COMMENT

Black hole remnants and the safety of the LHC

Alam Rahman

57 College Hostel Road, Thanapara, Gaibandha Sadar, Gaibandha 5700, Bangladesh

E-mail: feedback@lhcsafetyreview.org

Abstract.
This comment notes that if microscopic black holes can be produced at the LHC, a carefully assessment is needed of the potential environmental effects of black hole remnants.

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In a paper published in Volume 32 of Journal of Physics G, H. Stöcker (a former Honorary Editor of the journal) discusses the possible signals of microscopic black hole production at the LHC [1]. Stöcker notes that it cannot be assumed that black holes produced at the LHC would completely disappear, even if Hawking radiation does occur. Stöcker argues that, 'there are equally strong indications that the black holes do NOT evaporate completely, but rather leave a meta-stable black hole remnant'.

The possibility that all black holes hypothetically produced at the LHC could result in black hole remnants is not discussed in the current official safety report for the experiment [2]. The special case of pair production of black holes carrying new and opposite conserved quantum numbers is briefly mentioned, but the report only claims that such black holes cannot grow beyond their ground state. The report states that any further accretion of normal matter, 'would immediately be radiated away', but it does not consider the environmental effects of such radiation.

Stöcker's paper goes on to describe how using black hole remnants to convert ordinary matter into Hawking radiation could be a novel means of energy production—an idea for which Stöcker has been granted German patent DE 10 2006 007 824.1 [3]. Stöcker's paper estimates that a billion black hole remnants trapped in the LHC's rings could be used to produce 10^{21} joules of energy each year—an output rate of ∼32 TW. For comparison, CERN's paper on the astrophysical implications of stable TeV-scale black holes estimates that the total heat flow from the interior of the Earth is ∼40 TW [4].

This raises the question of whether the hypothetical production of black hole remnants at the LHC or in other future physics experiments could upset the energy

balance of the planet. Stöcker's estimate of an annual output of 10^{21} joules is for black hole remnants trapped at the LHC and it cannot be immediately applied to black hole remnants trapped within the Earth, but it does underscore the need to carefully assess this possible environmental impact of the LHC experiment.

References

[1] Stöcker H 2006 *J. Phys. G: Nucl. Part. Phys.* **32** S429 (arXiv:hep-ph/0607165)
[2] Ellis J *et al* (LSAG) 2008 *J. Phys. G: Nucl. Part. Phys.* **35** 115004 (arXiv:0806.3414)
[3] Stöcker H 2006 *Deutsches Patent- und Markenamt* DE 10 2006 007 824.1
[4] Giddings S B and Mangano M L 2008 *Phys. Rev.* D **78** 035009 (arXiv:0806.3381)