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Ben Fine

Fairfield University

On CT and CSA Groups and Related Ideas

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Abstract:

A group is G **commutative transitive** or CT if commuting is transitive on non-trivial elements. A group G is CSA or **conjugately separated abelian** if maximal abelian subgroups are malnormal. These concepts have played a prominent role in the studies of fully residually free groups, limit groups and dicriminating groups. They were especially important in the solution to the Tarski problems. CSA always implies CT however the class of CSA groups is a proper subclass of the class of CT groups. For limit groups and finitely generated elementary free groups they are equivalent. In this paper we examine the relationship between the two concepts. In particular we show that a finite CSA group must be abelian. If G is CT then we prove that G is not CSA if and only if G contains a nonabelian subgroup G_0 which contains a nontrivial abelian subgroup H that is normal in G_0 . For K a field the group $PSL(2, K)$ is never CSA but is CT if $\text{char}(K) = 2$ and for fields K of characteristic 0 where -1 is not a sum of two squares in K. For characteristic p, for an odd prime p, $PSL(2, K)$ is never CT. Infinite CT groups G with a composition series and having no nontrivial normal abelian subgroup must be monolithic with monolith a simple nonabalian CT group. Further if a group G is monolithic with monolith N isomorphic to $PSL(2, K)$ for a field K of characteristic 2 and G is CT then $G \approx N$.