

Proposal for collaboration  
of **Theoretical Electrical Technique**  
department of NTU “KhPI”

# Department of Theoretical Electrical Technique

**Head of the Department:**

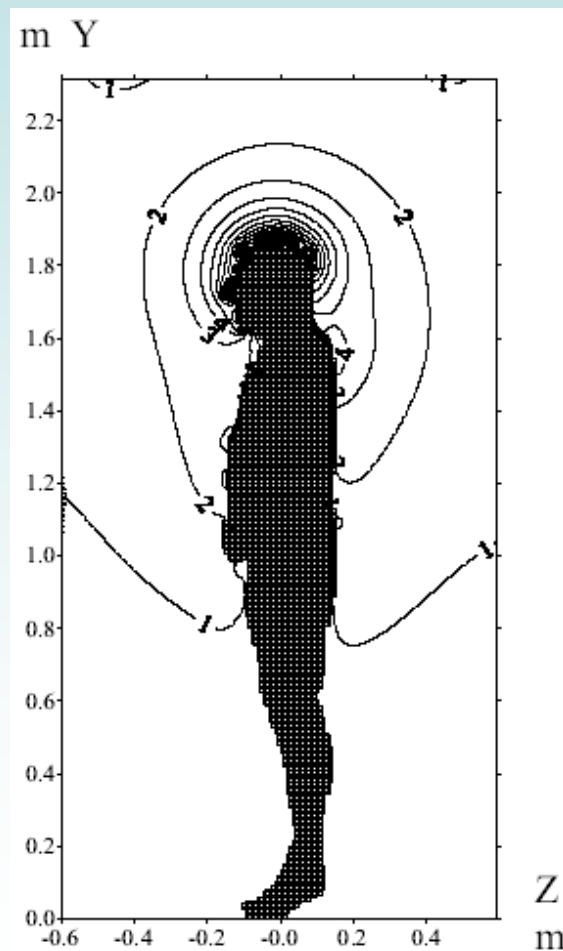
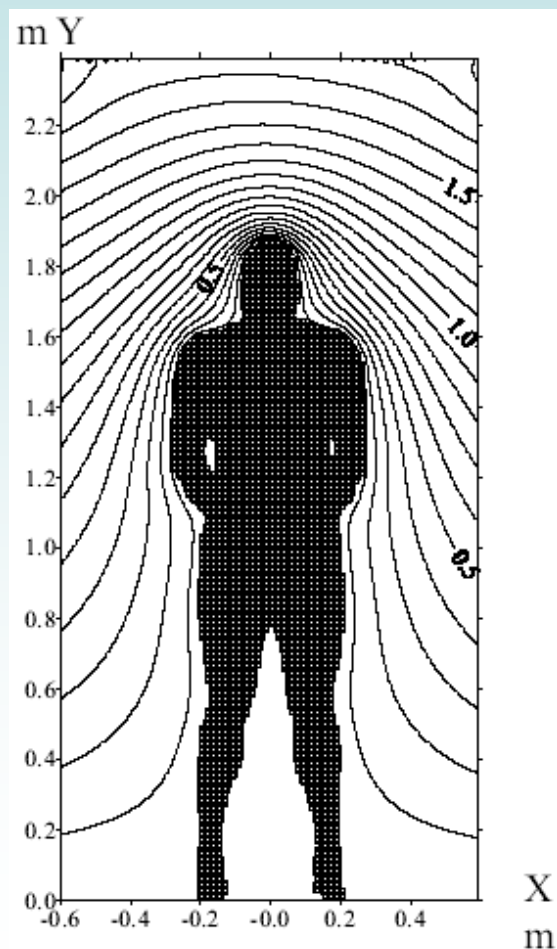
**prof. Rezynkin Oleg [orezynkin@gmail.com](mailto:orezynkin@gmail.com)**

**Research themes:**

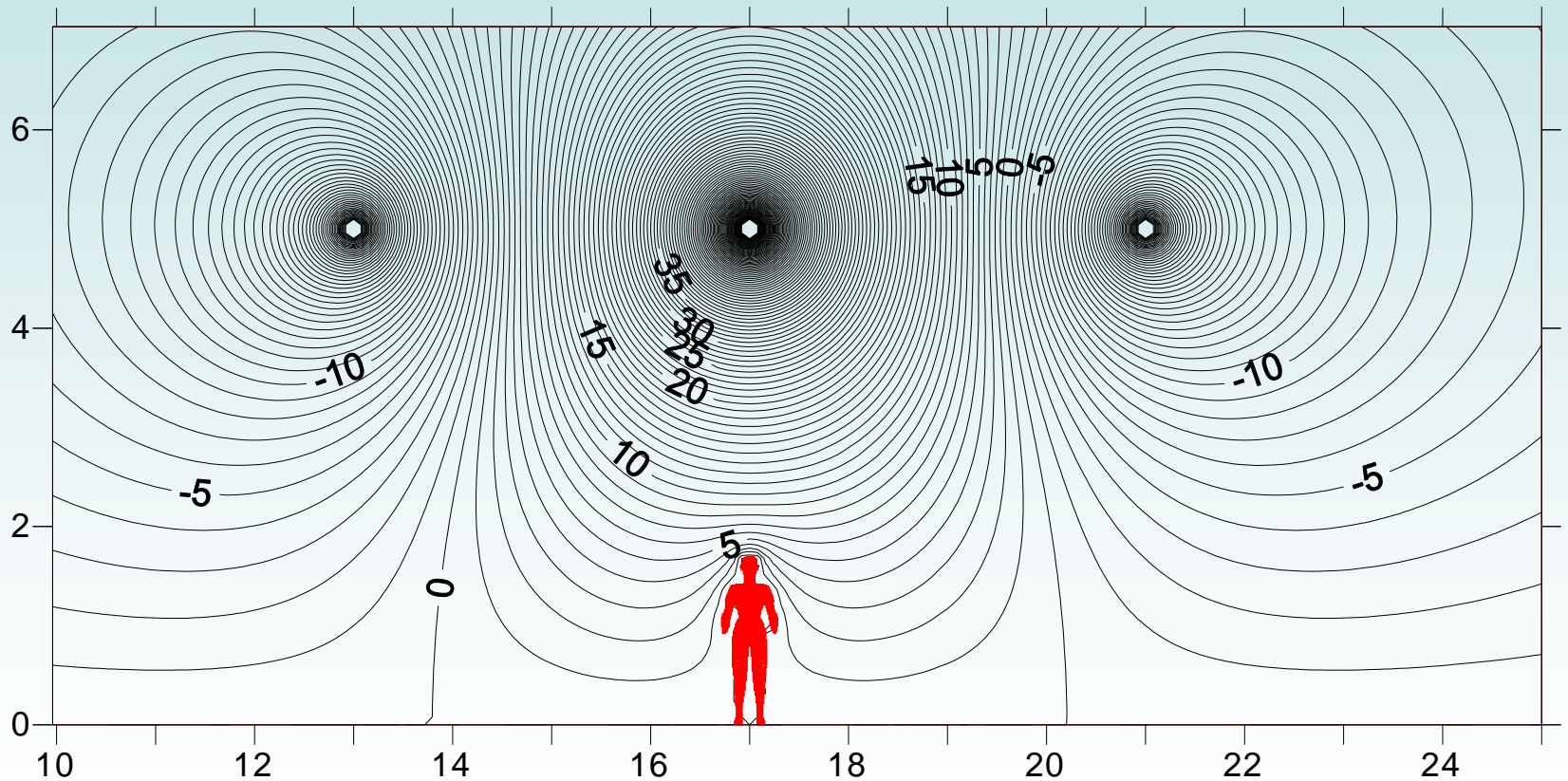
- 1. Numerical calculations of 3D electric field in human body tissues caused by EMF exposure.**
- 2. Numerical calculations of 3D electromagnetic fields for BioEMC and EMC applications.**
- 3. Physical modeling of electrical physical processes at HVDC and pulse HV application in HV Laboratory.**

# Examples of 3D electromagnetic fields calculation for various BioEMC and EMC applications

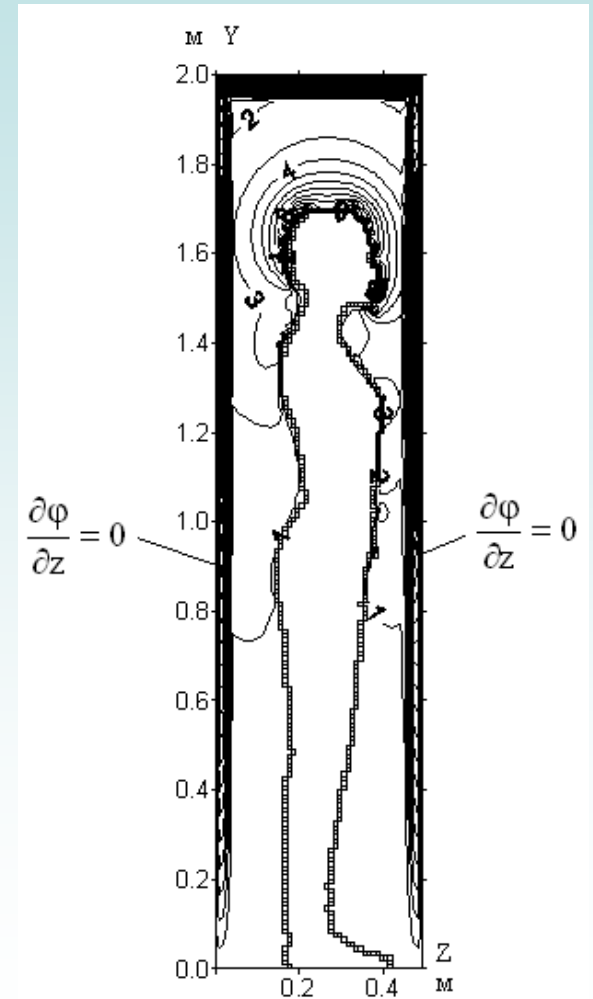
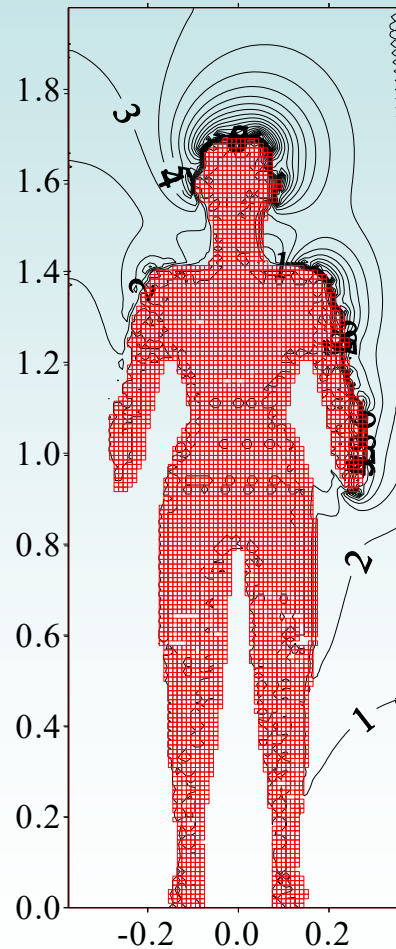
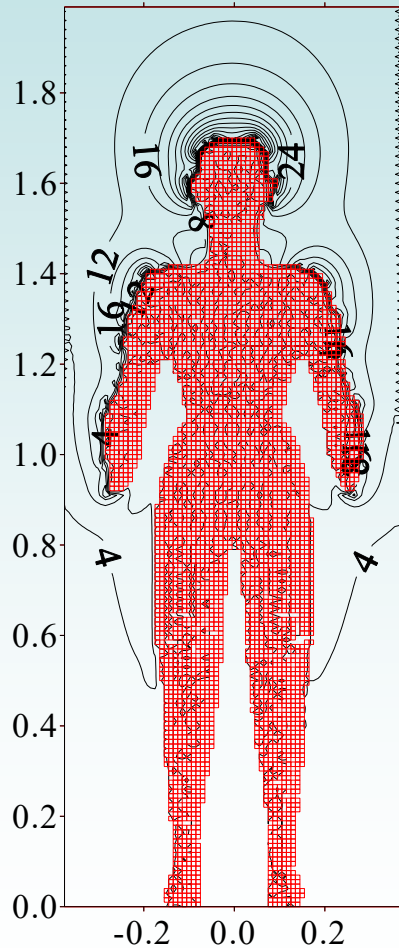
Calculated distribution of the lines of equal potentials and equal electric field strength around HUGO phantom



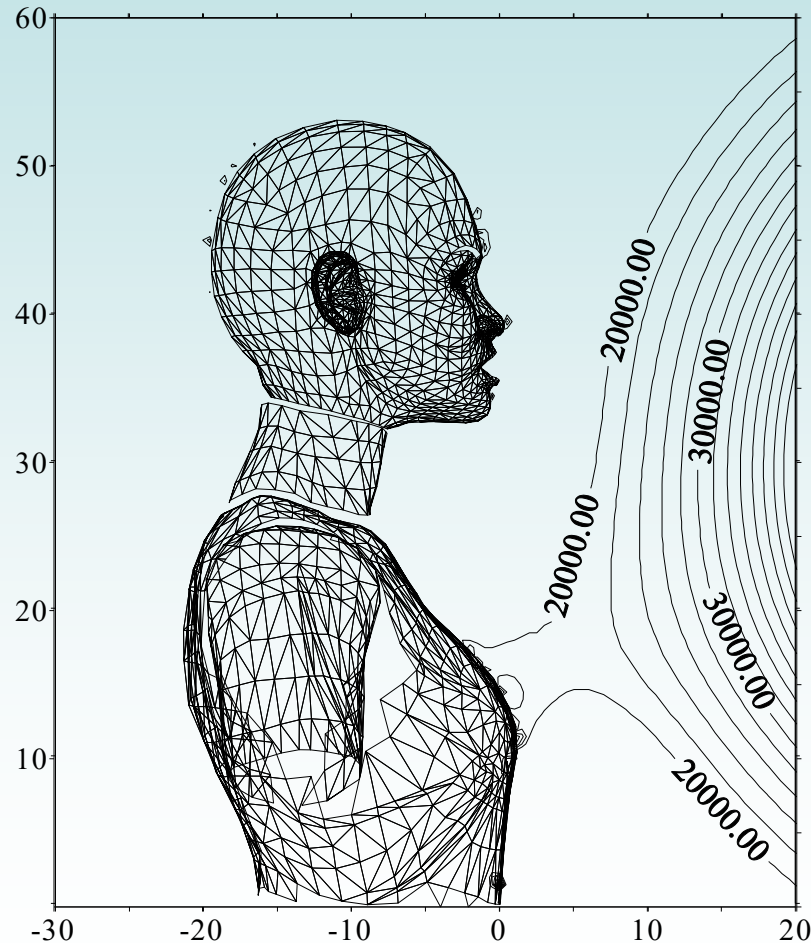
Calculated distribution of the equal potential lines in the average cross-section  $Z=\text{const}$  of the human body in the sanitary zone of power transmission line of 110kV



# Calculated distribution of the lines of equal electric field strength

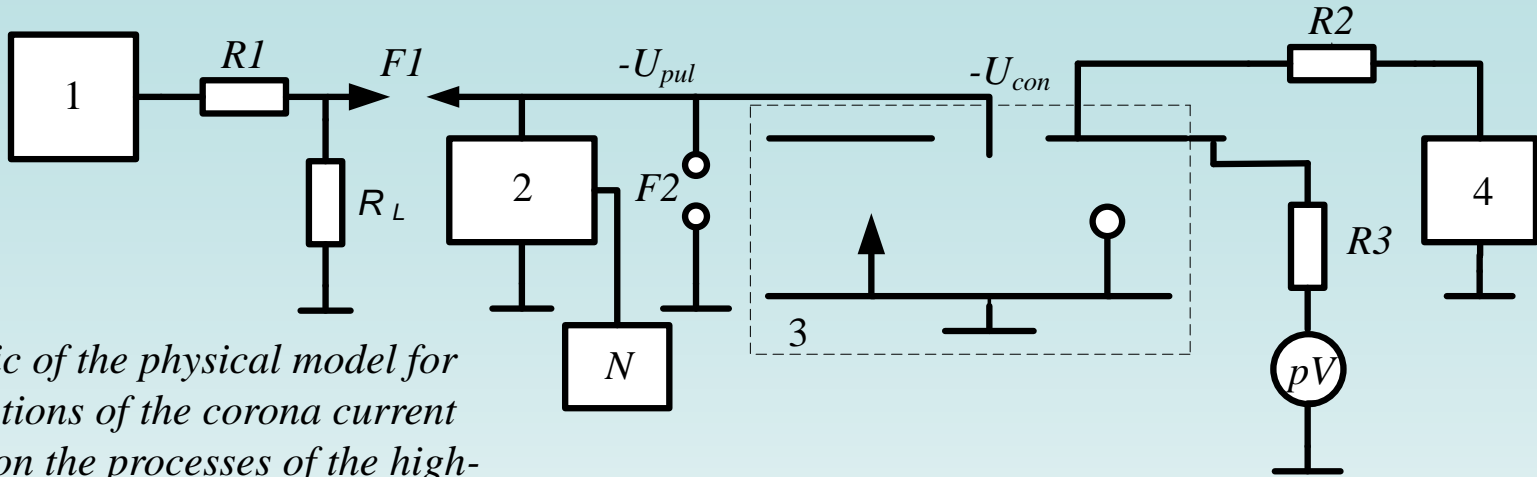


# Calculated lines of the equal electric field strength $E > 20\text{kV/m}$ in the vicinity of a VDT operator

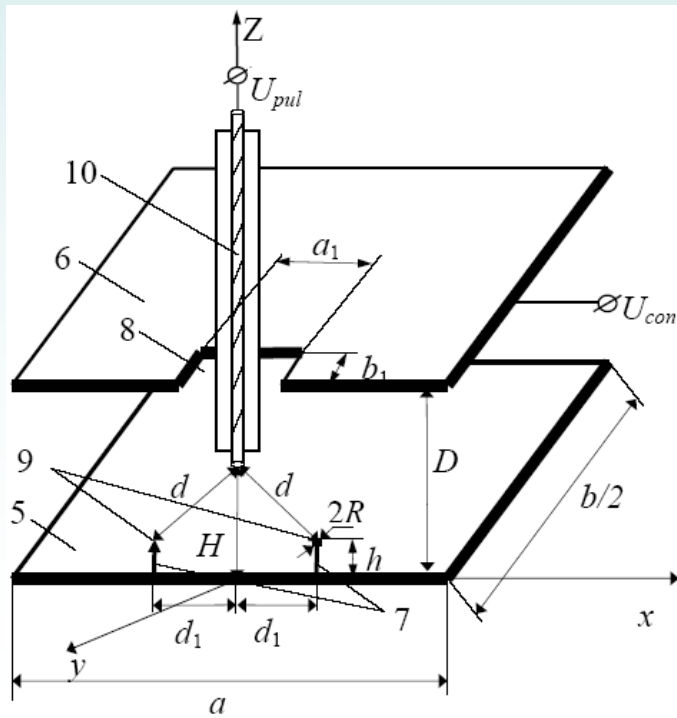


# Experimental investigations of discharge processes in long air gaps at HVDC and HV impulses application

Schematic diagram of the high voltage stand



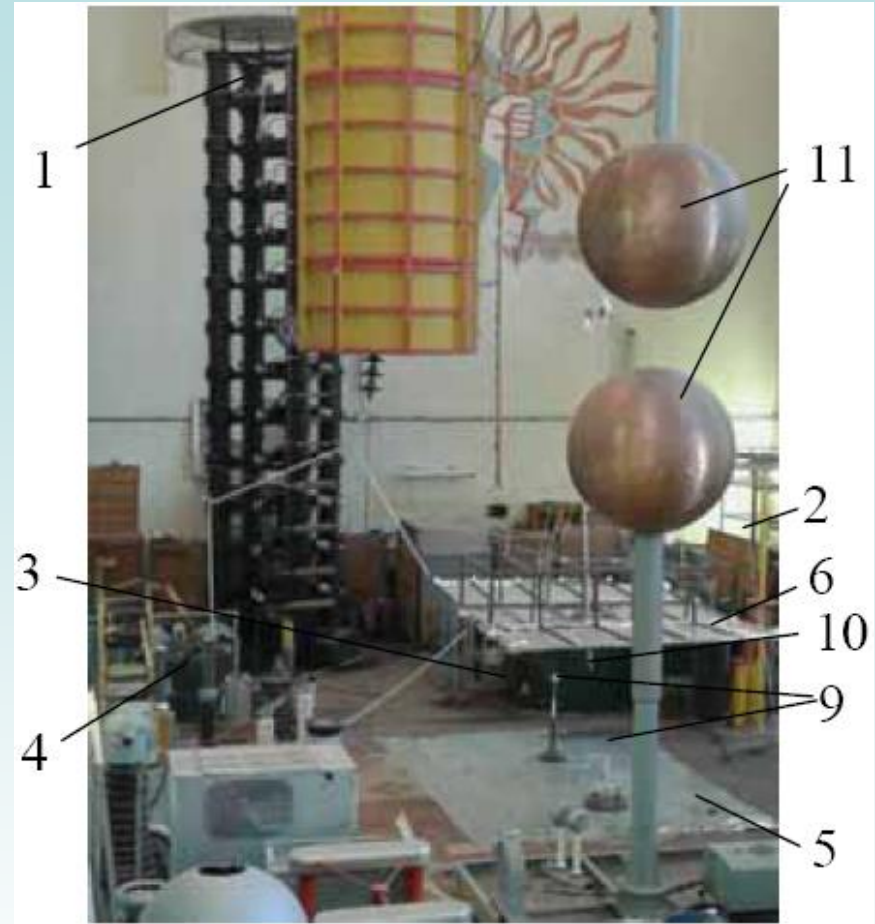
Schematic of the physical model for investigations of the corona current influence on the processes of the high-breakdown



1 is HV impulses generator;  $R_L = 22 \text{ k}\Omega$  is load resistance;  $R_2 = 500 \text{ k}\Omega$ ;  $R_3 = 200 \text{ M}\Omega$ , 2 is voltage divider; N is oscilloscope;  $F_1$  is discharge gap;  $F_2$  is protective spark gap; 3 is field-forming system; 4 is HV DC generator; pV is milliammeter; 5 is grounded plane; 6 is potential plane; 7 are grounded electrodes; 8 is opening in the high voltage plane; 9 are tops of the grounded electrodes; 10 is high-voltage electrode, 11 is ball measurement gap (ball diameter is 0.35 m).



# PHOTOS HIGH-VOLTAGE DISCHARGES AND HIGH VOLTAGE LABORATORY



1 is impulse HV generator; 2 is voltage divider; 3 is field-forming system; 4 is DC generator; 5 is grounded plane; 6 is potential plane; 9 is tops of the grounded electrodes; 10 is high-voltage electrode, 11 is ball measurement spark gap



# • Publications on the proposed themes

- • Rezinkina M., Markov M. Mathematical modelling of pulsed magnetic field action on neurons' bioelectric activity // *The Environmentalist*. – 2009 – Vol. 29, N 2. – P. 147-152 (DOI 10.1007/s10669-008-9200-6).
- • Rezinkina M., Bydianskaya E., Shcherba A. Alteration of brain electrical activity by electromagnetic field // *The Environmentalist* - 2007. - Vol. 27, N 4. – P. 417-422 (DOI 10.1007/s10669-007-9077-9).
- • Clemens M., Barchanski A., De Gerssem H., Weiland T., Rezinkina M. Numerical simulation of low frequency current density distributions in voxel based human anatomy models due to ambient electric and magnetic fields // 5-th International Conference on Computation in Electromagnetics. - Stratford-upon-Avon (UK). – 2004.
- • Rezinkina M.M., Rezinkin O.L. Numerical calculation of the heterogeneous quasi-static electrical field distribution in the presence of an operator of a video display terminal. 12-th International Symposium on High Voltage Engineering, Bangalore, India, 2001.
- • Zybanova L. Rezinkina M., Rezinkin O. Mathematical modeling of human body exposed to electromagnetic field. Proc. of Millennium Workshop on Biological Effects of Electromagnetic fields, Crete, Greece, 2000.
- • Zybanova L.F., Rezinkina M.M. Experimental and theoretical investigation of electromagnetic fields influence on rats and human beings. Proc. of the First World Congress on the Effects of Electricity and Magnetism in the Natural World, Madeira, 1998.
- • Zybanova L.F., Rezinkina M.M., Rezinkin O.L. Numerical investigation of the electrical fields penetration inside biological objects. Proc. of 10-th International Sympos. on High Voltage Engineering, Montreal (Canada), 1997, Vol. 2, p.p. 105-108.
- Rezinkina M., Rezinkin O., D'Alessandro F., Danyliuk A., Lisachuk G., Sosina E., Svetlichnaya E. Influence of corona on strike probability of grounded electrodes by high voltage discharges. *Journal of Electrostatics*. V. 83, 2016, P. 42–51.
- • Rezinkina M.M., Rezinkin O.L., Svetlichnay E.E. Electric Field in the Vicinity of Long Thin Conducting Rods. *Technical Physics*, 2015, Vol. 60, No. 9, pp. 1277–1283 (DOI 10.1134/S1063784215090182).
- • Rezinkina M., Rezinkin O., Bean C., Chalise S.R., Grasty J. Statistical analysis for probable varying potential lightnings stokes to extended objects // *High voltage Engineering (China)*. – Vol. 37, No 11. - 2011. – P. 11518 – 11523.

## **Proposal for the joint research**

**It is proposed to carry out joint research in the field of physical and mathematical modeling of EMF influence on biological and technical objects to find out safe levels of EMF strengths.**

**The novelty of this work is determined by the development of advanced physical and mathematical models, as well as application in the area of renewable energy sources elaboration.**