How to QuTiP

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What is QuTiP?

- QuTiP is **open-source software** for simulating the dynamics of open quantum systems. QuTiP aims to provide **user-friendly** and efficient numerical **simulations** of a wide variety of **Hamiltonians**, including those with arbitrary **time-dependence**, commonly found in a wide range of physics applications
- Based on Python libraries numpy, scipy, matplotlib, etc.
- More on: http://qutip.org/

Steps: Rabi oscillations

1) Begin with operators

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sz = q.sigmaz() * 0.5
```

2) Define initial density matrix

3) Write down Hamiltonian

4) Solve it

5) Visualize results

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plt.plot(t,q.expect(result.states, sz))
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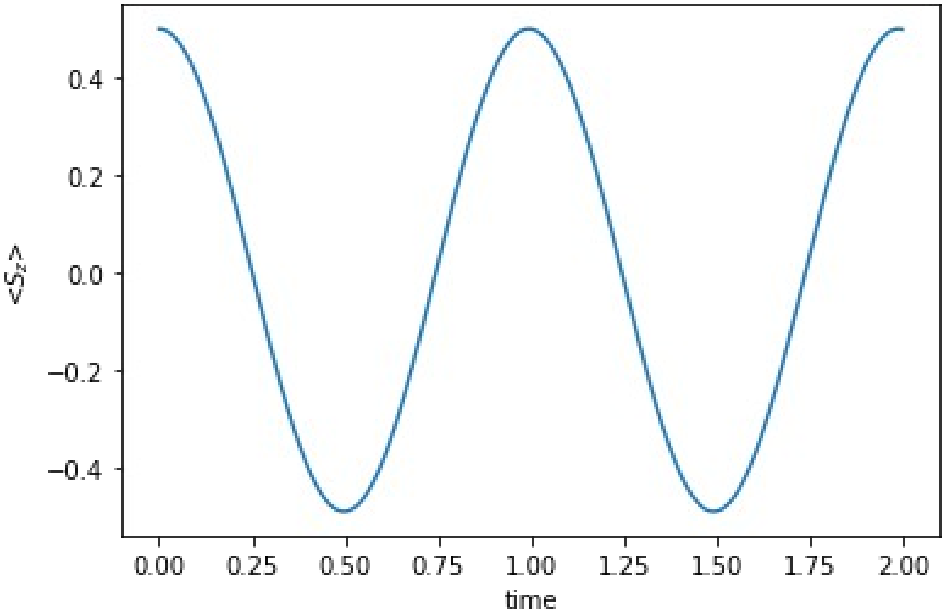

QuTiP with Jupyter Notebooks

ODMR for NV center

The NV Hamiltonian is given by:

$$H = \omega_e S_z + \omega_n I_z + A_{zz} S_z I_z$$

when applying a probe field ($\Omega S_x \sin(\omega t)$) we get in the rotating frame (RWA):

$$H = \Delta S_z + \omega_n I_z + A_{zz} S_z I_z + \Omega S_x$$

In [130]:

```
Azz=2.2 * 2 * np.pi #MHz
B0=1.0 #mT
bi = 2.e-3 * B0 *2 * np.pi

D = 2.87e3
bs = 28 * B0
ws = D - bs
```

Demonstration

Examples

- Time independent: Rabi, ODMR, Hartmann Hahn
- Time dependent: Non-RWA, Floquet-sidebands
- Open-system: T_1 decay electron spin and decoherence ^{14}N nuclear spin
- Hahn-echo revivals

Where to find the examples?

- https://github.com/jonasmeinel/how-to-qutip-4-pi3.git
- It is a public repository and can be downloaded directly
- Please contribute with more examples, references etc.