Abstract

We study embeddings of $\mathrm{PSL}_2(p^a)$ into exceptional groups $G(p^b)$ for $G = F_4, E_6, {}^2E_6, E_7$, and p a prime with a, b positive integers. With a few possible exceptions, we prove that any almost simple group with socle $\mathrm{PSL}_2(p^a)$, that is maximal inside an almost simple exceptional group of Lie type F_4, E_6, ${}^2E_6$ and E_7, is the fixed points under the Frobenius map of a corresponding maximal closed subgroup of type A_1 inside the algebraic group.

Together with a recent result of Burness and Testerman for p the Coxeter number plus one, this proves that all maximal subgroups with socle $\mathrm{PSL}_2(p^a)$ inside these finite almost simple groups are known, with three possible exceptions ($p^a = 7, 8, 25$ for E_7).

In the three remaining cases we provide considerable information about a potential maximal subgroup.