Bay Area Differential Geometry Seminar
Saturday, 5 February, 2011, 11 AM – 4:30 PM

San Francisco State University

click here for an interactive map

Thornton Hall, Room 211

click here for driving and walking directions

Click here now to reserve a free parking permit and lunch

Please click on each talk's title to see the abstract

11 AM – noon: Dr. Jose Espinar, Visiting Scholar, Stanford University.

Finite index operators on surfaces

12:15 – 1:30 PM: Lunch at the seminar site.

1:30 – 1:55 PM: Business meeting.

2 – 3 PM: Dr. Jaigyoung Choe, Visiting Professor, Stanford University.

First eigenvalue of the Laplacian on minimal surfaces in the 3-sphere

3 – 3:30 PM: Refreshments.

3:30 – 4:30 PM: Dr. Simon Brendle, Professor, Stanford University.

On Min-Oo's conjecture

Welcome to SFSU-Math (415.338.2251)

Directions to San Francisco State University: 1600 Holloway Avenue, San Francisco, CA 94132

By Car:

From the North: Take Highway 101 South, cross the Golden Gate Bridge. Stay in the far right lane after crossing to take the Highway 1 South/19th avenue exit. Follow 19th Avenue to campus, which is at Holloway Avenue.

To get to the parking garage, turn right onto Holloway Ave and continue to Font Blvd. Turn right onto Font Blvd. and continue to Lake Merced Blvd. Turn right onto Lake Merced Blvd. then take an **immediate** right onto State Drive which leads to the entrance of the parking garage. The bottom of this page has directions from the parking garage to the seminar room TH 211.

From the South: Take I-280 North, exit at 19th Avenue. Take Junipero Serra Boulevard to Holloway Avenue, turn left on Holloway Avenue to campus at 19th Avenue. (If you missed Junipero and stayed on 19th Ave, you would have to U-turn at Stonestown Mall.)

To get to the parking garage, continue on Holloway Ave to Font Blvd. Turn right onto Font Blvd. and continue to Lake Merced Blvd. Turn right onto Lake Merced Blvd. then take an **immediate** right onto State Drive which leads to the entrance of the parking garage. The bottom of this page has directions from the parking garage to the seminar room TH 211.

From the East: Take I-80 West across the Bay Bridge to Highway 101 South. Take 101 South to I-280 toward Daly City. Take the San Jose Avenue/Mission St. exit (immediately after the Ocean Avenue exit), bearing right onto Sagamore Street to Brotherhood Way.

To get directly to the parking garage stay on Brotherhood Way and turn right onto Lake Merced Blvd. Turn right onto State Drive which is the third light after turning onto Lake Merced Blvd. and **immediately** after Font Blvd. The entrance to the parking garage is at the end of State Drive. The bottom of this page has directions from the parking garage to the seminar room TH 211.

By BART (within the Bay Area or from SF International Airport and Oakland Airport)

Take any San Francisco-bound BART train to the Daly City BART station.

> From the BART station, there will be multiple taxi cabs available. Be advised that the cab companies will only accept cash payment, the estimated fare to campus is approximately $7-8. **OR**
>
> Obtain a transfer for the **28 Muni** (good for one ride to & from BART) from the machine (press green button) in the lobby before exiting the station. Exit at the "SFSU 19th Ave. & Holloway Ave." stop. Head north on 19th Ave. past HSS building, and Science Building. You will see Hensill Hall, turn left onto the building, you will see Thornton Hall (TH) ahead.

Please use Google maps to search for directions to campus from your desired starting point (hotel, airport etc.)

Directions from the parking garage to the seminar room:

For those who need it, we've provided **a** permit for your use at Lot 19 parking garage on campus; be sure to scratch off the correct date. To get to Thornton Hall (TH) you will need to take the elevator to the fifth floor of the garage. Exit to the left from the elevator. From there you will make another left to cross the nearby bridge that connects the garage with campus. After crossing the bridge, make another left and follow the road **uphill** (keeping right at the fork), **all the time staying in the "left-lane"**. You will walk for a few hundred yards, passing the athletic field/track which will be to your left, until you reach Thornton Hall, a gray building at the very end of the road. Turn right. Walk just a few more yards and turn left into the garage-looking entrance for Thornton Hall. Enter the first door on your left. You will be on the second floor. The seminar room TH 211 is near the far end and on the left of the long corridor in which you are standing.

**Taxi cabs are also available within San Francisco. You may reserve in advance with Yellow Cab (415) 333-3333 or Luxor Cab (415) 282-4141. If staying in Daly City, please use Serra Yellow Cab (650) 991-2345.*

Finite index operators on surfaces

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Abstract

We consider operators L acting on functions on a Riemannian surface, Σ, of the form

$$L = \Delta + V - aK,$$

where Δ is the Laplacian of Σ, K the Gaussian curvature, a is a positive constant and $V \in C^\infty(\Sigma)$. Such operators L arise as the stability operator of Σ immersed in a Riemannian $3-$manifold with constant mean curvature (for particular choices of V and a).

We assume L is non positive acting on functions compactly supported on Σ. If the potential, $V := c+P$ with c a nonnegative constant, verifies either a integrability condition, i.e. $P \in L^1(\Sigma)$ and P is non positive, or a decay condition, i.e. $|P(p)|s^2 \leq M$ for all $p \in D(p_0, s)$, we control the topology and conformal type of Σ. Moreover, we establish a *Distance Lemma*.

We apply such results to complete oriented stable $H-$surface immersed in a Killing submersion. In particular, for stable $H-$surfaces in a simply-connected homogeneous space with $4-$dimensional isometry group, we obtain:

- There are no complete, oriented, stable $H-$surfaces, $H > 1/2$, so that either $K_e^+ := \max\{0, K_e\} \in L^1(\Sigma)$ or $|K_e(p)|s^2 \leq M$ for all $p \in D(p_0, s)$ and $s > 0$, here K_e denotes the extrinsic curvature and M is a constant.
- Let $\Sigma \subset \mathbb{E}(\kappa, \tau)$, $\tau \neq 0$, be an oriented complete stable $H-$surface, $4H^2 + \kappa \geq 0$, so that either $\nu^2 \in L^1(\Sigma)$, or there exist a point $p_0 \in \Sigma$ and a constant M so that $|\nu(p)|^2 s^2 \leq M$ for all $p \in D(p_0, s)$ and $s > 0$. Then:
  - In $\mathbb{S}^3_{Berger}$, there are no such a stable $H-$surface.
  - In Nil_3, $H = 0$ and Σ is either a vertical plane (i.e. a vertical cylinder over a straight line in $\mathbb{R}^2$) or an entire vertical graph.
  - In $\widetilde{\mathrm{PSL}(2, \mathbb{R})}$, $H = \sqrt{-\kappa}/2$ and Σ is either a vertical horocylinder (i.e. a vertical cylinder over a horocycle in $\mathbb{H}^2(\kappa)$) or a complete multigraph.

Title: First eigenvalue of the Laplacian on minimal surfaces in $\mathbb{S}^3$

Abstract: Yau conjectured that the first eigenvalue of the Laplacian on compact embedded minimal surfaces in $\mathbb{S}^3$ should be equal to 2. We prove that Yau's conjecture is true for all minimal surfaces that are known to exist so far: the minimal surfaces constructed by Lawson, by Karcher-Pinkall-Sterling, and by Kapouleas-Yang. (Joint work with M. Soret)

ON MIN-OO'S CONJECTURE

SIMON BRENDLE

ABSTRACT. Consider a Riemannian metric on the hemisphere S^n_+ which has scalar curvature at least $n(n-1)$ and agrees with the standard metric in a neighborhood of the boundary. It was conjectured by Min-Oo that any metric with these properties must be isometric to the standard metric on the hemisphere. This conjecture is inspired by the positive mass theorem in general relativity, and has been verified in many special cases.

In this talk, I will discuss the background of Min-Oo's conjecture, and give a survey of various rigidity results involving scalar curvature. I will then describe joint work with F.C. Marques and A. Neves, which gives a complete answer to Min-Oo's Conjecture in dimension $n \geq 3$.

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Key words and phrases.