where Φ_f and Φ_w are the $\underline{24}$ representation of $SU(5)$ group. The breaking component is

$$\Phi_i = Diagonal\left(1,1,1,-\frac{3}{2},-\frac{3}{2}\right)(\sigma_i+\varphi_i), \tag{12}$$

where the subscript $i=f$, w. From (11) – (12) we obtain

$$V_{fw} = -A\left(2\sigma_f\sigma_w\varphi_f\varphi_w + \sigma_f\varphi_f\varphi_w^2 + \sigma_w\varphi_w\varphi_f^2 + \frac{1}{2}\varphi_f^2\varphi_w^2\right). \tag{13}$$

$|\sigma_w| = |\sigma_f|$ because of the symmetry of $s-matter$ and $f-matter$. Both σ_i and $m(\varphi_i)$ are functions of temperature T. When $T \geq T_{cr}$, $\sigma_i = m(\varphi_i) = 0$. Consequently $f-particles$ and $w-particles$ can easily transform from one to another so that $\rho_F = \rho_W$. When $T \sim 0$, both $|\sigma_i|$ and $m(\varphi_i)$ are large enough. Consequently interaction between $f-particles$ and $w-particles$ by the scalar bosons may be ignored. Thus there is only the gravitation between $f-matter$ and $w-matter$ when temperature is low.

There are the couplings of fermions (and gauge particles) and scalar bosons[7]. Hence there are the interactions of $f-fermions$ and $w-fermions$ shown in figures 1-3 and the interactions of $f-gauge$ bosons and $w-gauge$ bosons via the scalar bosons φ_f and φ_w. In the figures the dotted lines with arrows denote $W-fermion$ field ψ_w, the dotted lines without arrow denote $W-scalar$ field φ_w, the lines with arrows denote $F-fermion$ field ψ_f, the lines without arrow denote $F-scalar$ field φ_f, $M^2=-2A\sigma_f\sigma_w$, $R_f=-A\sigma_f$, $R_w=-A\sigma_w$ and $S=-A/2$.

It can be seen from figure 1 and (13) that when $-A\sigma_f\sigma_w > 0$ and $k^2-m^2<0$ or $-A\sigma_f\sigma_w<0$ and $k^2-m^2>0$, $f-fermions$ and $w-fermions$ are repulsive each other; when $-A\sigma_f\sigma_w>0$ and $k^2-m^2>0$ or $-A\sigma_f\sigma_w<0$ and $k^2-m^2<0$, $f-fermions$ and $w-fermions$ are attractive each other.

V. FEATURES AND OBSERVATION OF DARK MATTER IN PRESENT MODEL

According to the present model[3,4], $v-UFM$ and $v-UWM$ cannot form cluster, loosely distribute in space and have positive gravitational masses, hence both should be identified as cold dark matter. From (10) we have

$$\begin{aligned}\frac{\rho_{vFu}+\rho_{vWu}}{\rho_v} &= \frac{0.095\times 2}{0.27} = \frac{19}{27},\\ \frac{\rho_{vFu}+\rho_{vWu}}{\rho_{vD}} &= \frac{0.095\times 2}{0.23} = \frac{19}{23}.\end{aligned} \tag{14}$$