

# TEMPLE UNIVERSITY

Department of Mathematics

## Analysis Seminar

Room 617 Wachman Hall

Monday April 6, 2020, 2:40 p.m.

### *On $p$ -ellipticity and connections to solvability of elliptic complex valued PDEs*

by Martin Dindos

University of Edinburgh

**Abstract:** The notion of an elliptic partial differential equation (PDE) goes back at least to 1908, when it appeared in a paper J. Hadamard.

The essence of ellipticity is described by L. Evans in his classic textbook as follows: “The following calculations are often technically difficult but eventually yield extremely powerful and useful assertions concerning the smoothness of weak solutions. As always, the heart of each computation is the invocation of ellipticity: the point is to derive analytic estimates from the structural, algebraic assumption of ellipticity.”

In this talk we present a recently discovered structural condition, called  $p$ -ellipticity, which generalizes classical ellipticity and plays a fundamental role in many seemingly mutually unrelated aspects of the  $L^p$  theory of elliptic complex valued PDE. So far,  $p$ -ellipticity has proven to be the key condition for:

- (i) convexity of power functions (Bellman functions)
- (ii) dimension-free bilinear embeddings,
- (iii)  $L^p$ -contractivity and boundedness of semigroups  $(P_t^A)_{t>0}$  associated with elliptic operators,
- (iv) holomorphic functional calculus,
- (v) multilinear analysis,
- (vi) regularity theory of elliptic PDE with complex coefficients.

During the talk I will describe my contribution to this development in particularly to (vi). It is of note that the  $p$ -ellipticity was co-discovered independently by Carbonaro and Dragicevic on one side (from the perspective of (i) and (ii)), and Pipher and myself on the other.