Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Vortex electron current and fundamental non-ambipolarity of charged particles fluxes in 2D unmagnetized plasmas[1] ANATOLY KUDRYAVTSEV, St. Petersburg State University, EUGENE BOGDANOV, SPbSPU, ALEXANDER CHIRTSOV, SPbSU — It is shown that even for non-magnetic single-component plasma bounded by dielectric walls, in case of any 2D geometry, the condition of ambipolarity of fluxes (that is equality of electron and ion fluxes) is violated and vortex electric current arises. Since any complications (such as conductive walls, non-uniformity of mobilities, multicomponent consist of plasma, presence of magnetic field etc.) will only make worse the ambipolarity of fluxes, it may to declare that classical conception of ambipolar diffusion is not valid already for general 2D case. It is rather exclusive case and cannot be a paradigm for description of transport of charged particles in plasma. Thus, the ambipolarity of fluxes is rather exclusive case which is true only for simple idealized 1D models like length-uniform positive column of glow DC discharge. The presence of vortex component of current leads necessarily to additional Joule heating of electron gas. Also, the inequality of electron and ion fluxes can lead to such nontrivial phenomenon as arise of friction forces which are capable to enforce on neutral gas.

[1]This work was supported by the FZP and SPbGU.

Anatoly Kudryavtsev
St. Petersburg State University

Date submitted: 29 Jul 2011 Electronic form version 1.4