



Online LTP Seminar

Lecture 20

February 23, 2021

Osmotic pressure on cell membranes in a saline interacting with weakly ionized plasma

Mikhail Shneider

MAE Department, Princeton University, Princeton NJ 08544

In this talk, the attention is drawn to the importance of accounting for osmotic pressure when analyzing physiological effects on cells and viruses in plasma medicine and disinfection. The effect of a plasma on living cells and viruses in a physiological solution can be related to a change in pH and the osmotic pressure difference across the cell membrane, as a result of the injection into a physiological solution of additional long-lived ions by the plasma. This, in turn, leads to a stretching or compression of the membrane, depending on the difference of total external and internal pressures. The hypertonic solution mode is most likely realized. The selective effect of plasma on cells, observed in experiments, may be associated with the change in the mechanical properties of membranes (and thereby, a weakening of their protective properties). Corresponding estimates are given. Our work does not claim to have found the only reason, why weakly ionized non-equilibrium plasma leads to cell and virus death, but has identified a potential further physical mechanism that has relevance in plasma induced biological effects.

Short Bio

Dr. Mikhail N. Shneider received a master's degree in theoretical physics (with honors) from the Kazan State University, Russia, a Ph.D. in Plasma physics and Chemistry from All-Union Electrotechnical Institute, Moscow and Doctor of Sciences (highest scientific degree in Russia) in Plasma physics and Chemistry from Institute for High Temperatures, Russian Academy of Sciences, Moscow. Since 1998 until the present, Dr. Shneider has been working at the Mechanical and Aerospace Engineering Department, Princeton University. At present he is a Senior Research Scholar in the Applied Physics Group. His research interests are in the theoretical study of gas discharge physics; physical gasdynamics; biophysics, atmospheric electrical phenomena; non-linear optics and laser-matter interaction. Dr. Shneider was invited many times as a guest professor to universities in Austria, China, France, Germany, Great Britain and Russia. He has about 220 papers in refereed journals (10 review papers), 3 US patents, and two books.