

$$[W_p, K_{ij}] = [W_p, H] = 0$$



No Overlap

$$[W_p, K_{ij}] = 0$$


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One site

$$\begin{aligned} [W_p, K_{ij}] &= [\dots \sigma_1^\alpha \sigma_2^\alpha \sigma_2^\beta \sigma_3^\beta \dots, \sigma_2^\gamma] \\ &= [\sigma_2^\alpha \sigma_2^\beta, \sigma_2^\gamma] = 0 \end{aligned}$$


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Two sites

$$\begin{aligned} [W_p, K_{ij}] &= [\dots \sigma_1^\alpha \sigma_2^\alpha \sigma_2^\beta \sigma_3^\beta \sigma_3^\gamma \sigma_4^\gamma \dots, \sigma_2^\beta \sigma_3^\beta] \\ &= [\sigma_2^\gamma \sigma_3^\alpha, \sigma_2^\beta \sigma_3^\beta] = 0 \end{aligned}$$