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Generalized Large Algebras for Lie Algebra Contractions 101

İnönü-Wigner contractions were introduced in 1953 to explain how the symmetries of two systems connected by a limit are related; for example Poincaré group contracts to Galilei group as the speed of light goes to infinity. During an informal talk, Cahit Arf asked Erdal İnönü whether there is a large group that includes both the original and the contracted group as subgroups. İnönü answered this question in 1956 by constructing a large algebra, a Lie algebra containing both the original and the contracted algebra as subalgebras, and a corresponding large Lie group. However, this only covers first order contractions, where $\mathfrak{m}$ is rescaled by ε, for a decomposition $\mathfrak{g} = \mathfrak{s} \oplus \mathfrak{m}$ into a subalgebra $\mathfrak{s}$ and a complement $\mathfrak{m}$ satisfying İnönü's condition $[\mathfrak{s}, \mathfrak{m}] \subset \mathfrak{m}$. It does not cover higher order (Weimar-Woods) contractions, where generators are rescaled by powers ε^k with non-negative integer exponents k, the largest being the order n. In 2011, Khasanov and Kuperstein introduced a new approach to İnönü-Wigner contractions through quotients of the Lie algebra of smooth sections on the İnönü-Wigner Lie algebra bundle, and defined a sequence of higher dimensional Lie algebras $\mathfrak{g}_n$. They study $\mathfrak{g}_1$, but not $\mathfrak{g}_n$ for $n \geq 2$ in general. This poster aims to show that for the trivial Lie algebra bundle of $\mathfrak{g}$, every Weimar-Woods contraction of order n is a canonical subquotient of $\mathfrak{g}_n = \mathfrak{g} \otimes \mathbb{R}[\sigma]/(\sigma^{n+1})$, so that $\mathfrak{g}_n$ plays the role of a large algebra for contractions up to order n.