

What Is Detection?

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“**Detection**”, literally, in English, is the extraction of particular information from a larger stream of information without specific cooperation from or synchronization with the sender [1]. In Chinese, detection means inspection and measurement of the object or phenomenon, which couldn’t be directly observed, with apparatus, such as detecting space and the depth of the sea [2].

The term “detector” was first present in the history of radio communications for a device that detected the simple presence or absence of a radio signal. In Chinese, “detection” was first published in “Northern Qi Dynasty Book · Yuan Wen Telemetry”, meaning guess. In the poem “The Sword Pool” written by Gao Qi from Ming Dynasty, “The middle deep springs, detection costs repair terrier”, where detection means measurement. Nowadays, whether in Chinese or English, detection covers a lot of meanings, but mainly concentrating in accessing and measuring the information or property of objects, through a series of mechanical, physical or chemical methods.

Some human organs are actually small and complicated detection systems, to help us understand and perceive unknown world. Eyes, ears, noses and tongues reflect seeing, hearing, smell and taste separately. The radical reason that human could stand out above the animal circle is that human have learned how to create tools and use them to make up our weakness. We could explore unknown world and develop our living environment.

The process of how human learn about the universe and the nature is actually a history of evolvement and development of detectors. As the extent to which human know about the physical universe becomes deeper, the demand of ways to detect is higher. Taking the size of human eyes as the origin of the coordinates, it evolves in two directions: “big” (macro-structure) and “small” (micro-structure), as shown in **Figure 1**.

Toward “big”: Eyes could see the outline of the stars. We could use telescopes to identify the star, planet and the secondary planet; astronomical telescopes to watch comets and the galaxy, radio and X-ray telescopes to find out the galaxy and the universe... The launch of Hubble Space Telescope [3] [4] (as shown in **Figure 2**) sheds a new light for human to explore the universe.

Toward “small”: Eyes could see the organism. We have found out the cell with the help of microscopes; the discovery of DNA turns on the Science of Molecular Biology; the atom was detected by nuclear detectors. The existing high energy particles accelerators in CERN [5] [6] (as shown in **Figure 3**) have collided to produce new particle and found out the God particle (Higgs) [7], thus validating the standard model of particle physics. The aim for the plan to build the next generation super high energy collider is to explore the origin of the matter and the universe.

Detection is closely linked to our life. The Chinese government has paid more attention on the “fog and haze” problem. From Beijing to most cities in China, Particulate Matter (PM 2.5) is being detected and monitored. The PM 2.5 Air Detector has made indelible contributions to uncover the problem of atmospheric pollution in China. The nuclear panic caused by the Fukushima nuclear power plant leaks in Japanese, has coupled rarely known

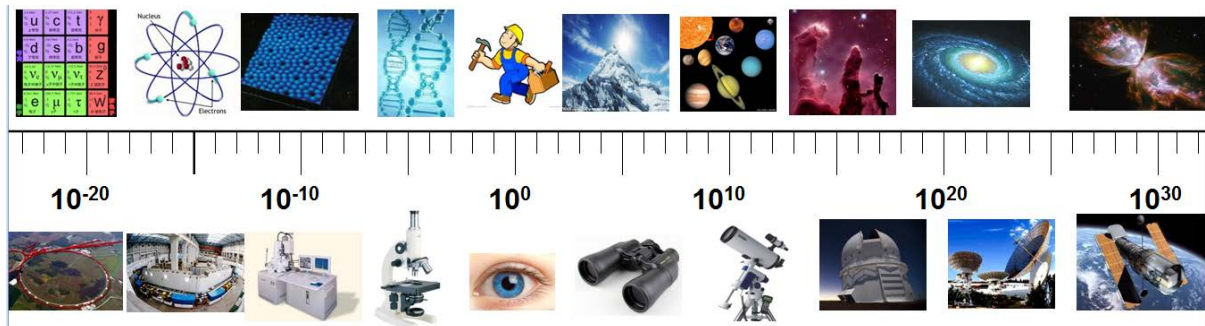


Figure 1. The Scale of the Matter and the Detectors for Observing¹.



Figure 2. Hubble Space Telescope [3] [4].

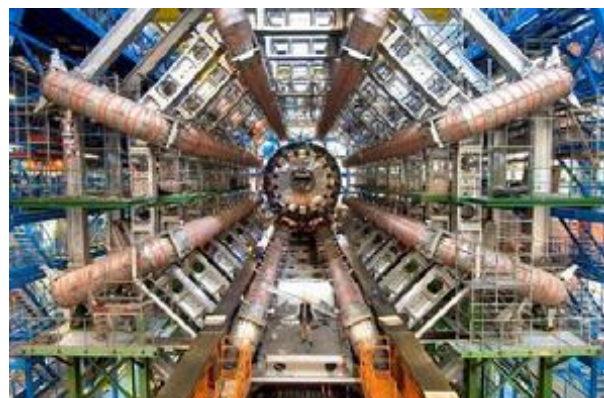


Figure 3. The Large Hadron Collider and detectors LHC [5] [6].

nuclear radiation detectors and cell phones, which has come into everyone's life.

In medical field, detection is shown everywhere without doubt. In traditional Chinese medicine, the four methods of diagnosis: observation, listening, interrogation and pulse-taking are the process of detection, during which, doctors diagnose the patients' cause and status of the illness through intuition and qualitative judgments (macro methods), based on the former knowledge and experiences. As for the Western medicine, biological and chemical analysis of the body fluid and microorganism, combined with physical detection such as CT, X-ray,

¹All the pictures to make up the Figure 1 are come from the website, thanks the owners very much.

PET, is adopted to analyze the illness, based on data analysis (micro methods). The focus of the two medical methods is different but the aim is the same, to protect human's health.

The discovery of new element, the compound of new material, and the realization of new invention, all need the development and improvement of detection technologies. The bottle neck of detection depends on the localization of the performance of detectors and the way to detect. Therefore, the development of science and the evolvement of detectors are highly interrelated and mutually reinforcing.

In various fields, including Food Testing, Infrared Detection, Laboratory Reconnaissance, Materials Test, Military Detection, Power Quality Detection, Security Detection, Water Detection, detectors are the tools for R&D work.

Sharp tools make good work.

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