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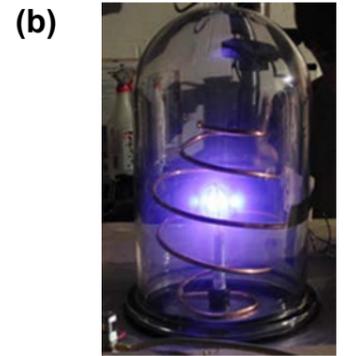
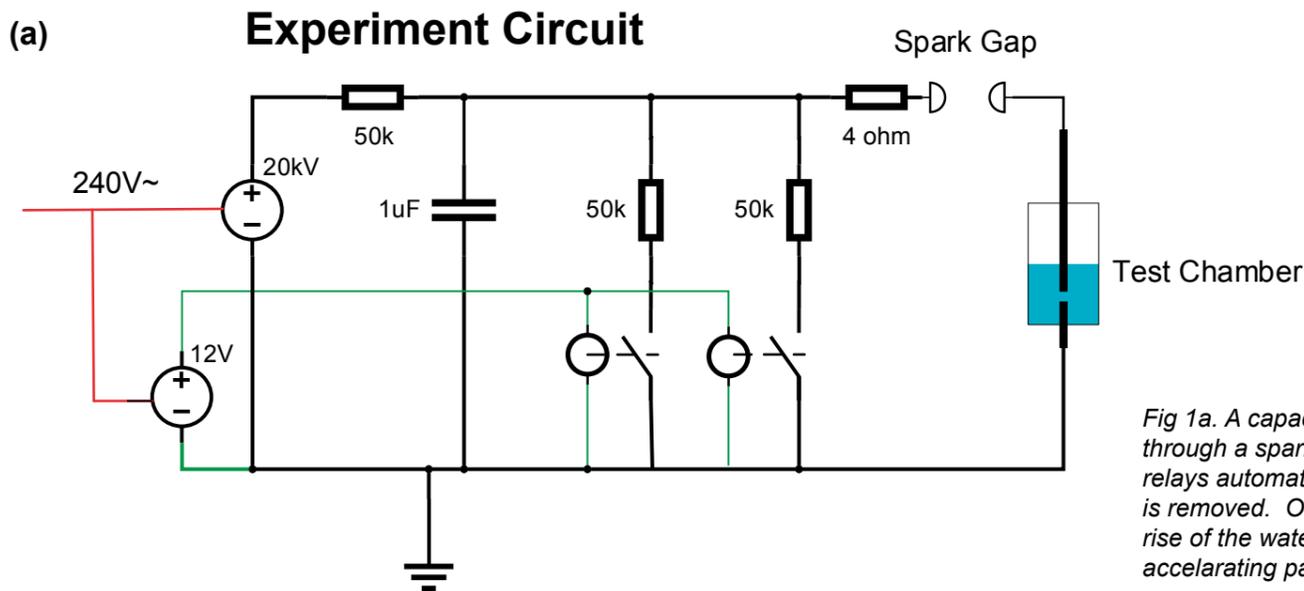


Fig 1a. A capacitor is charged to approx 20kV such that it discharges through a spark gap and then through a water sample. HV safety relays automatically discharge the circuit when the mains power is removed. Output energy found by measuring the temperature rise of the water b) A Farnsworth Fusor demonstrating fusion by accelerating particles through a high voltage field [3]

## Motivation

Published papers [1] claim that underwater electric discharges can, in some circumstances, release more energy than is supplied as electrical energy. This possibility is supported by detailed energy measurements of electrospray systems where a small but significant excess of energy was seen [2]. Such electric discharge systems are being investigated because of the potential that they could provide a commercially usable energy source.

### Technological challenge

The presence of high voltages and a large capacitor (Fig1a) presents a significant safety challenge. Experiments are performed in a closed cabinet with redundant safety switches to discharge the capacitor (Fig 1a). Fibreoptic temperature sensors were used to measure temperature rises of a fraction of a degree.

[1] Hathaway, G. (1998) J. Plasma Physics 60(4): 775-786.  
[2] Graneau, N. (2011) J. Applied Physics 109(3): 034908.

## Research goals

The aim is to better understand the physics of such discharges and attempt to reproduce the claimed energy yield. High speed photography (Fig 2) has shown the presence of a conductive channel a few ns before the plasma discharge. Shortly before this channel completes, the applied voltage will bridge the remaining microscopic bridge in the channel. It is conjectured that protons accelerating across this gap would have sufficient energy for fusion to occur, providing a possible explanation for any observed energy yield. Fusion through particles acceleration in electric fields has been demonstrated in amateur science experiments in the US (Fig 1b). However, a possible energy yield has only been seen in a handful of experiments (Fig 3) and the possibility that these are as a result of experimental artifacts cannot be excluded.

[3] Edwin, C. (2007) Physics World 20 (3): 10.

## Emerging vapour phase channel

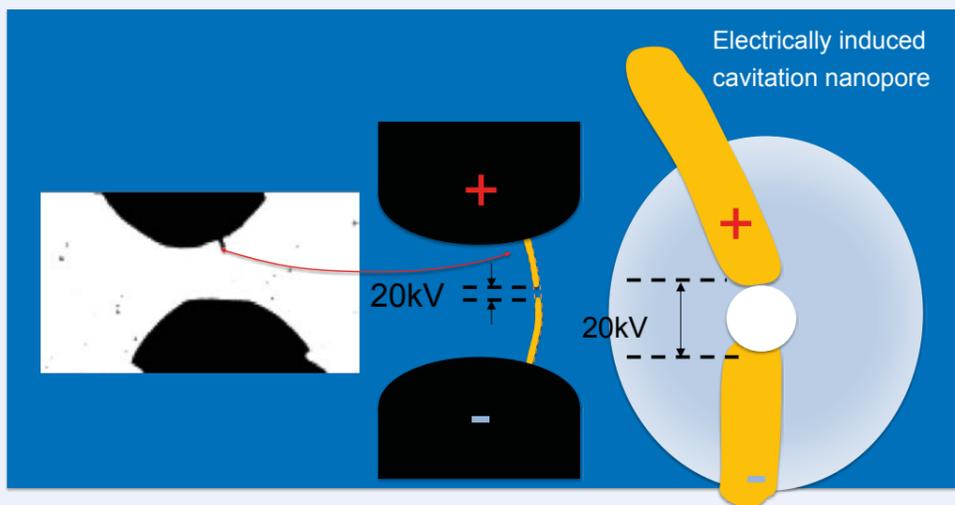


Fig 2. High speed photography (left) shows the emergence of a thin conductive channel between the electrodes, suggesting that the 20kV may fleetingly be present across a small residual gap in the channel.

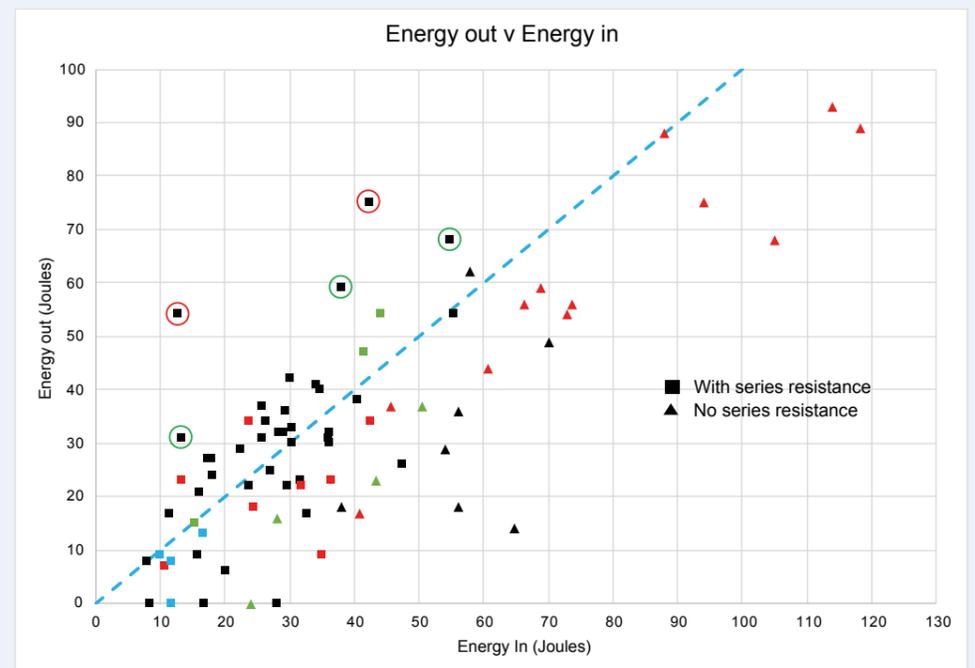


Fig 3. The output energy, measured using calorimetry typically mirrors the input energy, but occasionally may show an energy excess (Red and green circles)