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Rafael S. González D'León* (dleon@math.miami.edu). *On the free Lie algebra with k compatible brackets and poset topology.* Preliminary report.

It is a classical result that the multilinear component of the free Lie algebra with n generators $\mathcal{L}ie(n)$ has dimension $(n - 1)!$. It is also well known that $\mathcal{L}ie(n)$ is isomorphic as an \mathfrak{S}_n -module to the top cohomology of the poset of set partitions Π_n tensored with the sign representation. A conjecture of Feigin proved independently by Dotsenko-Khoroshkin and Liu is that the dimension of the multilinear component of the free Lie algebra with two compatible brackets $\mathcal{L}ie_2(n)$ is n^{n-1} . We study the free Lie algebra with k compatible brackets $\mathcal{L}ie_k(n)$ and extend results on the dimensions of $\mathcal{L}ie(n)$ and $\mathcal{L}ie_2(n)$ thereby answering some questions of Liu. Our technique is to construct an explicit isomorphism between $\mathcal{L}ie_k(n)$ and the top cohomology of a poset of weighted partitions and then to apply tools from poset topology. This extends previous work of González D'León and Wachs on the $k = 2$ case. (Received August 27, 2013)