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Aaron Lauve* (lauve@math.tamu.edu), Texas A&M University, Department of Mathematics, MS 3368, College Station, TX 77843-3368, and **Christophe Reutenauer** (reutenauer.christophe@uqam.ca). *Rational and irrational series over the free group.*

A curious identity of Euler goes as follows: the sum of x^k over all $k \in \mathbb{Z}$ is zero. Coming to grips with the meaning of this identity leads to a new characterization of the free skew field (extending the work of Duchamp and Reutenauer) inside the space of functions on the free group. Using results from automata theory, we further deduce that every Malcev-Neumann series over the free group has a rational expression without simplification. (Received September 17, 2008)