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DEFENCE AGAINST THE DARKNESS CAUSING ARTS

Abstract

Space Weather is a broad topic spanning several domains including Solar Flares, Coronal Mass Ejections, Geomagnetic Storms and Solar Winds. From these, CMEs could be argued as possessing the higher risk to Earth and its terrestrial infrastructure as their behaviour is not thoroughly understood.

To emphasise this, the widely known and well researched phenomenon of Solar Flares, are often linked to auroras and understood in-large by the public as not having terrestrial impacts. CMEs on the other hand, are larger eruptions that ripple from the Sun, driven by explosive releases of plasma.

Understanding CMEs is one dimension to the problem, followed by its effect on terrestrial infrastructure. Identifying the need for resiliency mechanisms through prediction, preparation, and mitigation for terrestrial infrastructure is the third.

Whether it be through primitive measures such as temporarily immobilising the world's "electron"-driven terrestrial infrastructure to prevent damage to Electrical, or sophisticated means through Digital Electromagnetic relays for Electrical Grids, there are solutions being deployed to protect against the effects of CMEs, varying in effectiveness.

The importance of this paper becomes significant when considering historic events such as the Carrington Event in 1859 which saw significant impacts to telegraph infrastructure or the Near Miss of 2012 that may have caused trillions of dollars' worth of damages in the United States alone if it had hit. The understanding that CMEs possess a global impact, not necessarily regionally isolated, further emphasises the potential risk. Whilst the probability of CMEs in the next decade is 100%, forecasts estimate a 6% to 12% probability of a Carrington-type event.

Accordingly, whilst the world's reliance on technology continues to increase, so does the risk of its disruption. This increase is best highlighted by the accelerated adoption of digital technologies during the COVID-19 Pandemic. Whilst this acceleration has supported the resiliency and recovery of many industries, it has transformed the world's services to become increasingly technology-centric, and therefore technology-reliant.

The risk associated with this disruption due to this technology-centricity would be high. In the context of a CME, this would be a secondary risk. The primary risk would be the supporting terrestrial infrastructure, such as the Electrical Grid. Consequently, if a CME were to occur tomorrow, the results could vary, and therefore forms the objective of this paper - to explore the scale of the problem and solution.