As part of the special New Years list theme issue, this month’s column is going to propose a ranking for the top 10 Nobel Prizes in physics out of the 117 that have been awarded. The primary criterion employed is that the work had to have a profound effect on the daily human quality of life in contrast to having a deep and lasting influence on our general knowledge of the universe. The recent buzz about the discovery of the Higgs boson captured the imaginations of the public at large and advanced our knowledge of the fundamental laws of nature but has currently had no practical impact on the day-to-day lives of most people. The energies required to unleash the Higgs are enormous and the idea that Higgs physics will be featured in the latest tech gadget absurd. Thus, its discovery has no place on this list, even though it was an amazing accomplishment.

Each entry in the list will be cited first with the year, followed by the text the Nobel committee used to describe the discovery followed by the person or persons to whom the prize was awarded. For those prizes where more than one discovery was recognized, the ordering will be alphabetical.

## 10. 1918: Discovery of elemental quanta – Max Planck

The one that started the whole enterprise of quantum mechanics. When faced with the puzzle of how to solve the ultraviolet catastrophe in the modeling of black body radiation, Planck proposed a radical concept: the energy in an oscillating mode couldn’t be any arbitrary value but had to be a multiple of some elementary packet of energy. The fact that is fit the experimental data so well launched a mode of physical investigation that enabled all of the incredible technology that we all enjoy.

## 9. 1989: Development of Methods to Isolate Atoms and Subatomic Particles for study; Development of the Atomic Clock – Hans Georg Dehmelt, Wolfgang Paul, Norman Foster Ramsey

This entry is primarily on the list due to the last cited development of the atomic clock. It is hard to reckon how important good time keeping and synchronization is to the underlying aspects of human activity. Knowing when to plant is vital to good harvests; knowing when to debit or credit an account is vital to good business; and knowing how to accurately keep good time opens the door for greater exploration of the universe.

## 8. 2007: Discovery of Giant Magnetoresistance – Albert Fert and Peter Grunberg

The digital age has profoundly enriched lives all over the world and this entry is the first of 3 concerning that aspect of our lives. The discovery of giant magnetoresistance immensely increased the areal density of information that could be stored on hard drives and it is the most important reason why huge amount of data can be placed in clouds and servers. Each of us is now endowed with the ability to store and access digital data in a way that only the richest corporations could a few decades earlier. It is not an over-statement to conclude that the new fields of data science and machine learning would not be possible with this discovery.

## 7. 1929: Discovery of the Wave Nature of Electrons – Louis-Victor de Broglie

What Planck began with his quantization of radiation, de Broglie finished with his proposal that matter had a wave-like nature of its very own. Arguing from symmetry and well-established physical models of classical mechanics, de Broglie’s idea of matter waves solidified quantum mechanics as the preeminent science and paved to way for the formal development of the theory by Heisenberg, Schrodinger, Born, and Dirac.

## 6. 1952: Discovery of Nuclear Magnetic Resonance in Solids – Felix Bloch and E.M. Purcell

Nuclear magnetic resonance is one of the two non-destructive imaging techniques on this list. Mostly known under its more politically-correct name of magnetic resonance imaging, this technique complements the use of X-rays in viewing the inner workings of the body with invasive surgery. It also has applications beyond medical imaging in a variety of situations where non-destructive investigation is required.

## 5. 1945: Discovery of the Exclusion Principle of Electrons – Wolfgang Pauli

Like the discoveries of Planck and de Broglie, Pauli’s idea is profound not for it intrinsic nature but for the doors it opened. Advances in chemistry and material sciences, research fields that have opened up miracle drugs and novel new plastics, semi-conductors, and other materials would not have happened without the idea that electrons pack into an atom in a way that prevents them from having the same quantum numbers.

## 4. 2009: Achievements Concerning the Transmission of Light in Fibres for Optical Communication; Invention of the CCD Sensor, an Imaging Semiconductor Circuit – Willard Boyd and George Smith; Charles Kao

We all take for granted the ability to take out a phone to film or photograph something of interest to us and to use the information superstructure to post or share what we’ve captured with others. In this way we communicate with love ones not present and memorialize for later study. In this way, we also make up an army of citizen-journalists who have created a new type of politics not filtered through official channels. All of this is having a profound effect on society and is enabled by the CCD and the fiber optics. I’ve often thought that perhaps the best name for this entry is the YouTube prize.

## 3. 1901: Discovery of X-Rays – Wilhelm Conrad Rontgen

The first Nobel Prize ever awarded, Rontgen’s discovery of X-Rays was also the first type of non-invasive imaging. Due to their ability to penetrate matter, X-Rays allowed the first views into the workings of the human body without the need to cut it open. Broken bones, infections, and tumors are only some of the maladies that could be treated with greater precision and with less pain for the patient. X-Rays also proved useful in investigating the goodness of welds, the stability of structures, and the like.

## 2. 1956: Investigations on Semiconductors and Invention of the Transistor – John Bardeen, Walter H. Brattain, William B. Shockey

It is hard to underestimate the importance of the transistor. Without it, logical gates, programming and practical computing, the entire digital age would not have come about. The idea that millions of these devices can be packed into an area about the size of a postage stamp staggers the imagination. And, as we are just at the beginning the road, it is hard to see just where all of this technology will lead. But one thing is certain, the transistor has had one of the most profound influences on society of any modern human invention.

## 1. 1909: Development of Wireless Telegraphy – Ferdinand Braun and Guglielmo Marconi

And number one on the list is Braun’s and Marconi’s invention of radio. ‘Wireless Telegraphy’, as the Nobel Committee called it, ushered in telecommunications and all that comes in its train: television, cell phones, radio, wireless routers, etc.. Man is a social creature and language is the glue that holds society together. Telecommunications allows the reach of language to go further linking far-away with close-to-home. No other entry in this list has done more to knit the world together as a single family.