Excerpt from Werner Heisenberg's "Physics and Philosophy"

In this way, finally, the nineteenth century developed an extremely rigid frame for natural science which formed not only science but also the general outlook of great masses of people. This frame was supported by the fundamental concepts of classical physics, space, time, matter and causality; the concept of reality applied to the things or events that we could perceive by our senses or that could be observed by means of the refined tools that technical science had provided. Matter was the primary reality. The progress of science was pictured as a crusade of conquest into the material world. Utility was the watchword of the time.

On the other hand, this frame was so narrow and rigid that it was difficult to find a place in it for many concepts of our language that had always belonged to its very substance, for instance, the concepts of mind, of the human soul or of life. Mind could be introduced into the general picture only as a kind of mirror of the material world; and when one studied the properties of this mirror in the science of psychology, the scientists were always tempted – if I may carry the comparison further – to pay more attention to its mechanical than to its optical properties. Even there one tried to apply the concepts of classical physics, primarily that of causality. In the same way life was to be explained as a physical and chemical process, governed by natural laws, completely determined by causality. Darwin's concept of evolution provided ample evidence for this interpretation. It was especially difficult to find in this framework room for those parts of reality that had been the object of the traditional religion and seemed now more or less only imaginary. Therefore, in those European countries in which one was wont to follow the ideas up to their extreme consequences, an open hostility of science toward religion developed, and even in the other countries there was an increasing tendency toward indifference toward such questions; only the ethical values of the Christian religion were excepted from this trend, at least for the time being. Confidence in the scientific method and in rational thinking replaced all other safeguards of the human mind.

Coming back now to the contributions of modern physics, one may say that the most important change brought about by its

results consists in the dissolution of this rigid frame of concepts of the nineteenth century. Of course many attempts had been made before to get away from this rigid frame which seemed obviously too narrow for an understanding of the essential parts of reality. But it had not been possible to see what could be wrong with the fundamental concepts like matter, space, time and causality that had been so extremely successful in the history of science. Only experimental research itself, carried out with all the refined equipment that technical science could offer, and its mathematical interpretation, provided the basis for a critical analysis — or, one may say, enforced the critical analysis — of these concepts, and finally resulted in the dissolution of the rigid frame.