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In[4]:= Needs ["SpinDynamica`"]
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SpinPermutationOperator

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In[5]:= ? SpinPermutationOperator
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SpinPermutationOperator[{j,k}] is the operator for exchange of spin j with spin k. SpinPermutationOperator[{j,k,l,m..}] is the operator for a cyclic permutation of the specified spins, with $j \rightarrow k, k \rightarrow l, l \rightarrow m$, etc.

SpinPermutationOperator[{{j2,k2..},{j1,k1..}}] is the operator for successive spin exchange operations, with the {j1,k1..} permutation preceding the {j2,k2..} permutation, and so on (i.e. right to left order of application).

2 spins-1/2

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In[6]:= SetSpinSystem[2]
```

... **SetSpinSystem**: the spin system has been set to $\left\{\left\{1, \frac{1}{2}\right\}, \left\{2, \frac{1}{2}\right\}\right\}$

... **SetBasis**: the state basis has been set to ZeemanBasis[$\left\{\left\{1, \frac{1}{2}\right\}, \left\{2, \frac{1}{2}\right\}\right\}$, BasisLabels \rightarrow Automatic].

```
In[7]:= MatrixRepresentation[SpinPermutationOperator[{1, 2}]] // MatrixForm
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Out[7]//MatrixForm=

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

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In[8]:= Ket[2]
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Out[8]= $|\beta\alpha\rangle$

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In[9]:= SpinPermutationOperator[{1, 2}][Ket[2]]
```

Out[9]= $|\alpha\beta\rangle$

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In[10]:= MatrixRepresentation[SpinPermutationOperator[{1, 2}], SingletTripletBasis[]] // MatrixForm
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Out[10]//MatrixForm=

$$\begin{pmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

4 spins-1/2

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In[11]:= SetSpinSystem[4]
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... **SetSpinSystem**: the spin system has been set to $\left\{\left\{1, \frac{1}{2}\right\}, \left\{2, \frac{1}{2}\right\}, \left\{3, \frac{1}{2}\right\}, \left\{4, \frac{1}{2}\right\}\right\}$

... **SetBasis**: the state basis has been set to ZeemanBasis[$\left\{\left\{1, \frac{1}{2}\right\}, \left\{2, \frac{1}{2}\right\}, \left\{3, \frac{1}{2}\right\}, \left\{4, \frac{1}{2}\right\}\right\}$, BasisLabels \rightarrow Automatic].

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In[12]:= Ket[3]
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Out[12]= $|\alpha\beta\alpha\alpha\rangle$

```
In[13]:= SpinPermutationOperator[{{1, 2}, {3, 4}}][Ket[3]]
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Out[13]= $|\beta\alpha\alpha\alpha\rangle$

