Why the Water Bridge does not collapse

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In 2007 an interesting phenomenon was rediscovered (It had been first time observed in 1893): a thread of water, the so-called water bridge, can hang between two glasses filled with deionized water if high voltage (of order 10 kV) is applied to them [1]. At first the edges of the completely filled glasses are in contact. When the voltage is applied, the water surface is deformed so that a water connection appears between the glasses. If the glasses are carefully moved apart, the water connection (the bridge) elongates and turns into a thin thread showing an amazing stability. A bridge of the length reaching 3.5 cm with the diameter of around 1 mm has been obtained.

The phenomenon has immediately captured attention and even entered some TV shows because the experiment is rather easy to reproduce and it can be treated as an evidence of some unique properties of water. What keeps the bridge stable against gravity? Several explanations have been published: quasi polymer chains are formed in the bridge and they form the load-carrying structure; this is a quantum effect; electrostatic field produces extra tension in a dielectric liquid.

We claim [2] that the force supporting the bridge is the surface tension of water; while the role of electric field is not to allow the bridge to reduce its surface energy by means of breaking into separate drops, where the high dielectric constant of water plays the role.

[1] E.C. Fuchs *et al.*, J. Phys. D.: Appl. Phys. 40, 6112 (2007).

[2] A.A. Aerov, Phys.Rev.E, 84, 036314 (2011)