

# Extension by continuity of the domain of Poly- and Hyper-logarithms

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## Abstract

Motivated by the continuation of polylogarithms which is better understood through (improper) iterated integrals and noncommutative differential equations (with asymptotic initial condition), we extend by continuity the initial domain of indexation of Poly- (and Hyper-) logarithms. Remarking that the codomain of the Li arrow is a nuclear space, we observe that this new domain is a shuffle subalgebra of the algebra of noncommutative series. This method can be applied *mutatis mutandis* to hyperlogarithms. If time permits, we give further insights and applications in particular by substitution of remarkable representative series.