Nonabelian multiplicative integration on curves is a classical theory, going back to Volterra in the 19th century. In differential geometry this operation can be interpreted as the holonomy of a connection along a curve. In probability theory this is a continuous-time Markov process.

This talk is about the 2-dimensional case. A rudimentary nonabelian multiplicative integration on surfaces was introduced in the 1920's by Schlesinger, but it is not widely known.

I will present a more sophisticated construction, in which there is a Lie group $H$, together with an action on it by another Lie group $G$. The multiplicative integral is an element of $H$, and it is the limit of Riemann products. Each Riemann product involves a fractal decomposition of the surface into kites (triangles with strings). There a twisting of the integrand, that comes from a 1-dimensional multiplicative integral along the strings, with values in the group $G$.

My main result is a 3-dimensional nonabelian Stokes Theorem. This result is new; only a special case of it was predicted (without proof) in papers in mathematical physics.

The motivation for my work was a problem in twisted deformation quantization. It is related to algebraic geometry (the structure of gerbes), algebraic topology (nerves of 2-groupoids), and mathematical physics (nonabelian gauge theory). I will say a few words about these relations at the end of the talk.

The talk itself is a computer presentation with numerous color pictures. I recommend printing a copy of the notes before the talk, from the link below. The talk should be accessible to a wide mathematical audience.