

# Department of Theoretical Physics

## Free Meson Seminar

<i>Speaker</i>	:	Jean-Paul Blaizot (ECT-Trento, Italy)
<i>Topic</i>	:	The transition temperature of the weakly interacting Bose gas
<i>Day, Date &amp; Time</i>	:	Thursday, November 22, 2007 at 2:30 p.m.
<i>Place</i>	:	AG 69

### *Abstract*

The calculation of the effect of weak repulsive interactions on the transition temperature  $T_c$  of a Bose gas is often considered as a classical textbook problem. However, its solution was not well understood until fairly recently, as illustrated by a large collection of contradictory results in the literature. This is because the calculation of  $T_c$  remains a nonperturbative problem, however weak the interaction is. In this talk, I shall explain the origin of the non perturbative character of the problem, and show how this problem has been solved using a variety of techniques of quantum field theory that find application in very remote areas, such as the physics of the quark-gluon plasma. These involve in particular effective theories and the functional renormalization group. Effective theories are used first in order to obtain a simple hamiltonian describing the atomic interactions: in terms of a contact potential whose strength is determined by the  $s$ -wave scattering length. Effective theories are used next in order to obtain a simple formula for the shift in  $T_c$ : near  $T_c$  the physics is dominated by low momentum modes whose dynamics is most economically described in terms of classical fields, and the ingredients needed to calculate the shift of  $T_c$  can be obtained from this classical field theory. Finally the renormalization group is used both to obtain a qualitative understanding, and also as a non perturbative tool to evaluate quantitatively the shift in  $T_c$ .

*(Saumen Datta)*