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

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The notion of an elliptic partial differential equation (PDE) goes back at least to 1908, when it appeared in a paper by J. Hadamard. In this talk we present a recently discovered structural condition, called $p$-ellipticity, which generalizes classical ellipticity. It was co-discovered independently by Carbonaro and Dragicevic on one hand, and Pipher and myself on the other, 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 particular to (vi).