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Non-exponential time-correlation function for random physical processes T.R.S. PRASANNA, Dept. of Met. Engg and Matls. Sci, IIT Bombay — Dielectric relaxation in gases is reconsidered phenoemenologically and it is shown that the dipole moment correlation function must have an inflection point at the mean collision time. The exponential function, used in the Debye and Van Vleck-Weisskopf models, does not possess an inflection point at finite times and must be rejected. New models that correctly represent the effects of collisions are necessary. A new time-correlation function is proposed that differs little numerically from the exponential function, exhibits an inflection point, is analytic at t = 0 and its power spectrum has finite moments to all orders. Problems related to divergence vanish. A new lineshape function is obtained that is indistinguishable from the Lorentzian lineshape. The new correlation function implies that the process is non-Markovian, which is theoretically consistent for all processes where the derivatives have physical meaning, including those described in terms of linear response theory. In addition, its mathematical superiority implies that it is advantageous to use this function over the exponential function for all such processes.

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