

Hamiltonian Term Breakdown

1. **000** : 0

2. **100** : $A |r00\rangle \langle 100|$
3. **r00** : $A^* |100\rangle \langle r00| + \Delta |r00\rangle \langle r00|$

4. **001** : $A |00r\rangle \langle 001|$
5. **00r** : $A^* |001\rangle \langle 00r| + \Delta |00r\rangle \langle 00r|$

6. **101** : $A |r01\rangle \langle 101| + A |10r\rangle \langle 101|$
7. **r01** : $A |r0r\rangle \langle r01| + A^* |101\rangle \langle r01| + \Delta |r01\rangle \langle r01|$
8. **10r** : $A |r0r\rangle \langle 10r| + A^* |101\rangle \langle 10r| + \Delta |10r\rangle \langle 10r|$
9. **r0r** : $A^* |r01\rangle \langle r0r| + A^* |10r\rangle \langle r0r| + (2\Delta + V(2d)^{-\alpha}) |r0r\rangle \langle r0r|$

10. **010** : $A |0r0\rangle \langle 010|$
11. **0r0** : $A^* |010\rangle \langle 0r0| + \Delta |0r0\rangle \langle 0r0|$

12. **110** : $A |r10\rangle \langle 110| + A |1r0\rangle \langle 110|$
13. **1r0** : $A |rr0\rangle \langle 1r0| + A^* |110\rangle \langle 1r0| + \Delta |1r0\rangle \langle 1r0|$
14. **r10** : $A |rr0\rangle \langle r10| + A^* |110\rangle \langle r10| + \Delta |r10\rangle \langle r10|$
15. **rr0** : $A^* |1r0\rangle \langle rr0| + A^* |r10\rangle \langle rr0| + (2\Delta + V(d)^{-\alpha}) |rr0\rangle \langle rr0|$

$$16. \mathbf{011} : A |\mathbf{0r1}\rangle \langle \mathbf{011}| + A |\mathbf{01r}\rangle \langle \mathbf{011}|$$

$$17. \mathbf{0r1} : A |\mathbf{0rr}\rangle \langle \mathbf{0r1}| + A^* |\mathbf{011}\rangle \langle \mathbf{0r1}| + \Delta |\mathbf{0r1}\rangle \langle \mathbf{0r1}|$$

$$18. \mathbf{01r} : A |\mathbf{0rr}\rangle \langle \mathbf{01r}| + A^* |\mathbf{011}\rangle \langle \mathbf{01r}| + \Delta |\mathbf{01r}\rangle \langle \mathbf{01r}|$$

$$19. \mathbf{0rr} : A^* |\mathbf{0r1}\rangle \langle \mathbf{0rr}| + A^* |\mathbf{01r}\rangle \langle \mathbf{0rr}| + (2\Delta + V(d)^{-\alpha}) |\mathbf{0rr}\rangle \langle \mathbf{0rr}|$$

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$$20. \mathbf{111} : A |\mathbf{r11}\rangle \langle \mathbf{111}| + A |\mathbf{1r1}\rangle \langle \mathbf{111}| + A |\mathbf{11r}\rangle \langle \mathbf{111}|$$

$$21. \mathbf{1r1} : A |\mathbf{rr1}\rangle \langle \mathbf{1r1}| + A |\mathbf{1rr}\rangle \langle \mathbf{1r1}| + A^* |\mathbf{111}\rangle \langle \mathbf{1r1}| + \Delta |\mathbf{1r1}\rangle \langle \mathbf{1r1}|$$

$$22. \mathbf{r11} : A |\mathbf{rr1}\rangle \langle \mathbf{r11}| + A |\mathbf{r1r}\rangle \langle \mathbf{r11}| + A^* |\mathbf{111}\rangle \langle \mathbf{r11}| + \Delta |\mathbf{r11}\rangle \langle \mathbf{r11}|$$

$$23. \mathbf{11r} : A |\mathbf{r1r}\rangle \langle \mathbf{11r}| + A |\mathbf{1rr}\rangle \langle \mathbf{11r}| + A^* |\mathbf{111}\rangle \langle \mathbf{11r}| + \Delta |\mathbf{11r}\rangle \langle \mathbf{11r}|$$

$$24. \mathbf{r1r} : A |\mathbf{rrr}\rangle \langle \mathbf{r1r}| + A^* |\mathbf{11r}\rangle \langle \mathbf{r1r}| + A^* |\mathbf{r11}\rangle \langle \mathbf{r1r}| + (2\Delta + V(2d)^{-\alpha}) |\mathbf{r1r}\rangle \langle \mathbf{r1r}|$$

$$25. \mathbf{rr1} : A |\mathbf{rrr}\rangle \langle \mathbf{rr1}| + A^* |\mathbf{1r1}\rangle \langle \mathbf{rr1}| + A^* |\mathbf{r11}\rangle \langle \mathbf{rr1}| + (2\Delta + V(d)^{-\alpha}) |\mathbf{rr1}\rangle \langle \mathbf{rr1}|$$

$$26. \mathbf{1rr} : A |\mathbf{rrr}\rangle \langle \mathbf{1rr}| + A^* |\mathbf{11r}\rangle \langle \mathbf{1rr}| + A^* |\mathbf{1r1}\rangle \langle \mathbf{1rr}| + (2\Delta + V(d)^{-\alpha}) |\mathbf{1rr}\rangle \langle \mathbf{1rr}|$$

$$27. \mathbf{rrr} : A^* |\mathbf{r1r}\rangle \langle \mathbf{rrr}| + A^* |\mathbf{rr1}\rangle \langle \mathbf{rrr}| + A^* |\mathbf{1rr}\rangle \langle \mathbf{rrr}| +$$

$$(3\Delta + V((2d)^{-\alpha} + 2(d)^{-\alpha})) |\mathbf{rrr}\rangle \langle \mathbf{rrr}|$$