2017 SGS program
February 26, 2017 (Sunday)
Skiles 006, School of Mathematics, Georgia Tech

8:30 **Refreshments** - Skiles Atrium and 008

9:25 **Announcements** - Skiles 006

Morning Session - Skiles 006

9:30 **Yuanzhen Shao**, Purdue University
Degenerate and singular elliptic operators on manifolds with singularities

Abstract: In this talk, we will introduce the concept of manifolds with singularities and study a class of elliptic differential operators that exhibit degenerate or singular behavior near the singularities. Based on this theory, we investigate several linear and nonlinear parabolic equations arising from geometric analysis and PDE. Emphasis will be given to geometric flows with "bad" initial metrics.

10:30 **Sungho Park**, Hankuk University of Foreign Studies and Georgia Tech
Circle-foliated minimal and CMC surfaces in $\mathbb{S}^3$

Abstract: We classify circle-foliated minimal surfaces and surfaces of constant mean curvature in $\mathbb{S}^3$ (locally). In special, we show that there is only one cmc surface foliated by geodesics for each mean curvature.

11:15 **Mozhgan (Nora) Entekhabi**, Wichita State University
Radial Limits of Bounded Nonparametric Prescribed Mean Curvature Surfaces

Abstract: Consider a bounded solution f of the prescribed mean curvature equa- tion over a bounded domain $\Omega \subset \mathbb{R}^2$ which has a corner at $(0,0)$ of size 2α and assume the mean curvature of the graph of f is bounded. If the corner is nonconvex/reentrant (i.e. $\alpha \in (\pi/2, \pi)$), then the radial limits

$$Rf(\theta) := \lim_{r \searrow 0} f(r\cos\theta, r\sin\theta)$$

exist for all interior directions (e.g. $\theta \in (\alpha, \alpha)$ if $\theta = \pm\alpha$ are tangent rays to $\partial\Omega$ at $(0,0)$), no matter how wild is the trace of f on $\partial\Omega$. If the corner is convex/protruding (i.e. $\alpha \in (0, \pi/2]$) and some extra conditions are satised, then the radial limits at $(0,0)$ from interior directions continue to exist. This generalizes, for example, known results about radial limits of capillary surfaces

12:00 **Lunch**

Afternoon Session - Skiles 006

2:00 **Vladimir Oliker**, Emory University
Freeform lenses, Jacobian equations, and supporting quadric method (SQM)

Abstract: Design of freeform refractive lenses is known to be a difficult inverse problem. But solutions, if available, can be very useful, especially in devices required to redirect and reshape the radiance of the source into an output irradiance redistributed over a given target according to a prescribed pattern. In this talk I present the results of theoretical and numerical analysis of refractive lenses designed with the Supporting Quadric Method. It is shown that such freeform lenses have a particular simple geometry and qualitatively their diffractive properties are comparable with rotationally symmetric lenses designed with classical methods.

3:00 **Miyuki Koiso**, Kyushu University
Stability and bifurcation for surfaces with constant mean curvature

Abstract: A surface with constant mean curvature (CMC surface) is an equilibrium surface of the area functional among surfaces which enclose the same volume (and satisfy given boundary conditions). A CMC surface is said to be stable if the second variation of the area is non-negative for all volume-preserving variations. In this talk we give criteria for stability of CMC surfaces in the three-dimensional euclidean space. We also give a sufficient condition for the existence of smooth bifurcation branches of fixed boundary CMC surfaces, and we discuss stability/ instability issues for the surfaces in bifurcating branches. By applying our theory, we determine the stability/instability of some explicit examples of CMC surfaces.

4:00 **Ray Treinen**, Texas State University
Unexpected non-uniqueness of equilibria for the 2D floating ball

Abstract: We consider a ball of density ρ floating on a liquid of density ρ_ℓ that partially fills a bounded container. We will consider the lower dimensional problem where $0 < \rho < \rho_\ell$, and we use a phase plane analysis to show existence of equilibria. This framework also gives us an approach to studying the uniqueness of the equilibria, and surprisingly there are examples of physical parameters that lead to non-uniqueness.