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Double covers of Klein surfaces with an automorphism group of type $(2,2,2,n)$

Abstract We say that a group G of automorphisms of a compact Klein surface X is of type $(2,2,2,n)$ if the universal covering transformation group of G is an NEC group with quadrangle signature $(2,2,2,n)$. Alternatively, the orbit space X/G is a hyperbolic quadrilateral with angles $\pi/2$, $\pi/2$, $\pi/2$ and π/n. Let X^+ be the Riemann double cover of X. It is well known that the full group $Aut(X^+)$ of conformal and anticonformal automorphisms of X^+ contains a subgroup iso-morphic to $Aut(X) \times C_2$, where $Aut(X)$ is the full group of automorphisms of X. Then a natural question arises: is $Aut(X^+)$ equal to $Aut(X) \times C_2$, or does X^+ admit other automorphisms?
This question has been considered for bordered Klein surfaces X of algebraic genus g with $12(g-1)$ automorphisms by May, and with $8(g-1)$ automorphisms by Bujalance, Costa, Gromadzki and Singerman. In both cases, $Aut(X)$ is of type $(2,2,2,n)$, with $n=3$ in the first case and $n=4$ in the second. Later, Costa and Porto studied the more general case where n is an odd prime p. They proved that $Aut(X^+) = Aut(X) \times C_2$ almost always occurs for such actions, and that in fact there is just one single exception for each value of p.
In this talk we will show that the same holds for group actions of type $(2,2,2,n)$ for all $n \geq 6$, again with one single exception for each value of n. This is joint work (in progress) with Emilio Bujalance and Marston Conder.