The expressions for t_i and g_{ij} (eq.(7) in §2) can be obtained from eq.(A4). For example, g_d is given by the coefficients of $|\Delta_d|^2$ in $\Delta F = \Delta F_1 + \Delta F_2$.

The meaning of the J_2-terms is now obvious. Since we got these terms by picking up $|\Delta_p^R|^2$ in G_{11}^R and G_{22}^R (diagonal components of the Green's functions), only one particle is transfered from (L) to (R) (or (R) to (L)) in this process. This means that one of the electrons consisting of a Cooper pair tunnels to the other side, while the other one is reflected when the Cooper is scattered at the interface. Hence the process including t_{kp} (tunneling matrix element) can lead to the suppression (g_d and g_s) and the interference (g_{ds}) of the superconducting order parameters.

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Fig. 1. Schematic phase diagram of the $t-J$ model within a slave-boson mean-field approximation. T_χ, T_{RVB} and T_{BE} are the transition temperature for the bond order, singelt RVB order and the Bose condensation, respectively.

Fig. 2. Interface between $d-$wave superconductors. The lines on both sides indicate the crystalline a-axis (the c-axis points out of the plane).

Fig. 3. Numerical results of the coefficients in F_I for D/D-junction: (a) t_d and (b) g_{ij} $(i,j=d,s)$. Here $\delta = 0.15$, $T = 0.8T_c$, $\tilde{t}^2 = 8.0$ and $\tilde{r}^2 = 0.2$.

Fig. 4 Spatial variation of the order parmeters and their relative phase. Here $\delta = 0.15$, $\tilde{t}^2 = 8.0$ and $\tilde{r}^2 = 0.2$ and $\varphi = \pi/4$.

Fig. 5. Phase diagram of surface states in the plane of T and φ. Here $\delta = 0.15$, $\tilde{t}^2 = 8.0$ and $\tilde{r}^2 = 0.2$. The line is for the D/D (S/D)-junction. (The $\mathcal{T}$-breaking region for D/D-junction is invisible in this scale.)

Fig. 6. Distributions of the surface current J_y (A/cm^2) and the local magnetic field B (G). Here $\delta = 0.15$, $T = 0.8T_c$, $\tilde{t}^2 = 8.0$, $\tilde{r}^2 = 0.2$ and $\varphi = \pi/4$.

Fig.7 Numerical results of the coefficients in F_I for S/D-junction. Here $\delta = 0.15$, $T = 0.8T_c$, $\tilde{t}^2 = 8.0$ and $\tilde{r}^2 = 0.2$.

Fig.8 The relative phases between Δ_d and Δ_s (Δ_0), ϕ_{ds} (ϕ_0) as a function of φ.