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LIGHT SPEED

Ken Tapping, 24th July, 2018

The fastest manmade object so far is the Juno spacecraft, which reached a speed of about 265,000 km/h. At that speed we could get to the Moon in about 90 minutes, not counting the difficulties of starting and stopping. Let's assume that using some sort of as yet unknown technical improvement we could make an engine that would accelerate a spacecraft to a million kilometres an hour. That would get us to Mars in a few days, and to the outer reaches of the Solar System in less than a year: tough for a manned mission, but workable. It would open the Solar System to manned and robotic exploration as never before.

One catch though is to reach such a speed without killing the passengers. If we are going to be accelerating for a long time then the optimum acceleration is "one gravity" where the passengers would feel the same weight as they do on Earth. It would take continuous acceleration for about eight hours to reach a million kilometres an hour and as long again to decelerate to a stop. Of course robots can be built to be far tougher, and survive must stronger accelerations and decelerations.

However, when we consider venturing beyond the Solar System things get more difficult. Proxima Centauri, the nearest star other than the Sun, lies about 4.3 light years away; the light from this star takes 4.3 years to get here. That is a distance of 43e12 (43 followed by 12 zeros) kilometres. Our spacecraft, travelling at a million kilometres an hour, full speed, would take almost 5000 years to get there. If we want to get to even that nearest star, we will need to do better. Maybe, assuming we have unlimited amounts of fuel, and the engines can stand it, we can leave them on for longer. In a year we might reach a billion kilometres an hour, we would get to the star in about 5 years. Even then, exploring our neighbourhood in the Milky Way will involve journeys of thousands of years. Can we leave the engines on for longer, and continue to accelerate? After a year we will have reached almost 90% of the speed of light, how about leaving the engines on for longer; can we cut the journey time down to something more reasonable?

Not really, as we reach speeds close to that of light, roughly 1.1 billion kilometres an hour, we run into the universe's fundamental speed limit. You cannot travel through space-time faster than light. As Einstein famously showed, the faster you go through space, the slower time goes for you compared with everyone who stays home. If you travel to that nearest star at 99.9% of the speed of light, and you go straight there and then come straight home, your onboard clock will tell you just under ten years have passed. However, you will find when you get home that over 220 years have gone by. Leaving friends and family and returning home eight or nine generations later is not much of an incentive to make the trip. If you go faster it gets worse. Passengers on longer, faster trips could return to find the Earth does not exist any more. Author C.S. Lewis described cosmic distances as "God's Quarantine Precautions". Maybe he was not far off the truth.

That is not to say that cosmic distances will make the rest of the universe permanently inaccessible to us. The technologies we have now would appear to be little less than magic to our ancestors of just a few generations ago. Would they have believed we can cross the Atlantic in a few hours? Arthur C. Clarke, the famous science fiction writer said, "When an eminent scientist says that something is absolutely impossible, he is almost always wrong". The solution is out there. From the Wright brothers to walking on the Moon was only 63 years. Maybe we won't have that long to wait.

Venus lies low in the west after sunset, with Jupiter in the Southwest and Saturn in the South after dark. Mars rises around 10pm. The Moon will be Full on the 27th.

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