

Lunedì 19 dicembre, dalle ore 11.00 (in punto) presso la **Sala Riunioni** di questo Dipartimento, si svolgerà *Workshop on*

VARIATIONAL TECHNIQUES FOR NONLINEAR ELLIPTIC PROBLEMS

Motivation. Nonlinear differential equations are commonly used in formulating most of the fundamental laws of nature as well as many technological problems, among others. It has become increasingly more evident that the nonlinear analysis is of crucial importance in mathematical sciences and its ideas and methods have turned out to be essential tools in the analysis of nonlinear phenomena in many areas of mathematics.

Il Workshop seguirà il seguente programma:

– dalle 11.00 alle 11.45 la chiarissima

Professoressa Francesca COLASUONNO,

del *Dipartimento di Matematica dell'Università di Bologna*, terrà una conferenza su:

Symmetry breaking for radial problems with lack of compactness

ABSTRACT. In this talk, we present an existence result for the Dirichlet problem associated to the elliptic equation $-\Delta u + u = a(x)|u|^{p-2}u$, set in an annulus or an exterior domain of \mathbb{R}^N . Here $p > 2$ is allowed to be supercritical in the sense of Sobolev embeddings, and $a(x)$ is a positive weight with additional symmetry and monotonicity properties, which are shared by the solution that we construct. For this problem, we find a new type of positive, axially symmetric solutions. Moreover, in the case where the weight a is constant, we detect a condition, depending only on the exponent p and on the inner radius of the annulus, that ensures that the solution is nonradial. In this setting, the major difficulty to overcome is the lack of compactness in a nonradial framework, in a possibly unbounded domain. The proofs rely on a combination of variational methods and dynamical system techniques. This is joint work with Alberto Boscaggin (*Università di Torino*), Benedetta Noris (*Politecnico di Milano*), and Tobias Weth (*Goethe-Universität Frankfurt*).

– dalle 12.00 alle 12.45 il chiarissimo

Professor Alberto MAIONE,

del *Department for Applied Mathematics dell'Albert-Ludwigs-University Freiburg*, Germania, terrà una conferenza su:

Variational methods for a class of mixed local–nonlocal operators

ABSTRACT. Problems driven by operators of mixed local and nonlocal type have raised a certain interest in the last few years, for example in connection with the study of optimal animal foraging strategies. From a pure mathematical point of view, the superposition of local and nonlocal operators, such as the Laplacian and the Fractional Laplacian, generates a lack of scale invariance that can lead to unexpected complications. Our goal is to prove the existence of solutions of semilinear elliptic problems governed by these operators and dependent on a real parameter: when the parameter is sufficiently large, our existence results are known or applications of standard variational methods, but when the real parameter is too small, the situation suddenly becomes more delicate, especially since the operator is no longer positive-definite, the naturally associated bilinear form does not induce a scalar product nor a norm, the variational spectrum may have negative eigenvalues, and even the maximum principle may fail. In this talk, I show how to overcome these difficulties and obtain the expected existence results. This research is done in collaboration with Dimitri Mugnai (*Tuscia University of Viterbo*) and Eugenio Vecchi (*University of Bologna*).

Scopo della giornata di studio è quello di illustrare alcuni recenti risultati nell'ambito dell'Analisi Nonlineare con particolare riferimento a problemi nonlineari e non locali.

L'evento è rivolto a studenti magistrali, dottorandi e Postdoc, nonché a ricercatori interessati al settore. Il workshop di un giorno è su temi inerenti ai progetti scientifici di Ateneo di P. Pucci e a collaborazioni scientifiche in atto con i professori invitati.

Sarà particolarmente gradita la presenza della SV.

Patrizia Pucci