STRANGER IN A STRANGE LAND

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Strange Stars? Notwithstanding his matter-of-fact manner, I had a grave suspicion that my guide was out to pull my leg. Sure the sky is full of odd objects like Neutron Stars (stars made entirely of neutrons) and Black Holes (hungry monsters that eat up everything that ventures close, including light), but this must be stranger still. And it did nothing to my morale to find out that the investigation required something I sorely lacked - a good grinding in Particle Physics. In the final year of PhD I was rapidly running out of time. Yet, here was a chance to go beyond the mundane. A serious perusal gave me a queer feeling. This would either make a nice science-fiction or a scientist's dream. I was hooked.

Almost everything on Earth is made up of tiny atoms in which electrons go round tinier balls of neutrons and protons. But neutrons and protons are made up of even tinier particles called **quark**s. There are six types of quarks. And Particle Physicists, being the ingenious lot they are, named them - **up, down, top, bottom, charm** and **strange**! Though only the **up** and **down** quarks are found inside the neutrons and the protons. But these quarks are extremely shy objects - They prefer to form a small group and hide behind a shell. From outside we see only the shell of such conglomerates and call them **hadron**s. The familiar neutron and proton are two such hadrons.

The quarks could be pried out of their shells if the hadrons are squeezed really hard. When hadrons are packed really tight so that they crush against each other out pop the quarks from inside! But the densities needed would be enormous - a million billion times that of iron. And of course to push matter to such extraordinary densities one needs extraordinarily large forces. How on earth, or above it, could one produce that kind of force? Simple - use Gravity.

Wait a minute. Isn't gravity the weakest of the four fundamental forces? That's right. But ultimately gravity wins out. Because it is proportional to the total mass. When one deals with massive objects like a star gravity is the force that dominates over all the others. Actually gravity controls the complete life-history of a star - from birth to death. And the individuality of a star lies in it's mass which is the factor gravity depends upon. So there are stars like our Sun which go on shining without much change for billions of years. And there are heavier stars which end their lives in a spectacular supernova after a short lifespan of a mere (astronomically speaking!) million years.

It's from the ashes of this later variety of stars that the bizarre objects - neutron stars, strange stars or black holes emerge. The reason is simple. Because they were very massive to begin with, they experience the maximum squeeze in the hands of gravity giving rise to final products with unthinkable densities. In a neutron star, matter is so dense that the protons gobble up the electrons and convert themselves into neutrons. A black hole, on the other hand, is the ultimate squeezed state of matter - everything gets concentrated to a point.

A strange star is intermediate between these two. If a neutron star is squeezed a little more we reach the magic density at which neutrons exist no more. They break up into **up** and **down** quarks. And we get a star made of **up** and **down** quarks entirely. Twenty years ago this picture changed a little. It was argued that that the **up**s and the **down**s don't feel very comfortable with themselves. So some of the **up**s go and convert themselves into the **strange**s. And then they live happily ever after in the object we now call the Strange Star.

I started my PhD to look into the behaviour of neutron stars when more material is dumped on them. It happens if the neutron star has a companion star that is shredding its outer layers. We realised that by increasing it's mass we are basically squeezing the neutron star a bit more. That is, in the process, the neutron star has been converted to a strange star! So now it is essential to understand the physics of these strange objects.

At the moment we struggle to cut through the red-tape to obtain extra time to finish the investigation (I am supposed to submit my thesis in a month) while the stars in the sky remain as oblivious of us as ever and as constant. And through the millennium they pose as daunting a problem to us as they did to the first humans.