

**Theorie der Kondensierten Materie I WS 2012/2013**

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**1. Mean-squared radius of a Cooper pair** (75 + 25 = 100 Punkte)

- (a) Calculate the mean-squared radius  $\langle \mathbf{r}^2 \rangle$  of a Cooper pair with total momentum  $\mathbf{K} = 0$ . Here,  $\mathbf{r}$  is the relative coordinate of the two electrons that make up the Cooper pair, and the expectation value is to be computed with the Cooper pair wavefunction. Use the form of the coupling function considered in the lecture.
- (b) Estimate the size of a Cooper pair. Show that it is considerably larger than the lattice spacing.