

ALGEBRA  
SEMINAR

*The non-Abelian Whitney theorem and the Higher Pairing on  
Graphs*

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**Abstract:** For a connected graph  $G$  with no 1-valent vertices, the set of based reduced graphs is sufficient to recover the graph. This is non-commutative invariant of the graph. Its abelianization, the cycle space of the graph is sufficient to recover the graph up to two moves by Whitney's 2-isomorphism theorem. In this talk, we will consider a unipotent invariants that interpolates between the set of paths and its abelianization. There is a related isomorphism theorem that lets you recover the graph from the analogous unipotent invariant. In the same spirit, we will introduce a unipotent pairing between paths and ordered  $n$ -tuples of cycles which was inspired by Chen's theory of iterated integrals and which generalizes the length pairing between cycles. We conjecture a higher Picard-Lefschetz theorem relating this pairing to the asymptotics of iterated integrals on degenerating families of curves, and state a sort of Torelli theorem relating the asymptotics to the dual graph of a degeneration.

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MATHEMATICS AND COMPUTER SCIENCE  
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