

Abstract Submitted
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Derivation of the Direct-Interaction Approximation Using Novikov's Theorem¹ J.A. KROMMES, Princeton University — The direct-interaction approximation (DIA)² is a crucially important statistical closure for both neutral fluids and plasmas. Kraichnan's original derivation proceeded in k space and assumed a large number N of interacting Fourier modes. That is problematic; the DIA can be formulated even for $N = 3$. In the present work an alternate x -space procedure based on Novikov's theorem is described. That theorem is a statement about the correlations of certain Gaussian functionals. Turbulence cannot be Gaussian due to nonlinearity, but Novikov's theorem can be used to formulate self-consistent equations for a Gaussian component of the turbulence. The DIA emerges under the assumption that certain higher-order correlations are small. In essence, this procedure is merely a restatement of Kraichnan's arguments, but it adds additional perspective because the assumption of large N is not required. Details can be found in a lengthy set of tutorial Lecture Notes.³

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²R. H. Kraichnan, *J. Fluid Mech.* **5**, 497 (1959).

³J. A. Krommes, A tutorial introduction to the statistical theory of turbulent plasmas, a half-century after Kadomtsev's *Plasma Turbulence* and the resonance-broadening theory of Dupree and Weinstock, *J. Plasma Phys.*, in press.

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