Tosion units in the integral group ring of $\mathrm{PSL}(2, p^f)$

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Let G be a finite group and $V(\mathbb{Z}G)$ the group of normalized units in the intgeral group ring of G. A long standing conjecture of H.J. Zassenhaus asks, whether for every torsion unit $u \in V(\mathbb{Z}G)$ there exists a unit in $\mathbb{Q}G$ conjugating u onto an element of G. In case there is, one says, that u is rationally conjugate to a group element. A weaker form of the Zassenhaus Conjecture, the so called Primegraph Question, asks, whether it follows from $V(\mathbb{Z}G)$ having an element of order pq, that G also posseses an element of order pq, for every pair of different prime numbers p and q.

Several results concerning this questions for $G = \mathrm{PSL}(2, p^f)$ will be presented in this talk. Especially the result, that every torsion subgroup of prime power order of $V(\mathbb{Z}\,\mathrm{PSL}(2, p^f))$ is rationally conjugate to a subgroup of G provided $f \leq 2$ or $p = 2$. The methods involved are the so called HeLP-method and a method developed by the speaker and A. Bächle from an argument of M. Hertweck, which involves integral and modular representation theory.