In the left panels ($t = 0$ s), the level crossing length at $\sin^2 2\theta_{13} = 10^{-2}$ and 10^{-3} are larger than the oscillation length at all region. Therefore, the resonance is adiabatic. On the other hand, in the case of $\sin^2 2\theta_{13} = 10^{-4}$ and 10^{-5}, the level crossing length at the resonance is almost same as or slightly smaller than the oscillation length of $\bar{\nu}_e$. Therefore, the resonance is non-adiabatic. In the right panels ($t = 3$ s) when the shock wave reaches the H-resonance, the level crossing length, δr, is of the same order or smaller than the oscillation length $L_{\rm osc}$ for all cases of the mixing angle, expect for $\sin^2 2\theta_{13} = 10^{-2}$. This satisfies non-adiabatic condition $\gamma < 1$ as discussed above. We understand, therefore, that the resonance becomes non-adiabatic by the effect of the shock wave. In Figure 2, the influence of the shock wave appears about 2 s after core bounce. This result is consistent with our simulation (see Figure 1).

In the case of normal hierarchy, the survival probability of $\bar{\nu}_e$ does not change much because there is no resonance in the $\bar{\nu}$ sector. Therefore, the survival probability of $\bar{\nu}_e$ in normal hierarchy is always ~ 0.7 regardless of the value of $\sin^2 2\theta_{13}$ or independently of the shock wave.

We note that there is L-resonance in ν sector even in the case of inverted hierarchy. However, the value of θ_{12} which is related to L-resonance is very large (see Eq. (3)), and the level crossing length of our simulation is not as small as the oscillation length at the resonance. Therefore, γ at the L-resonance is larger than 1. As a result, the survival probability of ν_e in inverted hierarchy does not change drastically, and stays always ~ 0.3.

B. Supernova neutrino spectrum

We calculate the supernova neutrino spectra using the survival probabilities. Figure 4 shows the spectra of ν_e. Left panels of Figure 4 show the spectra in the case of normal hierarchy, and right panels show the results of inverted hierarchy. Figure 5 is same as Figure 4 but for $\bar{\nu}_e$ spectra. Red solid and blue dotted lines are the spectra with and without shock wave, respectively. In order to clearly observe the shock wave effects, we display these ratio, $\phi_{\rm with}/\phi_{\rm without}$, of the spectra with to without shock in lower part of each panel.

We see clearly the shock wave effects in the ν_e spectra in Figure 4 in normal hierarchy. In the case of $\sin^2 2\theta_{13} = 10^{-3}$ and 10^{-4}, an enhancement in low energy component of the neutrino spectra is seen when the shock wave reaches the H-resonance. At later times, the