

# *Selective express method for measuring longitudinal spin relaxation time in solid-state systems*

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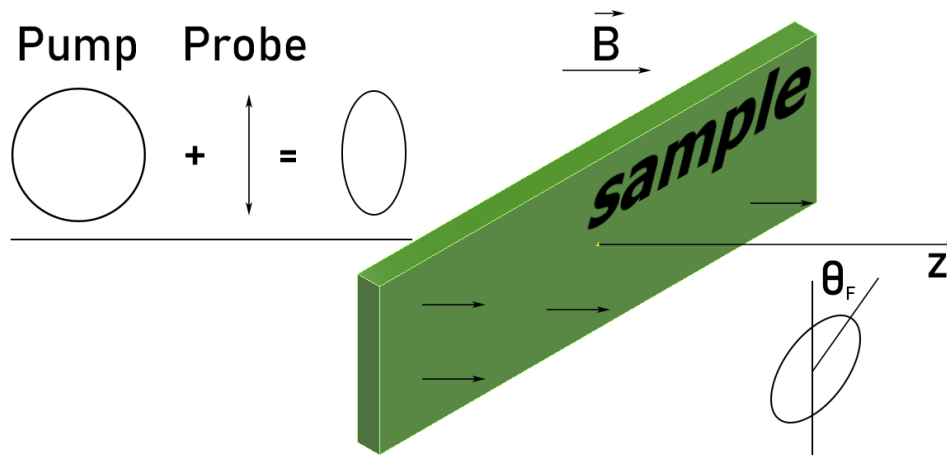
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# Detecting magnetic resonance optically

- **Larmor frequency**  $f_{larm} = \frac{2\pi g\mu_b B}{\hbar}$
- Additional radiofrequency (rf)  $\longrightarrow$  spin system experience a resonance when  $f_{rf} = f_{larm}$   
(Electron-spin resonance)
- ESR can also be detected optically, e.g., by measuring the degree of circular polarization of photoluminescence, which significantly increases sensitivity of the method
- The spin ensemble can be synchronized by a periodic train of laser pulses, thus providing a locking of several electron spin precession modes.

# Pump probe method



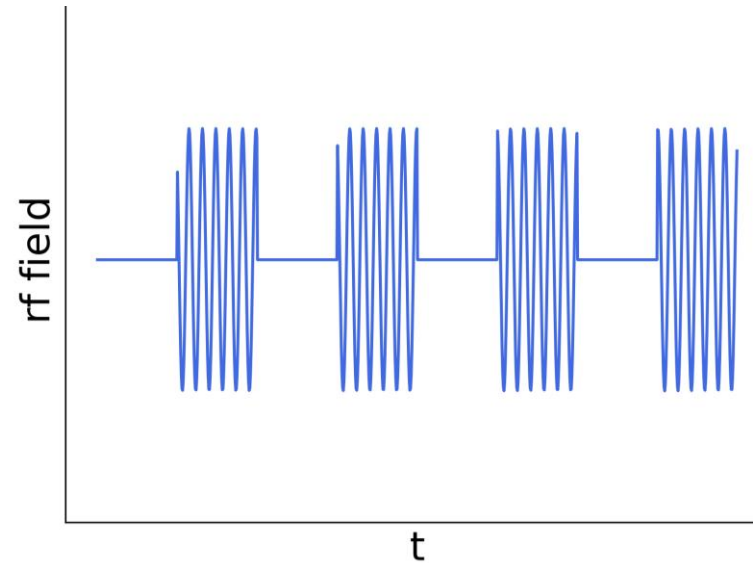
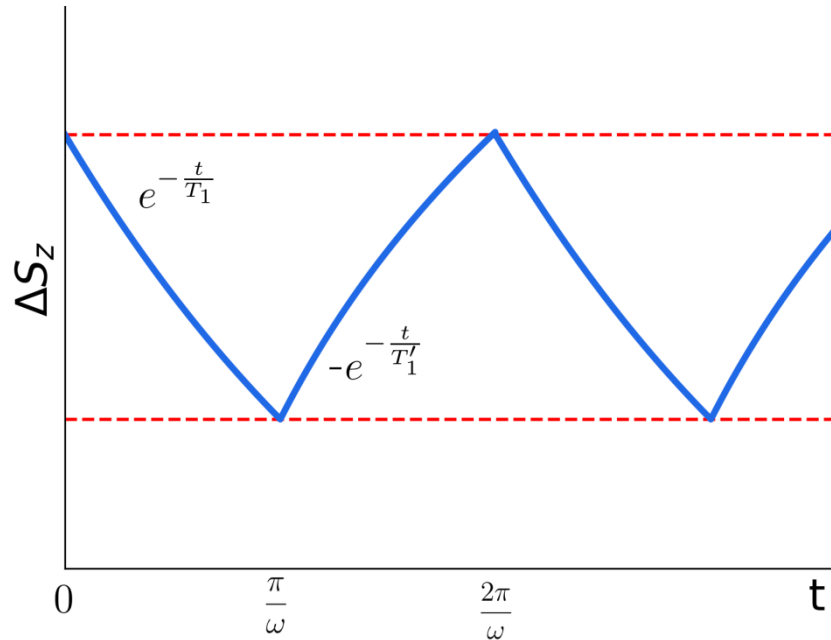
Measured signal,  $\Delta S_z \propto \theta_F(\text{rf off}) - \theta_F(\text{rf on})$

- Sample is excited with intense circularly polarized pump pulse, which induces resonant transitions and generates spin oriented electrons and holes
- Linearly-polarized part provides the rotation of the polarization plane of the transmitted probe pulse



***Rotation of elliptically-polarized plane***

# How to measure relaxation time?

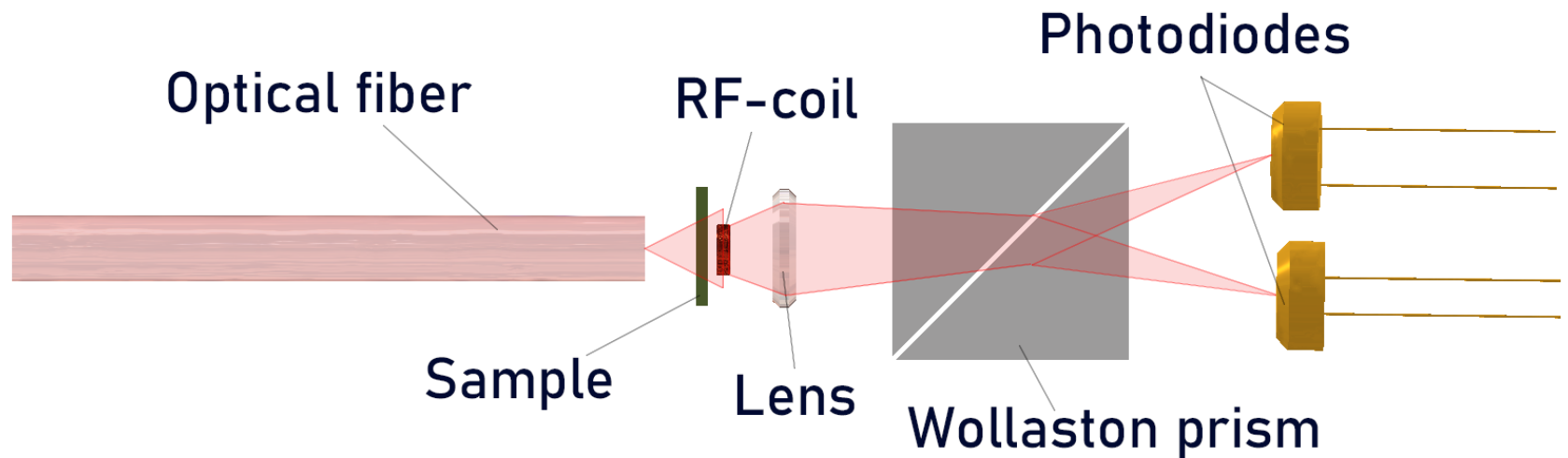


Measured signal,  $\Delta S_z \propto \theta_F(\text{rf off}) - \theta_F(\text{rf on})$

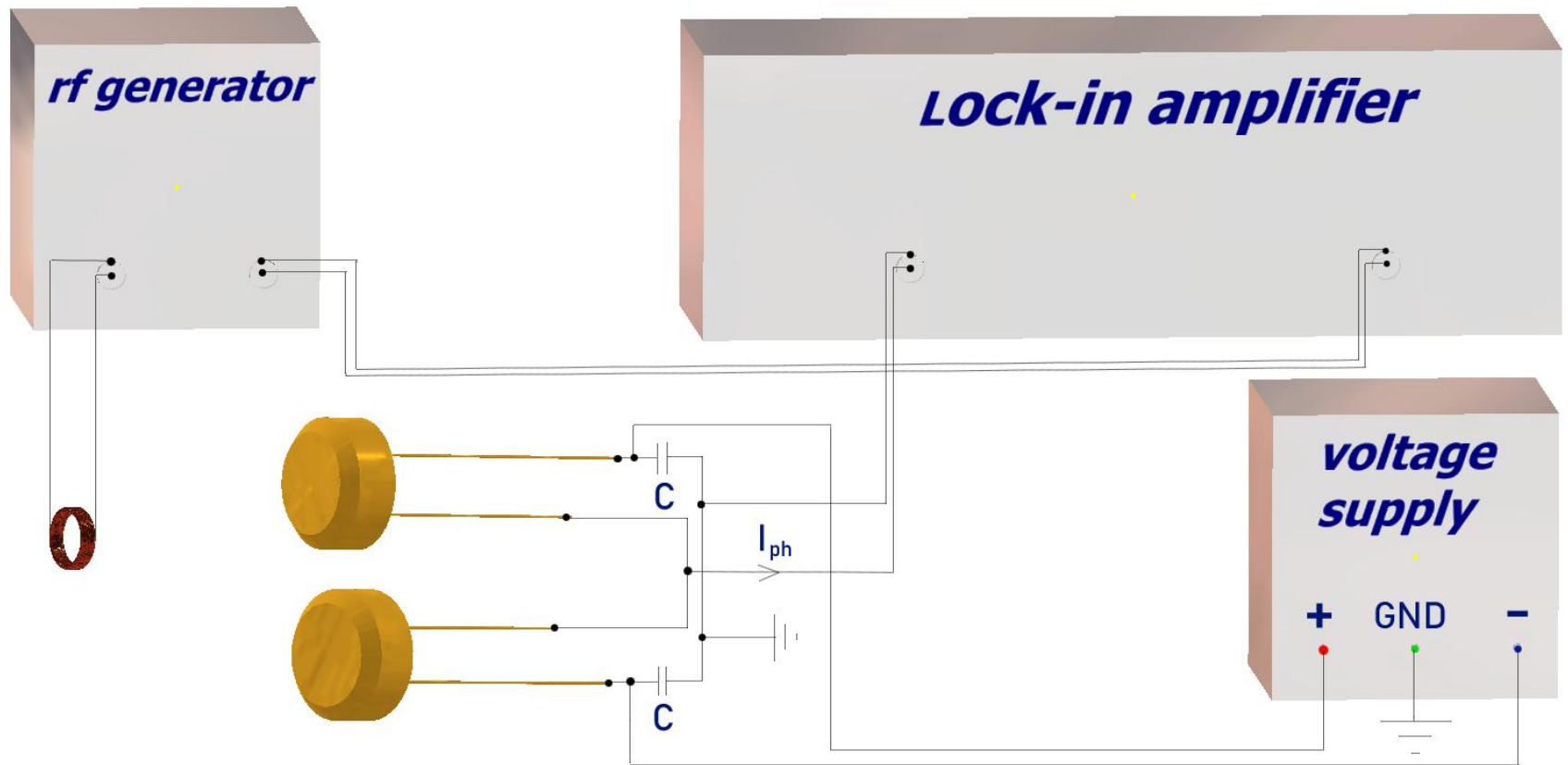
Spin projection change on an axis  
Parallel to the magnetic field direction  
 $\Delta S_z(t)$

$$ESR \approx \sqrt{\frac{1}{1 + \omega^2 T_1^2}}$$

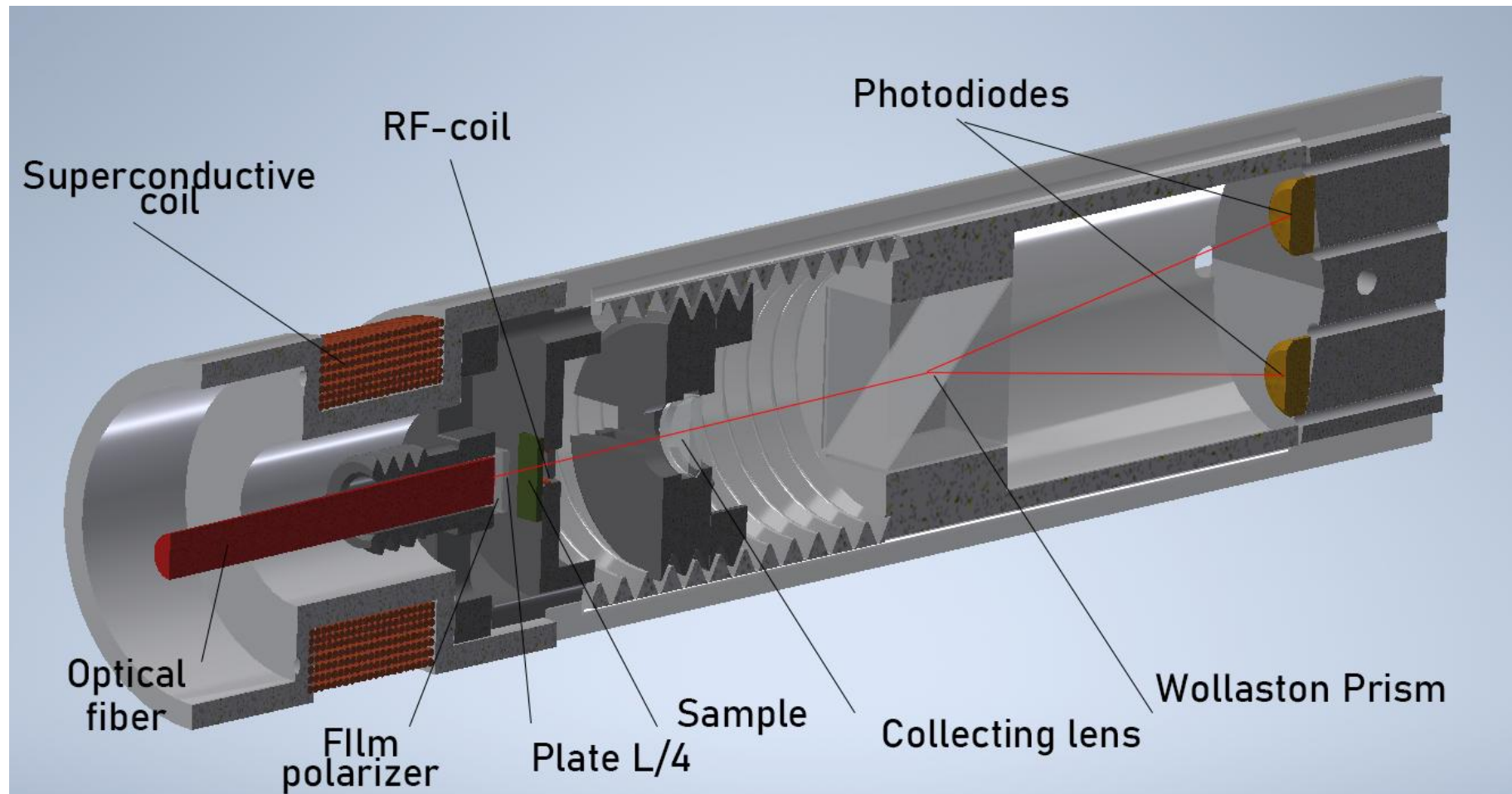
# Beam allocation



# Measurement scheme



# Experimental setup



# Practice

