1099-35-300   **Svitlana Mayboroda*** (`svitlana@umn.edu`), University of Minnesota, School of Mathematics, 206 Church st SE, Minneapolis, MN 55455, and **Steve Hofmann**, **Carlos Kenig** and **Jill Pipher**. *Rellich identity and elliptic boundary problems.*

One of the simplest and the most important results in elliptic theory is the maximum principle. It provides sharp estimates for the solutions to elliptic PDEs in L^∞. It holds on arbitrary domains for all (real) divergence form elliptic operators. The well-posedness of boundary problems in L^p, $p < \infty$, is a far more intricate and challenging question, and without additional assumptions on the operator L^p bounds can fail for any finite p.

As it turns out, the matters come down to the fundamental Rellich inequalities. The Rellich identity ascertains that the tangential and normal traces of a harmonic function have equal L^2 norms. For the Laplacian and for more general symmetric elliptic operators Rellich identity is a result of a short and elegant integration by parts argument. However, already for very special complex matrices of a block form Rellich is equivalent to the celebrated profound Kato square root problem of the operator theory. I will discuss the recent (one-sided) Rellich estimates for real non-symmetric operators, the novel analysis techniques leading to them, perplexing counterexamples, as well as challenging open problems in the theory. (Received February 10, 2014)