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Journal of Lie Theory 17 (2007) 525–538

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The Baker-Campbell-Hausdorff Formula in the Free Metabelian Lie Algebra

The classical Baker-Campbell-Hausdorff formula gives a recursive way to compute the Hausdorff series $H = \ln(e^X e^Y)$ for non-commuting X, Y . Formally H lives in the graded completion of the free Lie algebra L generated by X, Y . We present a closed explicit formula for $H = \ln(e^X e^Y)$ in a linear basis of the graded completion of the free metabelian Lie algebra $L/[[L, L], [L, L]]$.

Keywords: Lie algebra, metabelian Lie algebra, Hausdorff series, Baker-Campbell-Hausdorff formula, metabelian BCH formula, Zassenhaus formula, Kashiwara-Vergne conjecture.

MSC: 17B01