Stability for Faber-Krahn inequalities and the ACF formula

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The Faber-Krahn inequality states that the first Dirichlet eigenvalue of the Laplacian on a domain is greater than or equal to that of a ball of the same volume (and if equality holds, then the domain is a translate of a ball). Similar inequalities are available on other manifolds where balls minimize perimeter over sets of a given volume. I will present a new sharp stability theorem for such inequalities: if the eigenvalue of a set is close to a ball, then the first eigenfunction of that set must be close to the first eigenfunction of a ball, with the closeness quantified in an optimal way. I will also explain an application of this to the behavior of the Alt-Caffarelli-Friedman monotonicity formula, which has implications for free boundary problems with multiple phases. This is based on joint work with Mark Allen and Robin Neumayer.