Forum

Will the 100 TeV Hadron Collider Get Built?

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Abstract

I do very much want to see 100 TeV Hadron Collider built but I have no idea how insurmountable the difficulties are going to be. I think it really depends on whether China takes a big interest. There are however many alternative experiments that could lead to progress in physics if it does not get approved.

Key Words: 100 TeV, hadron collider.

The possibility for a 100 TeV hadron collider was first mentioned on this blog in 2011 long before your other favoured outlets got excited about it, but before we consider naming it the ViXra Legacy Hadron Collider ("VLHC"), it should be admitted that the idea was part of a plan formed as long ago as Snowmass-1996 in the US, even if it did take viXra to shake it back into the consciousness of physicists.

As I said at the time, it is going to be very hard to get funding for the VLHC because it will require the emptying of quite a lot of penny jars. It also has no guarantee of a discovery unless you think that finding no new physics will discover the multiverse. I do buy that argument but it is going to be a hard to sell to the public especially since a lot of physicists will disagree. The possibility of finding supersymmetry or some other mechanism that would solve the hierarchy problem and make the universe almost natural is a good case to make but I am not sure it will be strong enough.

Already the hope of the US offering funding for this project is about as remote as SPT 0243-49 and for Europe it may not be much nearer. However there is a very real chance now that China will pick up the tab. This is especially true if Japan confirms its plans to build the ILC because China will not want to let Japan continue to have the most prestigious physics project in Asia. Apart from this you will hear many arguments in favour of building aVLHC including the following:

1. Accelerator projects have produced spin-offs such as the World Wide Web, touch screens and MRI scanners.
2. Although discoveries at the energy frontier have no technological benefit they make life worth living.
3. Accelerators foster international collaborations that transcend international politics.
4. A hadron collider is about the same price as a good aircraft carrier.

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5. A hadron collider will boost national prestige.
6. For every x dollars a country spends on a collider y dollars are returned in engineering contracts.
7. For every x dollars a country spends on a collider the value of the research skills obtained by students and post-docs has a value to that countries economy greater than x – y dollars.
8. A hadron collider will not destroy the Earth.

In theory research spending is allocated by funding agencies that are independent of political parties but we all know that in practice this is not true and that the bigger the amount being spent, the less true it is. The question then is which of these seven arguments would convince a politician. The case for spin-offs is rather flimsy and easily torn apart by the projects detractors of which there will be many chosen to advise the politicians. Points 2 to 4 are more likely to have a net negative effect on persuading your typical world leader to support the project. In particular the last thing they want is academics fostering relationships that go against the politicians everyday international squabbles, whereas a better aircraft carrier is always high on their list of wants. The prestige argument brings some hope but only in countries where the current leader or his offspring might still be in power when the thing bears fruit.

The case therefore rests of points 6 to 8. Points 6 and 7 seem to add up to a winning case but someone needs to have done the accounting to prove it. Where are the reports from the LHC that count the economic benefit it brought to each country? Of course they don't exists because if they did the politicians would just start squabbling about who got the best money's worth.
This leaves the physicists the job of proving point 8. With the LHC world safety was done as an afterthought well after the project was already underway. Only physicists themselves are qualified to make the risk assessment and they have an obvious conflict of interest, so their case needs to be very convincing.

For the LHC they were able to show that the collisions they were planning had been done before by cosmic rays in Earth's atmosphere a million times over in the past without an obvious catastrophe. Given the increased energy and luminosity required for the VLHC this is going to be reduced to a much less convincing factor (I dare not say how small I think this will be in case someone starts quoting it.) The case was also made that even more physics has been tested by neutron stars but it is less obvious that neutron stars are as vulnerable to physics accidents as Earth or that they are not sometimes destroyed. I do not think for one second that a VLHC is dangerous but we can only set limits on its safety and there is a chance this point could prove a problem. Again the chance of getting round this will increase if the country hosting the VLHC is not too democratic but that may still leave a lot of people upset around the world.

I do very much want to see the VLHC built but I have no idea how insurmountable the difficulties are going to be. I think it really depends on whether China takes a big interest. There are however many alternative experiments that could lead to progress in physics if the VLHC does not get approved. They may even be cheaper and possible in a much shorter time-scale. As I have remarked before I am especially in favour of the project to build a large proton decay experiment in the antarctic using a scaled up version of the ice-cube. I am disappointed that this

experiment is not getting more support from theorists. I don't think we should be talking down alternatives just to talk up the VLHC or we may end up with nothing.

Reference

1. http://blog.vixra.org/2014/03/07/will-the-100-tev-hadron-collider-get-built/