

# Homological representations of motion groups

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## Abstract.

The *Lawrence representations* are an important family of representations of the braid groups. The first is the *Burau representation* and the second is the *LKB representation*, which was used by Bigelow and Krammer to prove that the braid groups are *linear* (act faithfully on finite-dimensional vector spaces).

The construction of the Lawrence representations is homological; I will first describe a general setting into which this construction naturally belongs, which produces a wide family of representations of *motion groups* (such as surface braid groups, loop braid groups, etc.). The simplest non-trivial new representation amongst these is an analogue of the reduced Burau representation for the extended loop braid groups; I will explain this in detail, as well as steps towards analogues of the higher Lawrence representations for loop braid groups.

In fact, the general construction naturally produces infinite “nilpotent towers” of representations of motion groups, as long as the lower central series of an associated “mixed” motion group has infinite length. I will discuss examples of this phenomenon both for the classical and the loop braid groups. In particular, the LKB representation is the bottom layer of such a tower.

All of this represents joint work with Arthur Soulié ([arxiv:1910.13423](https://arxiv.org/abs/1910.13423) and [arxiv:2109.11468](https://arxiv.org/abs/2109.11468)) and part of it is also joint work with Jacques Darné ([arxiv:2201.03542](https://arxiv.org/abs/2201.03542)).