



The Shape of the Noncentral Chi-square Density

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A noncentral chi-square density is log-concave if the degree of freedom is $\nu \geq 2$. We complement this known result by showing that, for each $0 < \nu < 2$, there exists $\lambda_{\nu} > 0$ such that the chi-square with ν degrees of freedom and noncentrality parameter λ has a decreasing density if $\lambda \leq \lambda_{\nu}$, and is bi-modal otherwise. The critical λ_{ν} is characterized by an equation involving a ratio of modified Bessel functions. When an interior mode exists we derive precise bounds on its location.

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