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NEWSPAPER EDITION

Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Sunday - Britain
Sunday - Comment
Sunday - World
Sunday - Scotland
Sunday - Ireland
Sunday - Review
Sunday - Football
Sunday - Sport
Sunday - Business
Sunday - Money
Sunday - Property
Sunday - Magazine
Sunday - Travel
Sunday - Culture
Sunday - Books
Sunday - Doors
Sunday - Style
Sunday - Jobs
Sunday - Motoring

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British £700m to smash open big bang secret

Jonathan Leake, Science Editor

BRITISH scientists have won £700m of government money to build the world's largest and most powerful atom-smasher in an attempt to unlock the universe's ultimate secrets.

The 20-mile-long machine - the Next Generation Linear Collider (NGLC) - would recreate the conditions in the first few billionths of a second after the big bang, the explosive event thought to have created the universe.

However, to do so it will need to accelerate subatomic particles along a tunnel long enough for them to reach near-light speeds - so that they can annihilate each other. If it succeeds it could give physicists a direct insight into the processes that led to the formation of energy and matter - and where they come from. Details will be announced this Tuesday by the Particle Physics and Astronomy Research Council (PPARC), which has decided to make the new machine a focal point of its funding for the next 20 years.

Britain is not the only country involved. The collider will cost an estimated £2.5 billion to build and £3 billion to run, making it the costliest science instrument ever built.

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BACK

TIMES ONLINE
Home
Breaking news
Britain
World
Sport
Business
Your Money
Comment
Sports Book
Travel
Entertainment
Shopping
Law
Classifieds
Games
Crossword
Motoring
Property
Health
Student
Weather
Sunday Times

NEWSPAPER
Today
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

QUICK CLICKS
Appointments
Arts
Books
Christmas Appeal
Contact Us
Creme
Education
Encounters
Fast Times
Finest
First night
Food and Drink
From the

It is so expensive that physicists around the world, recognising that no single country could afford it, have thrown aside their national rivalries to promote a global approach.

However, Britain's contribution is likely to be among the largest with the physicists winning strong support from Lord Sainsbury, the science minister. The machine is, however, too large to be built in Britain. The most likely sites are Germany, America and Japan.

Professor Ian Halliday, PPARC's chief executive, said the final cost of Britain's contribution was uncertain but could rise as high as £350m for the construction plus a similar amount in running costs.

"This is something we really want to do," he said. "The big question in modern physics is how matter gets its mass - in everyday terms, why does it weigh anything? This machine could answer that question."

The answer to Halliday's question is thought to lie in a theory put forward by Peter Higgs, a British physicist. In the late 1960s he proposed that every cubic inch of the universe was permeated by countless billions of a hitherto unknown subatomic particle.

This particle, he said, was created in the big bang and interacted with ordinary matter in ways that gave it mass - a property that was essential to create the universe, stars and planets we see today.

However, said Higgs, the particle would reveal itself only if other larger subatomic particles could be smashed together at such high energies that they would fly totally apart.

Higgs's idea fitted in so well with everything physicists knew that they have spent the past 35 years trying to find the particle - now named the Higgs boson - with a succession of increasingly powerful accelerators.

So far, despite an estimated expenditure of £6 billion, they have failed. However, they have seen enough clues to convince them that the Higgs boson is out there - and that it could be found by an even more powerful machine.

Another accelerator, the Large Hadron Collider, is already under construction at Cern, the European particle physics research centre near Geneva in Switzerland. It might have the potential to find the Higgs boson but even if it succeeds it will show relatively few details on its origins and interactions.

The NGLC would work by producing electrons at one end of the 20-mile-long machine. Positrons, the antimatter counterpart to electrons, would be produced at the opposite end. Both sets of particles would be accelerated by powerful surges of radio-frequency electromagnetic energy and then focused into a beam less than a billionth of a metre in diameter.

When the beams collide the two types of particle should annihilate each other, producing a cascade of even smaller particles - with the Higgs boson among them. Physicists will record the millions of collisions and their by-products on a super-senstive digital camera.

Critics fear such a big and expensive project risks turning into a scientific black hole - sucking in cash and resources. An earlier American attempt to build a similar machine was humiliatingly abandoned after it lost more than £1 billion and never worked.

Scientists point out, however, that although particle physics may seem irrelevant to most taxpayers, the benefits can be immense - starting with the discovery of the electron in 1897, which paved the way for almost every modern electrical appliance.

Similarly, the discovery of the positron in 1933 led to positron emission tomography, now a standard medical diagnostic technique. And it was the need to transmit data to researchers scattered across the globe that led to the invention of the world wide web at Cern in the 1980s.