LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN

MATHEMATISCHES INSTITUT
PROF. THOMAS ØSTERGAARD SØRENSEN, PHD
VORLESUNGSANKÜNDIGUNG

SoSe16

Vorlesung (2 SWS ohne Übungen):

Semi-linear Elliptic PDEs 2

Time and place: *Tuesday 16:15-18:00 in B 040.*

First meeting: *Tuesday April 12th 2016, 16:15 in B 040.*

Synopsis: This course is a continuation of my lecture *Semi-linear Elliptic PDEs* in the past semester. It continues the study of *existence* of weak solutions of semi-linear elliptic *P*artial *D*ifferential *E*quations (PDEs).

Examples of semi-linear elliptic PDEs are abundant, in particular from Physics, Geometry, and Biology. They in particular describe solitary (or, stationary) waves for nonlinear time-dependent equations from Physics, such as the Klein-Gordon equation and the nonlinear Schrödinger equation (sometimes called 'nonlinear scalar field equations' in these cases). They also appear as stationary states for nonlinear heat equations, or in nonlinear diffusion in population genetics. On the other hand, such equations often appear in problems in Differential Geometry, such as the Yamabe Problem. There are also connections with constant mean curvature and minimal surfaces, as well as to stationary solutions for various geometric flows.

In this course we will continue the study of various *techniques* to prove existence of weak solutions to such equations.

Topics to (possibly) be discussed: Variational methods (Minimization techniques: constrained minimization (on spheres and Nehari manifolds), lack of compactness; Minimax methods: Saddle Point Theorem).
Non-variational methods (Fixpoint theory, Monotone operators).

Audience: Master students of Mathematics (WP 17.2, 18.1, 18.2, 44.3, 45.2, 45.3) and Physics, TMP-Master.

Prerequisites: Knowledge of Sobolev spaces (also on domains) and the theory of weak solutions of *linear* elliptic PDEs, as normally presented in (some version of) PDE2. The course will start with a (quick!) review of the material covered last semester. Students who wish to follow this course, but did *not* follow the course last semester, should (in due time!) contact me via email to discuss the prerequisites needed.

Language: The lecture will be in English.

Literature: Badiale & Serra, *Semilinear Elliptic Equations for Beginners*, Springer *(2011)* (and further literature).

Further information : http://www.math.lmu.de/~sorensen

Prof. Thomas Østergaard Sørensen, Ph.D.