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The search for singularities of the solutions to the Dirichlet problem : recent developments

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The solution of the classical Dirichlet problem for Laplace operator in an ellipsoid, when the boundary data is a polynomial, is itself a polynomial. Moreover, D. Khavinson and H. Shapiro showed in 1992 that if the data is an entire function of real variables, the solution will be an entire harmonic function. They conjectured that ellipsoids are the only domains satisfying this property. In this talk we shall discuss the recent progress in proving this conjecture. In particular, we shall outline the recent results of H. Render, S. Bell, P. Ebenfelt, D. Khavinson, E. Lundberg and H. Shapiro regarding global continuation of solutions of the Dirichlet problem with polynomial or rational data. In particular, we shall discuss a method of complex lightning bolts that frequently allows to predict location of singularities of all solutions of the Dirichlet problem with a polynomial, or rational data.