复旦大学数学科学学院
数学综合报告会

报告题目：Removable singularities for Lipschitz harmonic functions, Geometric Measure Theory, and fine structure of the harmonic measure

报告人：Professor Alexander Volberg (Michigan State University)

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报告摘要：

What are the removable singularities of harmonic functions with bounded gradient? This problem, that takes its origins in certain problems of complex analysis, which are 140 years old was solved recently. It is a free boundary problem and its solution (which we will explain) is based on extension to a new territory of classical theory of singular integrals. Singular integrals are ubiquitous objects. The simplest ones are called Calderon–Zygmund operators. Their theory was completed in the 50's by Zygmund and Calderon. Or it seemed like that. The last 20 years saw the need to consider CZ operators in very bad environment, so kernels are still very good, but the ambient set/measure has no regularity whatsoever. Initially, such situations appeared from the wish to solve some outstanding problems in complex analysis: such as problems of Painlev\'e, Ahlfors', Denjoy's, and Vitushkin's. The analysis of CZ operators on very bad sets is also very fruitful in the part of Geometric Measure Theory that deals with removability mentioned above and rectifiability. It can be viewed as the study of very low regularity free boundary problems. We will explain the genesis of ideas that led to several long and difficult proves that culminated in our solution to problems of Denjoy, Vitushkin and Guy David, and also brought the solution by Tolsa of Painlev\'e's problem.

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