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Analytic Beyond-Mean-Field BEC Density Profiles at Next-Order in Dimensional Perturbation Theory[1] MARTIN DUNN, W. BLAKE LAING, DEBORAH WATSON, University of Oklahoma — The density profile of a BEC offers an experimentally accessible window into beyond-mean-field effects in a macroscopic quantum object. These effects include a greater spatial extent resulting from hard collisions within the system as well as fermionization and crystallization in quasi-one and two dimensional systems. Even at lowest order, dimensional perturbation theory (DPT) yields wave functions of large-N systems which include correlation effects, and which have previously been used to derive the lowest-order density profile. DPT has now been extended beyond the lowest order to the next-order wave function. In this work we show how to derive the next-order density profile (a function of one degree of freedom) from this next-order DPT wave function (a function of a very considerable number of degrees of freedom). The functional form of the higher-order density profile includes the possibility of fermionization/crystallization.

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