

# Preface

In the late sixteenth century, the German scholar Johannes Kepler inherited a huge amount of data about the positions of the planets, from his mentor Tycho Brahe who had just passed away. The motivated Kepler set upon improving the Greek model of the universe, armed with the latest figures. His technique was all too familiar as it had been tested for nearly two thousand years. He would have to add one more sphere or epicycle as it was called, to the orbit of a planet. Or he would have to slightly shift the centre of a circular orbit. Things like that. But try as he might, and that meant several years of frantic calculations, he could not bridge a tiny discrepancy between Brahe's observations and the model of the universe. The difference arose for the planet Mars, and it was miniscule, one might even say, not worth all these trials and tribulations. Kepler himself confidently declared that this minute discrepancy was really pointing the way to a reformation of astronomy. And so it did! The two thousand years old Greek model of the universe collapsed, when Kepler discovered that by using a slightly non circular orbit, an elliptical orbit in fact, the discrepancy vanished. This heralded the beginning of modern science.

Early in the last century, a similar situation prevailed. Breath taking progress had been made in science in the preceding centuries that had witnessed unparalleled contributions from the likes of Isaac Newton, James Clerk Maxwell and others. And yet there was a small something that didn't add up, a fly in the ointment. This was in the form of the results of some recent experiments which could be explained by the beautiful theories of physics and the universe, almost – but not quite. Once again science took a tumble. The new and minute discrepancies gave birth to the special theory of relativity, the general theory of relativity and Quantum theory, which undoubtedly were the intellectual peaks of the last century. They have gone

a long way in shaping and reshaping our concepts of the universe and indeed technology which touches our lives. At last after millennia of scientific and intellectual quest, everything seemed to be falling in to place.

However, as the last century drew to a close certain discrepancies surfaced. Some of them were miniscule by any standards. For instance the mysterious particle called the neutrino was supposed to be massless. It turned out to have the slightest of masses, much, much lighter than the lightest known particle, the electron.

The realization has been creeping into the scientific community, that we are missing out on something. The awe inspiring, mind blowing contributions of the last century may not be the last word. These concepts were bizarre and upturned the cosy picture of the universe which was inherited from the time of Newton. But perhaps the radical ideas left behind by twentieth century physics are no more than a fore taste. A new cosmos seems to be emerging which is even more bizarre, even more crazy than we could ever imagine. We may well be at another dramatic turning point in our intellectual evolution and conception of the universe, confronting unexpected, even unimaginable concepts of spacetime and the universe. The story is still unfolding.

I have tried to capture the mood and spirit of this new paradigm shift in the following pages. Undoubtedly, in the course of simplification, to reach out to a larger audience, precision would be lost. This is because it is not possible to go into the merciless technical detail. In the process, to help the cause, I have here and there repeated certain ideas and concepts, and have almost always tried to keep the references at a popular level. I am grateful to Prof. Walter Greiner of the Frankfurt Institute of Advanced Studies for useful advice and also my secretary Mrs. Y. Padma and my wife Dr. B.S. Lakshmi for invaluable help in the preparation of the manuscript. My thanks are also due to Prof. K.K. Phua and Lakshmi Narayan of World Scientific, for unstinted cooperation.

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