stationary current filaments with relativistic electrons in plasma focus [[1]](#footnote-1)\*)

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Recently, the current filaments in plasma focus (PF) [1] were investigated in the plasma model with the London current [2]. The obtained quasi-cylindrical supersonic, subsonic and stationary structures are limited by the current flowing through one filament to a value of 100 A in order of magnitude. In the same model, filament generation was considered as a result of the development of the corrugation instability of the rarefaction shock wave, which forms near the surface of the PF insulator [3].

A new hydrodynamic model that takes into account relativistic plasma electrons is demonstrated here. Note that relativistic electrons are detected in PF discharges with an energy of 200 keV and more [1]. In the discussed one-fluid plasma model, the relation for the current generalizes   
the expression for the London current. In this model, tangential discontinuities and shock waves are studied.

Stationary cylindrical structures are investigated numerically in the plasma model with relativistic electrons. The solution depends on the radius of the filament, which is determined by   
the coordinate of the tangential discontinuity, and on the current flowing along the tangential discontinuity. In the filament structure around the tangential discontinuity, the reverse currents are induced. The induced currents are closed. Moreover, part of the closed circuit of the induced currents is part of the filament, and the other part is outside it. The reverse induced currents in   
the filament structure include both volume currents and currents flowing along the surface of   
the discontinuity at which the magnetic field reverses its direction. The filaments may have a radius greater or less than the London penetration depth. The solution for current values of 1 kA and 10 kA through the filament are presented.

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References

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3. Tsybenko S.P., Gurei A.E., Bulletin of the Lebedev Physics Institute, 2019, **46**, 157.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/CU-Nikulin.docx) [↑](#footnote-ref-1)