quED

The Entanglement Demonstrator

Hardware

qutools' quED is a state-of-the-art physics experiment for the generation and analysis of polarization-entangled photon pairs. Its design combines recent achievements of quantum optics technology into a simple and user-friendly system for academic, research and applied purposes.

The setup is perfectly suited to practically demonstrate the physics of entanglement in student lab courses at colleges and universities. The high performance enables its integration into modern scientific experiments and commercial applications. A fully automated motorized version is also available.

quED Specifications

	basic model	high rate option
Single-count rate	> 10 kHz	> 50 kHz
Coincident-count rate	> 1 kHz	> 5 kHz
Entanglement quality	> 88 %	> 88 %
Operating wavelength	810 nm	810 nm
Pump laser power	15 mW	> 50 mW

Phase-matching	type I
SPDC type	degenerate; non-collinear
Coincidence window length	approx. 40 ns
Dimensions (in mm)	optical unit: < 450 x 600 x 100 electronic unit: 480 x 300 x 150
Counting rate interface	graphical touch display
Connections	USB, Ethernet

Add-Ons

Michelson Interferometer quED-MI

Demonstrate the wave nature of single photons through their interference or build a quantum eraser. Also available in a motorized version.

Hanbury Brown-Twiss quED-HBT

Explore the particle nature of single photons or generate quantum numbers.

Hong-Ou-Mandel Effect quED-HOM

Experience the purely quantum 2-photon interference effect by revealing the Hong-Ou-Mandel dip. Also available in a motorized version.

Key features

- Generation / analysis of true polarization-entangled photon pairs
- Complete system to violate Bell's inequalities (CHSH)
- Hands-on study of quantum phenomena
- Easy-to-use
- Custom configuration
- Automated motorized version available
- Additional polarization-control and polarization-analysis optics available

System includes

- Two silicon avalanche photodiodes
- Four channel counter with integrated coincidence logic
- Two polarizers in rotation optic mounts
- Control and read-out unit
- Alignment utilities including auxiliary low-power laser module
- Connection to a PC

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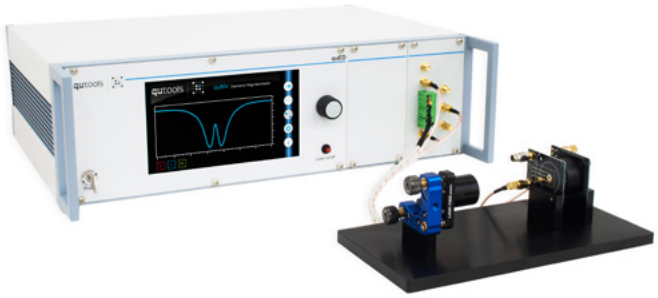
quNV

Quantum Sensing by Diamond Magnetometer



Key Features

- HPHT Diamond Sample
- 520 nm CW Diode Laser
- 4 GHz RF Microwave Sweep Generator
- Photodiode, Control & Read-Out Unit

Experiments

- NV Center Fluorescence
- Optically Detected Magnetic Resonance (ODMR)
- Spin Relaxation Time
- Magnetic Field Sensing

quNV Specifications

Experimental Board

Connections to control unit	quNV Controller
Laser safety	Orange tinted housing with laser interlock
Angular laser adjustment	Kinematic mount
Dimensions (in mm)	250 x 125 x 90 mm³

Diamond Sample

Type	Ib HPHT
Orientation	typ. {100} faces
Nitrogen concentration	< 200 ppm
Boron Concentration	< 0.1 ppm
Diameter	typ. < 2 mm x 0.5 mm

Excitation Laser

Laser Diode	Focused CW
Power	< 50 mW
Wavelength	520 ± 10 nm

Microwave Source

Frequency range	2.2 ... 4.4 GHz
Power	-43 ... +20 dBm
Antenna	Coplanar wave guide

Microwave Switch

Rise time	< 10 ns
Isolation	> 80 dB
Input	Control unit & external

Photodiode

Type	Silicon PIN Photodiode
Responsivity (@ 650 nm)	0.45 A/W
Wavelength Range	300 ... 1100 nm

Optical filter

Type	Bandpass
Transmission band (T > 90%)	662 ... 799 nm
Suppression (320 ... 1120 nm)	> OD 6,5

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