the Sun! and as it migrated, it pushed aside everything in its path, in the zone occupied by Mars and the asteroid belt.... And then Saturn was formed and Saturn migrates behind but then something happens that is probably quite exceptional, the Jupiter-Saturn duo enter into resonance, that is to say that as one performs a revolution, the other does typically two revolutions. This mechanism, curiously, drags Jupiter and Saturn towards the periphery, freeing up the internal zone, the one that we call the habitable zone, just where water is liquid, freeing it up so that rocky planets form like the Earth and we have a zone where life is able to emerge! If Jupiter had stayed in this zone, the Earth would never have been able to form!

Another quite astonishing phenomenon, we have a Moon! And this Moon has an extraordinarily important mass, one per cent, that's a lot, one per cent of the mass of the Earth. No other planet in the solar system has moons of such a mass in proportion. And this Moon has two effects. Jacques Laskar at the IMCCE has calculated that the Moon stabilised the axis of rotation of the Earth and as you know, this is what creates the seasons, summer and winter. And if this axis were to be more tilted, if it wandered from 23.5 degrees to more than 40 degrees, we can calculate that the polar ice caps would be not very far from the equator so that things would become very, very cold during certain periods.

I am not saying that life would have been eradicated on Earth because of this regular oscillation due to the axis of rotation, but nevertheless the situation would have been much less propitious to the progression of life towards complex species like the animals. If you imagine that on a scale of a million years, all of a sudden things freeze up to the edge of the Equator, if the deserts are frozen, well the animals are going to die! So this Moon has stabilised and probably helped the progression of life.

And there is a second phenomenon linked to the Moon, the Moon creates tides on Earth, that has been known for a long time and German researchers have calculated that the effect of tides on the interior of the Earth has been able to keep our core and its deep mantle in a fluid state that allows the mechanisms of convection and that consequently keeps in place a magnetic field that protects us! Now if this Moon wasn't there, maybe this tidal effect would disappear, the convection would stop, the magnetic field would stop and at that moment the Earth would come into contact with the solar wind, leading to escape of the atmosphere, end of the green house effect, the planet would get more cold and life probably would end since there wouldn't be any more liquid water! So the Moon may also have greatly contributed to the continuation of life, in any case to its evolution towards very sophisticated life.

So are we commonplace or exceptional? I would say that the 21st century is showing that we are rather more exceptional than we thought, shall we say, in the 20th century! Now knowing if there are other intelligent beings in the Universe, well that's another story....