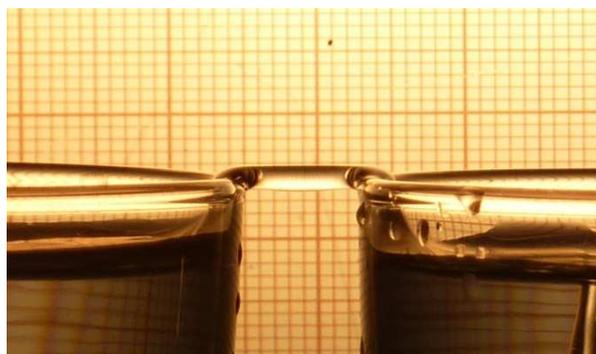


Floating Water Bridge

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1.) Introduction

Water is undoubtedly the most important chemical substance of the world. Despite this, and in spite of the fact that it is practically ubiquitous, it still represents one of the best explored substances, but not well-understood. So it was fascinating for me to get to know an experiment and phenomena that seems to be new and still not understood from the community of physicists. In the last three years a lot of papers on this subject appeared. Dr. Elmar Fuchs (Wetsus - Centre of Excellence for Sustainable Water Technology, Leeuwarden, NL), author of many publications in this field gave me numerous hints for experiments and for the theoretical considerations.

2.) Experiments

This phenomenon defies immediate perception: If a high voltage is applied to pure water filling two beakers kept close to each other, a connection forms spontaneously, giving the impression of a floating water bridge. For the experiments discussed two beakers with 50 mm diameter and 80 mm height made of glass were filled with deionized water, all filled 3mm below the beakers' edges with triply deionized water or water for car batteries (easier to get). Platinum electrodes were submerged in the centre of the beakers, one set to ground potential (cathode), the other on high voltage, up to 25 kV dc. A Leybold high-voltage power supply was used. Since the voltage generator had an inner resistance of 50 M Ω the output current was limited to avoid the formation of sparks, I approached the two beakers until their borders are in contact. By increasing the electrical voltage, water climbed up the remaining distance. A stable watery connection of several millimeter length is formed when a high-DC voltage is applied. With platinum electrodes and no electrolysis observed, a relatively high current and mass flow was measured. Once the beakers are separated, the bridge remains stable for almost a complete hour, depending on several factors.

3.) Measurements

To clarify this phenomenon I made measurements on electrical (current, voltage, resistance) and mechanical parameters (length and diameter of the bridge, mass flow between the glasses and force between the beakers). In order to analyze the heat flow and energy conversion I

decided to make investigations by infrared camera. The problem was that this loaned camera was not able to take videos. I developed a solution to solve this problem by taking a video of the display of the IR camera, on which the heat flow was shown. So I could visualize the heat flow. This exhibited clearly that in both directions of the bridge there are streams. Furthermore the bridge shows the highest temperature of the surrounding water.

By theoretical considerations concerning electrical and mechanical quantities I could clarify the energy conversion. Trials to measure the magnetic field of the bridge didn't show any recognizable effects. For further clarification of the phenomenon I tried to build bridges with different fluids. With tap water there didn't build up a bridge. But with castor oil I could build excellent stable bridges. Videos of the trials with castor oil are shown on: <http://www.youtube.com/watch?v=Xipr1jMO1GQ&feature=related>). I assume I was the first one, who made investigations with castor oil. The current in this case was too small to be measured. The IR pictures in this case showed no warming of the bridge.

4.) Results

High voltage arranges water molecules in a line of positive and negative polarity by turns like a rope. A Water Bridge of one centimeter may bundle many water ropes which are composed of arranged more than hundreds of millions of water molecules. I believe that the phenomenon was caused by electrical dipole moment of H₂O molecular. So the addition of an electrolyte will disturb the aligned structure.

5.) References

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