

Secondary comets of 3D/Biela suppressed Earth's magnetosphere during the Carrington Event.

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The external magnetic field required for the historical Carrington storm on September 2, 1859, was ~ 90 nT [1]. On the 67P/Churyumov–Gerasimenko Comet, the spacecraft measured a magnetic field of ~ 300 nT in 2015 [2]. Magnetic fields of secondary comets/meteors of the 3D/Biela Comet in 1859 could have been even stronger [3].

An analogy to the Earth's intersection with 3D/Biela fragments was the collision of Comet Siding Spring with Mars in 2014, when the cometary magnetic field suppressed the Martian magnetosphere [4]. This collision resembled a solar storm because the cometary plasma density is two orders of magnitude greater than the solar wind plasma density [4]. Even after the comet left Mars, the spacecraft measured disturbances in the magnetosphere. Similarly, after the historic peak on September 2, 1859, disturbances continued until September 7, 1859 [5].

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[2] Goetz, C. et al. (2019) A&A 630 A38. [3] German, B. (2025) Joint Meeting EPSC-DPS-12, Finland, 18. <https://doi.org/10.5194/epsc-dps2025-12> [4] Espley, J. et al. (2015) GRL 42 8810–8818. [5] Stewart, B. (1861) Phil. TransRSL 151 423. <https://doi.org/10.1098/rstl.1861.0023>