Title: Structure of the Galois group of the maximal unramified pro-2-extension of some $\mathbb{Z}_2$-extensions

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For a number field k, we consider the Galois group $G = \mathrm{Gal}(\mathcal{L}(k_\infty)/k_\infty)$ of the maximal unramified pro-2-extension of the cyclotomic $\mathbb{Z}_2$-extension k_∞ of k. In terms of transfer, we establish a necessary and sufficient condition for a 2-group to be abelian or metacyclic non-abelian whenever its abelianization is of type $(2^n, 2^m)$, with $n \geq 2$ and $m \geq 2$. Then we apply this result to construct an infinite family of real quadratic fields for which G is an abelian pro-2-group of rank 2.

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