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Conserving Gapless Mean-Field Theroy for Bose-Einstein Condensates TAKAFUMI KITA, Division of Physics, Hokkaido University — A new conserving gapless mean-field theory for Bose-Einstein condensates is constructed based on a Luttinger-Ward thermodynamic functional. It is applied to a weakly interacting uniform gas with the density n and the s-wave scattering length a to clarify its basic thermodynamic properties. It is found that the condensation here occurs as a first-order transition. The shift of the transition temperature from the ideal-gas result T_0 is positive and given to the leading order by $\Delta T_c = 2.33 a n^{1/3} T_0$, in agreement with a couple of preceding estimates. The theory is expected to form a new theoretical basis for the trapped Bose-Einstein condensates at finite temperatures.

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