ASTRONOMY

Big science calls for big investments

Tuesday, September 23, 2008 3:39 AM

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What would persuade governments to spend billions of dollars on a single objective? If the goal is curing cancer and many people would see the benefit of such research, it would be easier to justify the cost.

But if the research is about fundamental particles and the structure of matter, how do scientists justify the large expense?

These questions are relevant to the $8 billion, multinational Large Hadron Collider.

The cost is too expensive for just one country to finance, so particle physicists from around the world joined forces, transcending borders to share in the discoveries.

The science is so abstract that you might be amazed that the governments of so many nations agreed to share the cost.

What's so compelling about this science?

To put this in perspective, let's go back to life in the 1890s. At that time, electricity was available only to a few cities in America, and the Wright brothers had yet to fly their first airplane.

To the person of that day, research into the electron (a fundamental constituent of matter) must have seemed incredibly esoteric. When J.J. Thompson discovered the electron in 1897, he jokingly made a toast with his colleagues to the discovery of this "useless particle."

Of course, today, the electron and all its applications are essential to daily life. But not all particle discoveries have had such an impact

on society. Also, there is a significant time lag between discovery and applications. Studies of the atom and radioactive decay led, after many decades, to numerous applications such as cancer radiation therapy.

Does this mean the discoveries at the Large Hadron Collider will benefit society? There is no crystal ball to the future, so no one knows for sure.

One reason physicists are so excited about the collider is that it has the potential to answer some big questions about our universe.

For example, it is well known that there is more matter than antimatter in the universe. In the simplest of theoretical models, both matter and antimatter should have been created in equal amounts, which would annihilate, leaving nothing.

Clearly, something is missing in this simplistic theory, because we (and our universe) exist. Data from the collider might uncover the reason that matter dominated over antimatter after the big bang, leaving an expanding universe.

Another example of what could be learned through the collider is an explanation of the exactly opposite charges of the proton and the electron. Protons are made of smaller objects called quarks, while electrons are thought to be indivisible.

At present, quarks and electrons are thought to be completely different types of particles, just as stars and black holes are classified as different objects.

But the negative charge of the electron and the exactly opposite positive charge of the proton suggest that there should be some connection between these two particles. The collider might find new particles (called supersymmetric particles) that would provide this connection.

The bottom line is that the collider might help us understand more about our universe and the forces that have led to the existence of Earth. The search for these lofty goals might yield side benefits of technical applications that aid society, in the same way that sending a human to the moon led to technical spinoffs that have helped mankind.

Imagine a writer of the next century writing a column about the collider. What would this columnist say? We can hope that the collider results are as exciting as other discoveries of the past century.

So sit tight; it won't be long before we find out what the collider can tell us about the subatomic world.

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