Answers on comments to problem No 17 (2010) GEORGIA

Dear Ilya,

First of all I want to thank all the reviewers for very useful remarks.
Please see my answers below. We revised our article respectively.

Answers to Review 1:

Q1. *Page 2 says that the water splits into ions H+ and OH-. It is not very clear what forces may cause it, since the binding energy is very high.*
A1: We agree that the binding energy in water molecule is high, however still there are some ions produced by the self-ionization reactions (http://en.wikipedia.org/wiki/Self-ionization_of_water ; http://www.chemguide.co.uk/physical/acidbaseeqia/kw.html). In normal conditions 1 liter of water contains ~10^{-7} moles of ions. It is very small amount so commonly ions in pure water can be neglected, but not for our case. We estimated that this very small amount can lead to large effects. So to clarify this issue we will add this reference to our article.

Q2. *The known literature says that this effect is characteristic only for non-distilled water, where contaminant salts dissociate, and their ions are the carriers of charge. This aspect is mentioned, but never fully explained in the text.*
A2: In our paper we evaluated that even in pure water there are enough ions for generation of large charges using Kelvin's dropper, though of course adding salt increases the effect very much. As we wrote: "Addition of salt to water forces generator to start its action much faster and provides higher voltage. This is due to Na^+ and Cl^- ions in salt which increase the number of ions in bowl. It makes the amplitude and the probability of initial fluctuation higher. Also, additional ions increase charge accumulation speed as compared with charge leak speed since in this case each drop has a larger charge". Though exact numerical calculations can not be done because there are too many parameters affecting the process. E.g. it is very difficult to calculate the parasite currents and discharge speed, and also quantitatively to take the humidity into account . So we only stressed qualitatively that adding salt causes the effect to start earlier and charge to grow faster.

Q3. *Only the introduction features the references to the literature, while there are no references in the experimental and theoretical parts. Should any references be added? Are they necessary?*
A3: In experimental part we did all the experiments ourselves, so I don't know what reference can be placed. As to the theoretical calculations, issues in the relevant directions were made in the references we presented in the beginning of our article, though our calculations are a bit different.

Answers to Reviewer 2:

Q1. *The Figure 1, showing the Kelvin's dropper: It looks like the author has taken this figure from a book. Very few explanations are given on it. It is not explained what the letters (A, B, C …) mean. A and B look like capacitors, but why the outer plate of one capacitor (A) is connected to C (which looks like ground), and the outer plate of another capacitor (B) is not?*
A1: The figure 1 was taken from internet article http://mrgreenbiz.wordpress.com/2008/06/13/ . It is only for historical reasons so we made no explanations. It is picture of the original

device made by Lord Kelvin. About this figure we wrote: “Lord Kelvin invented a very interesting device and showed it on special occasions”. We did not base any of our calculations and evaluations on this picture. In the revised article I will put a reference on this picture.

Q2. *Much attention is paid to the influence of H+ / OH- separation on the phenomena. But the fact how the charges of these ions are compensated is not described clearly. If an ion H+ meets an electron, it would form atomic hydrogen and leaving the bulk of water. From my point of view, the process of discharge of droppers is not described completely.*
A2: Of course in the water there are processes of ion creation and compensation (http://en.wikipedia.org/wiki/Self-ionization_of_water ; http://www.chemguide.co.uk/physical/acidbaseeqia/kw.html). We added a reference on this issue. On the other hand, electric fields of inductors will attract ions of one sign and repel ions of the opposite sign thus working against compensation in the vicinity of the droppers. Ions repelled from the droppers will compensate each-other within the bowl. So the water in the bowl is electrically neutral. As we wrote “Water conductivity ensures the charge flow in the bowl so that ions can flow to the droppers under the influence of inductor’s field”.

Q3. *Evaluation of voltage growth rate: too many equations. Should less important features be less detailed? Some equations can be skipped, as the calculations are quite simple.*
A3: We showed that qualitative suggestions and calculations using the equivalent scheme give the similar results, so I think it is quite interesting.

Q4. *Evaluation of accumulated charge: I do not understand how it is connected to the problem. In any real conditions all the ions (with the suggested fraction of 10^{-7}) of water would not be separated by Kelvin’s dropper. Why not use your theory for voltage growth rate with a small initial charge and real parameters of water (volume and electrical properties) to calculate an actual “ideal” charge instead? The electric forces might also themselves split the water molecules into ions. This fact can also change the charge growth rate and the maximal charge.*
A4: We just showed that even such very small concentration of ions in pure water can lead to very large charge generated by Kelvin’s dropper. Under “Ideal” we assumed that ALL the ions existing in 1 liter bowl at REAL normal conditions will be separated. We evaluated such case and this gives a huge charge. Of course not all the ions will be separated, thus the charge is large but much less then in “Ideal” case. Though it is very difficult to predict, what part of ions will be separated. Of course the electric forces also polarize water molecules and split them into ions thus increasing the effect. We will add this suggestion to our article.

Answers to Reviewer 3:

Q1. References: The list of references is not typeset properly. Are the references [1] and [2] books, articles, or web pages? Please type the references in a way that the readers may immediately understand where and how they may look for a document.
Add the publisher if it’s a book, volumes and journal titles if it’s a periodical, or the URL if it’s a web page.
A1: I agree that references [1, 2] will be easier to find if we’ll give the exact URL-s. (In other way reader must print the titles in google.com and search there). So we add exact URLs.

Q2. Consistency of units and spelling: Please use a blank spacing between a numerical value and its dimension (30 kV, not 30kV). Please check whether short notations (e.g. C or V) or full notations (e.g. Coulombs or Volts) are used throughout the text. Note that the short notations are clearly preferred. Please write either Fig., or Figure, or figure uniformly in the manuscript.
A2: Corrected.

Q3.Sources of images: please provide direct information on where the Figure 1 and Figure 2 are taken from. Are all other images of own work?
A3: I put references on Fig.1 and Fig.2. All other figures are our own.

Once more I want to express my thanks for all remarks which were very usefull.

With the best regards

Alexander Barnaveli.