A criterion of unbalance of some simple groups of Lie type

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A finite simple nonabelian group K is called locally balanced (locally 1-balanced) with respect to a prime p if $O_{p'}(C_G(x))=1$ for any element x of order p from $G = Aut(K)$. The locally unbalanced finite simple nonabelian groups were determined in Theorem 7.7.1 from [1]. However, the item (d) of this theorem is wrong. This mistake is removed by the following theorem.

Theorem. *Let G be a finite almost simple group, $K = Soc(G)$ be a group of Lie type over a field of characteristic r, and $x \in G \setminus Inndiag(K)$ be an element of a prime order $p \neq r$. Then the following conditions are equivalent:*

(1) $O_{p'}(C_G(x)) \neq 1$;

(2) x induces a field automorphism on K and $(|C_K(x)|, p) = 1$.

References

[1] D. Gorenstein, R. Lyons, R. Solomon, *The classification of the finite simple groups, number 3*, AMS, Providence, Rhode Island, 1991.

[2] V. I. Zenkov, A criterion for the failure of local balance of some simple groups Lie type. *Trudy Instituta Matematiki i Mekhaniki UrO RAN* **22(2)** (2016) 148–150.