

# Phase Transitions and Critical Phenomena

**ETH**

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

## Exercise Sheet 12

HS 14

V. B. Geshkenbein

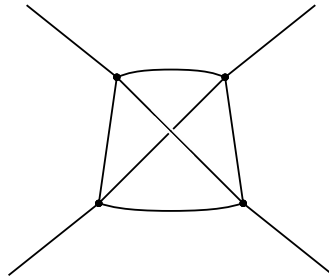
### Problem 1 Summation of the “parquet” diagrams

In the lecture we discussed that the so-called “parquet” diagrams with  $n$  loops give a divergent contribution to the four point correlation function

$$\sim u^{n+1} \log^n \frac{\Lambda}{p} \quad (1)$$

where  $\Lambda$  is a short distance cut-off and  $p$  is a typical value of momentum on the external legs, corresponding to the scale we are interested in. We ignored the other diagrams because they contribute to the four-point correlation function in sub-leading orders.

To see an example, consider the following diagram



and show that its contribution diverges as

$$\sim u^4 \log \frac{\Lambda}{p}. \quad (2)$$

### Problem 2 Gradient term in the Landau theory

Find RG equation for the gradient term in the Landau theory. Show that it is not renormalized. For this look on the contribution to  $\Sigma(\mathbf{k})$  given by the following diagram:

