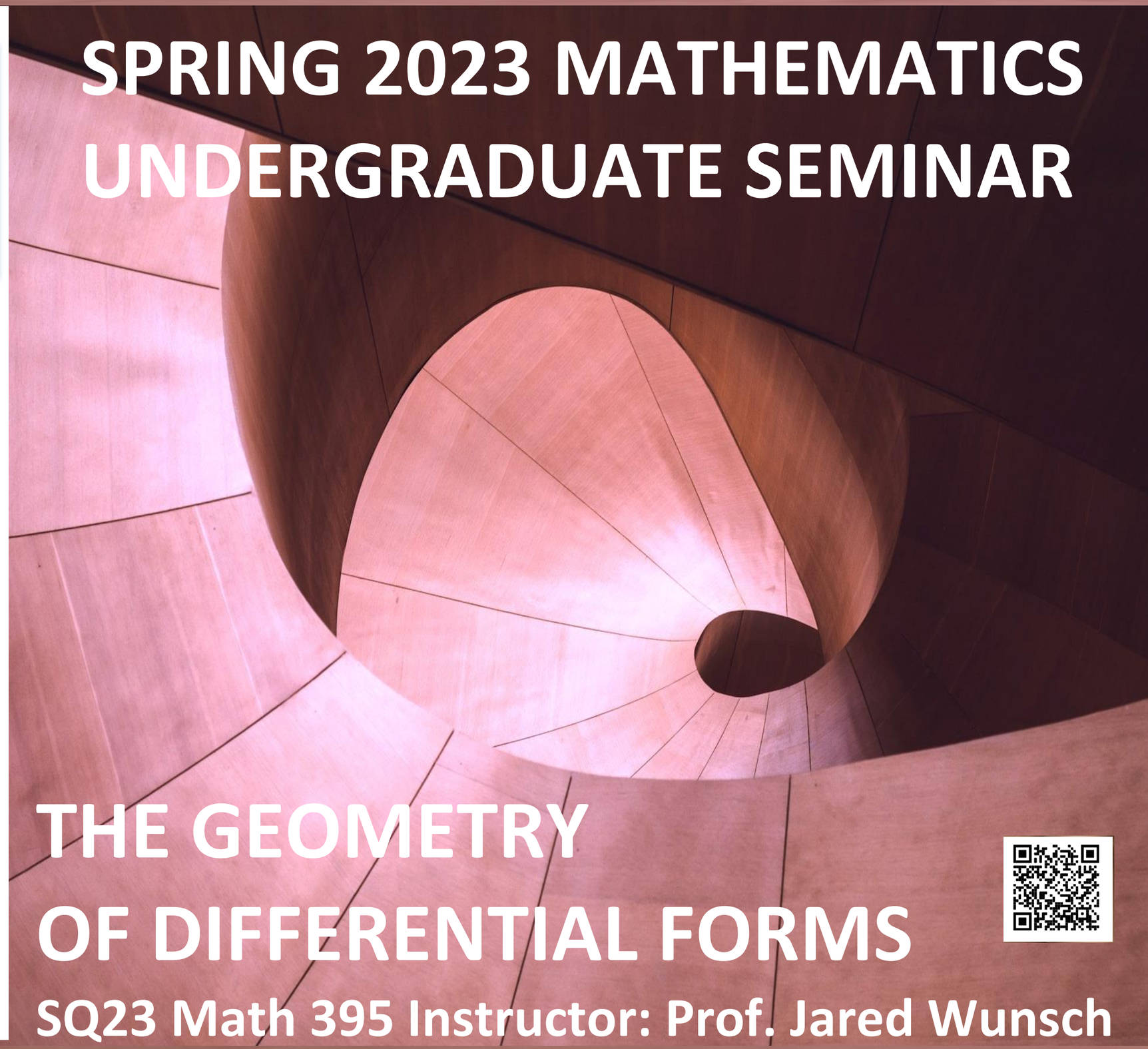
SPRING 2023 MATHEMATICS UNDERGRADUATE SEMINAR



THE GEOMETRY OF DIFFERENTIAL FORMS

SQ23 Math 395 Instructor: Prof. Jared Wunsch

Here are some simple equations:

$$\int_X d\omega = \int_{\partial X} \omega.$$

$$d\omega = 0,\ d\star\omega = j.$$

They don't look like much, but the first one contains all of the content of Green's theorem, the Divergence Theorem, and Stokes' s theorem from multivariable calculus, together with their vast generalization to higher dimensions as described by Élie Cartan in 1945. The pair of equations below it is a modern formulation of Maxwell's equations of electromagnetism, which led Maxwell to realize in 1861 that light is an electromagnetic wave.

These powerful equations are very short! This is because the language of differential forms is so powerful. It is crucial to understanding modern geometry, topology, and high-energy physics. In this seminar, you'll learn this powerful tool and some of its many beautiful applictions.

Prerequisites:

Math 320-2 (with 320-3 co-requisite) or 321-2, Math 291-1,2,3, or 334-0, or 330-2, or 331-2