

Past research activity...

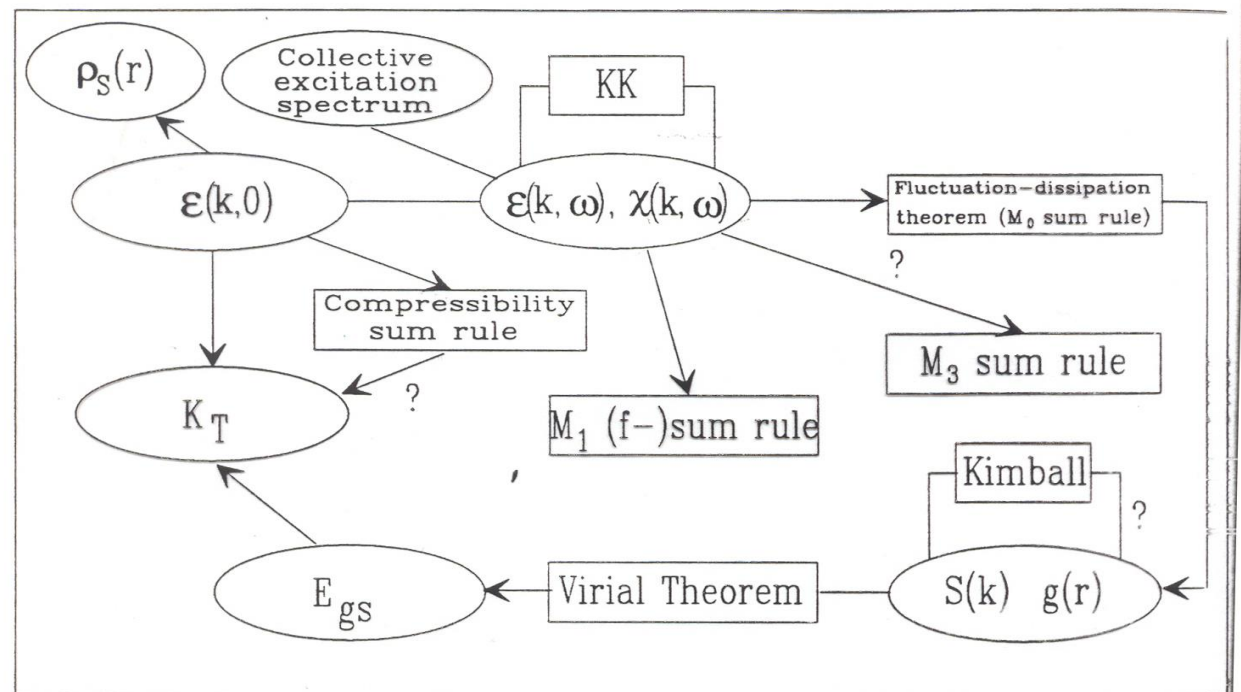
Screening, Structure, and Excitations in Charged Bose Fluids

[Mod.Phys.Lett.B94,JPCM94, JPCM95, JPCM96]

Within Tosi's group@SNS

➤ The ground state and the structure of Charged Bose Fluids may be relevant as a model system for HTcSC, neutron stars physics, and to disentangle the effects of statistics in the better known analogous Fermi (electron) systems

➤ Approach: use of static local-field theories for the dielectric function together with sum rules



➤ **Response function**

$$\chi(k, \omega) = \frac{\chi_0(k, \omega)}{1 - v_k [1 - G(k, \omega) \chi_0(k, \omega)]}$$

with approximations e.g.

$$G(k, \omega); \quad G_{STLS}(k, \omega) = -\frac{1}{N} \sum_{k'} \frac{v_k v_{k'}}{k'^2} [S(|k - k'|) - 1]$$

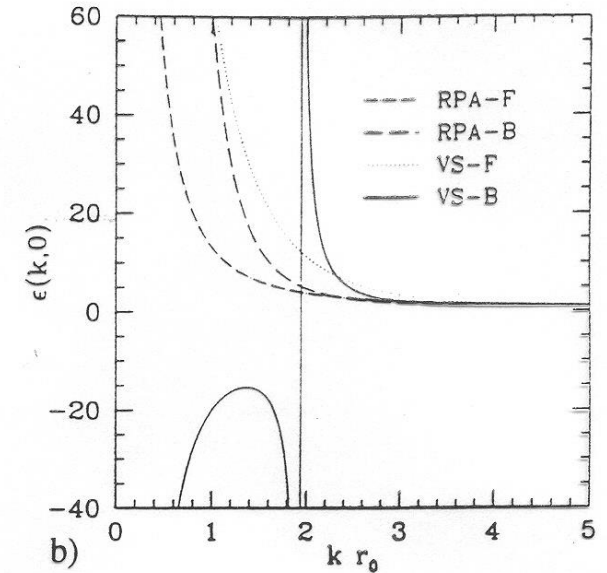
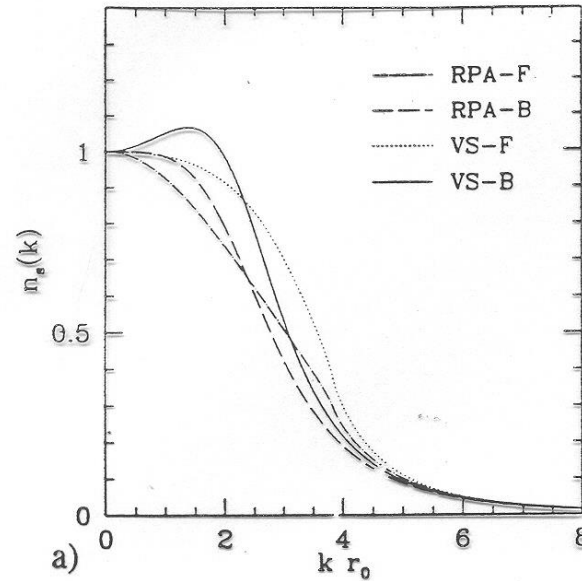
and subsequent improvements (VS satisfying compressibility sum-rule, PV satisfying 3-rd moment)

➤ **Correlation energy**

In comparison with QMC data, STLS, and VS and PV are accurate in predicting the gs-energy, VS more suitable at large r_s . No appreciable differences between gs-energy of bosons and exch+correlation energy of fermions above r_s about 20. STLS only satisfies Kimball-Niklasson's relation at $r=0$. Only VS accounts for the static dielectric function

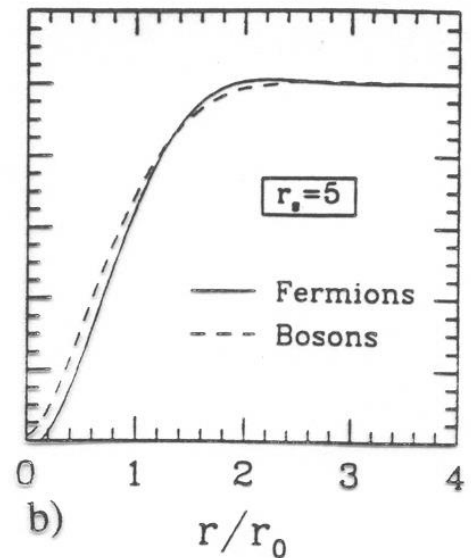
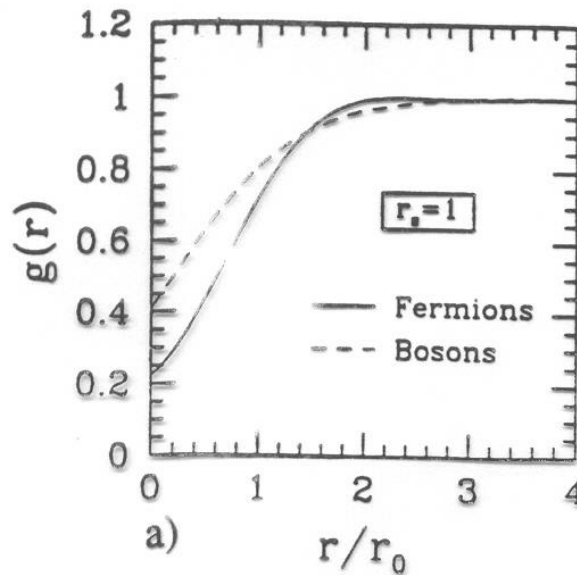
➤ Screening

Bosons tend to overscreen (negative dielectric function) due to local piling up



➤ Structure

Differences between bosons and fermions at short distance and low coupling due to statistics



➤ **Excitations**

Bosons have negative dispersion at $k \rightarrow 0$ at all r_s values ($E_{\text{kin}}=0$ and strong correlations, see also negative dielectric function). Plasmon exhausts the density-density sum rule

