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Title: Finite 2-groups of rank 2

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Let G be a 2-group. In this paper, we investigate the 2-group G in which $r(G) = 2$ and G has more than three involutions. We prove that if $\Omega_1(G) \cong D_{2^n}$ or $D_{2^n} * C_4$ with $n \geq 3$, then G' is abelian and there exists a maximal subgroup M of G such that M is metacyclic. If $\Omega_1(G) \cong D_{2^n} * Q_{2^m}$ with $n, m \geq 3$, then either $\Phi(G) \leq \Omega_1(G)$ or $|\Phi(G)| = |\Omega_1(G)|$ and $G' \cap \Omega_1(G)$ is a maximal subgroup of $\Omega_1(G)$.

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