```
In[1]:= Needs["SpinDynamica`"]
```

SpinDynamica version 3.0.1 loaded

ModifyBuiltIn: The following built–in routines have been modified in SpinDynamica:
{Chop, Dot, Duration, Exp, Expand, ExpandAll, NumericQ, Plus, Power, Simplify, Times, WignerD}.
Evaluate ??*symbol* to generate the additional definitions for *symbol*.

SingleTransitionOperator

```
In[2]:= ?SingleTransitionOperator
```

SingleTransitionOperator[{r,s}, μ] defines a single transition operator within the current basis. Allowed values of μ are "x", "y", "z", "+","−" or "u", "E", "1" for the Unity Operator. The state identifiers {r,s} must be members of the BasisLabels for the current basis. The most general form is SingleTransitionOperator[{{r,s},basis}, μ] which constructs a single transition operator for kets within any basis.

2 spins-1/2

```
In[3]:= SetSpinSystem[2]
```

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

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

```
In[4]:= BasisLabels[]
```

Out[4]= {1, 2, 3, 4}

```
In[5]:= Ket[1]
        Ket[2]
```

Out[5]= $|\alpha\alpha\rangle$

Out[6]= $|\beta\alpha\rangle$

```
In[7]:= SingleTransitionOperator[{1, 2}, "x"]
```

Out[7]= $\frac{|\beta\alpha\rangle.\langle\alpha\alpha|}{2} + \frac{|\alpha\alpha\rangle.\langle\beta\alpha|}{2}$

```
In[8]:= MatrixRepresentation[
          SingleTransitionOperator[{1, 2}, "x"]
         ] // MatrixForm
```

Out[8]//MatrixForm=

$$\begin{pmatrix} 0 & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[9]:=
```
MatrixRepresentation[
  SingleTransitionOperator[{1, 3}, "y"]
 ] // MatrixForm
```

Out[9]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & -\frac{i}{2} & 0 \\ 0 & 0 & 0 & 0 \\ \frac{i}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[10]:=
```
Ket[{1, SingletTripletBasis[]}]
```

Out[10]= $\frac{-|\beta\alpha\rangle + |\alpha\beta\rangle}{\sqrt{2}}$

In[11]:=
```
Ket[{2, SingletTripletBasis[]}]
```

Out[11]= $|\alpha\alpha\rangle$

In[12]:=
```
SingleTransitionOperator[{{1, 3}, SingletTripletBasis[]}, "z"]
```

Out[12]= $-\frac{|\beta\alpha\rangle.\langle\alpha\beta|}{2} - \frac{|\alpha\beta\rangle.\langle\beta\alpha|}{2}$

In[13]:=
```
MatrixRepresentation[
  SingleTransitionOperator[{{1, 3}, SingletTripletBasis[]}, "z"]
 ] // MatrixForm
```

Out[13]//MatrixForm=

$$\begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

In[14]:=
```
SetBasis[SingletTripletBasis[]]
```

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

In[15]:=
```
MatrixRepresentation[
  SingleTransitionOperator[{{1, 3}, SingletTripletBasis[]}, "z"]
 ] // MatrixForm
```

Out[15]//MatrixForm=

$$\begin{pmatrix} \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{2} & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$