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E. Mukhin, V. Tarasov* (vt@math.iupui.edu) and **A. Varchenko**. *The B. and M. Shapiro conjecture and the Bethe ansatz.*

The B. and M. Shapiro conjecture in real algebraic geometry says that if the Wronskian of a set of polynomials with complex coefficients has real roots only, then the complex span of this set of polynomials has a basis that consists of polynomials with real coefficients. We have proved this conjecture using the algebraic Bethe ansatz method for the Gaudin model associated with the general linear Lie algebra. We have related the problem of describing the span of polynomials with given Wronskian to computing the eigenvalue problem for certain matrices, and the key observation for the proof of the B. and M. Shapiro conjecture is that eigenvalues of a real symmetric matrix are real. (Received February 13, 2006)