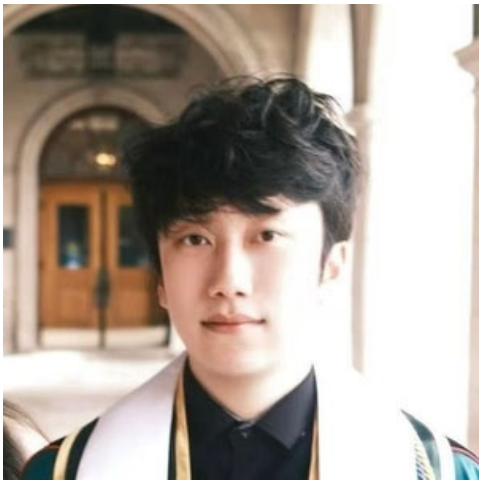
GRADUATE STUDENT GEOMETRY SEMINAR

UNIVERSITY OF NOTRE DAME

Department of Mathematics

Guest Speaker: James Cheng

University of Notre Dame



Lecture Title:

An Introduction to Min-Max Theory

Date: Friday, November 13, 2026

Time: 4:00 PM

Location: 258 Hurley Hall

Abstract:

Min–max theory uses topologically nontrivial families to construct critical points of geometric variational problems. In this talk, we begin with Birkhoff's construction of closed geodesics on a Riemannian two-sphere, introducing sweepouts, width, and curve-shortening process. We then revisit the argument through the mountain-pass picture and explore its extension to minimal surfaces in Riemannian three-spheres. Following the Simon–Smith framework as presented by Colding and De Lellis, we explain the roles of pull-tight, almost minimizing sequences, and replacements, which allow us to pass from a weak limit to a smooth embedded minimal surface. We conclude with remarks on genus bounds for the limiting surface.