

Extreme Ball Lightning Event of August 6, 1868, in County Donegal, Ireland

J. Pace VanDevender*, Aaron P. VanDevender†,
Peter Wilson¶, Peter van Doorn**,
and Niall McGinley††,

**Sandia National Laboratories, Albuquerque, NM 87185-0125 USA
†National Institute of Standards and Technology, Mailcode 847.10,
325 Broadway, Boulder, CO 80305-3328 USA*

*¶Room G1109, School of Environmental Sciences, University of Ulster,
Coleraine campus, Cromore Road, Coleraine, Co. Londonderry
BT52 1SA Northern Ireland, UK*

***Tornado and Storm Research Organization, TORRO, PO Box 972,
Thelwall, Warrington, WA4 9DP - UK*

††Ardaturr, Churchill PO, Letterkenny, Co. Donegal, Ireland

Although laboratory experiments have produced glowing balls of light that fade in <1 s after external power is removed and theories have been proposed to explain low-energy events, energetic ball lightning is not understood. A seminal event that illuminates the fundamental nature of ball lightning is needed to advance our understanding of the phenomenon. We report such a seminal event: the energetic ball lightning event of August 6, 1868, in County Donegal, Ireland, extensively reported to the Royal Society by M. Fitzgerald¹. It lasted for 20 minutes, left a 6 m square hole and a 100 m long by 1.2 m deep trench, tore away a 25 m long and 1.5 m deep stream bank that diverted the course of the stream, and terminated by producing a shallow cave in the opposite bank of the stream. We found and characterized the site and show that the geomorphology and carbon dating support the account by M. Fitzgerald.

We find that the excavation is not consistent with chemical, nuclear, or electrostatic forces but is consistent with Analysis of the event and the local conditions in 2006 is consistent with magnetic induction at ~ 1 MHz frequency expelling the moderately conductive, water saturated peat down to the underlying clay/rock layer. The 60-cm diameter—which diminished to 10 cm diameter without reducing the impact of the ball lightning on the environment-- and the size of the depressions, the yield strength of the peat, and the lack of any mention of smoke or steam in Fitzgerald's report would be consistent with the core of the ball lightning being a magnetically levitated mini black hole weighing more than 20,000 kg.

The results suggest that such energetic ball lightning should be detectable at great distances by its electromagnetic emissions, which might provide a characteristic signature to reveal the source of the energy and the equilibrium configuration of the contained currents. Unexplained intermittent emissions in the MHz range are necessary but not sufficient indicators of such emissions. We report on over fifty 1 to >1000-s bursts of electromagnetic energy between 3 MHz and 350 MHz that were recorded by the FORTE satellite in October of 1997 and that are not consistent with known sources. Ground-based time-resolved observations should help identify the origin of the FORTE emissions and may help find and understand modern energetic ball lightning events to move us beyond glowing balls of light.

1. M. Fitzgerald, *Quarterly Journal of the Meteorological Society, First Quarter of 1878*, titled Quarterly Proceeding at the March 20th, 1878, Proceedings at the Meetings of the Society, Publisher, The Royal Society, London, England, 1878, pp 160-161.