LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MATHEMATISCHES INSTITUT
PROF. THOMAS ØSTERGAARD SØRENSEN, PHD

VORLESUNGSANKÜNDIGUNG

WiSe15/16

Vorlesung (2 SWS ohne Übungen):

Semi-linear Elliptic PDEs

Time and place: ***Wednesday 16:15-18:00 in B 045.***

First meeting: ***Wednesday October 14th 2015, 16:15 in B 045.***

Synopsis: This course studies *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 study various *techniques* to prove existence of weak solutions to such equations in *bounded* domains.

Topics to be discussed: Nonlinear functional analysis; Critical points; Variational methods (Minimization techniques: compact problems, constrained minimization, lack of compactness; Minimax methods: Palais-Smale sequences, Mountain Pass Theorem, Saddle Point Theorem).

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 (on domains) and the theory of weak solutions of *linear* elliptic PDEs, as normally presented in (some version of) PDE2 will be an advantage. The course will start with a (quick!) review of this material. Students who wish to follow this course, but did *not* yet follow a course on this material, 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).*

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

Prof. Thomas Østergaard Sørensen, Ph.D.