les grands modèles de langage peuvent-ils impacter le développement des technologies quantiques?

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image generated with DALL-E

agenda



Quantum Efficiency (QE)

Counter TREvency refers to the prohability that are inclused prioritizes of produces a detectable signal. A high CE is crucial for ensuring that the detector can accurately count the number of problems altotor taking too many offsen. It is a primary measure of the detector's semiority, with values typically opposed an a percentage. Higher CE mass that the detector is more likely to accurately inspective the number of domains that offset domains that offset on the more likely to accurately inspective.

Dark Count Rate

The Dark Court Rate measures the frequency at which a detector registers a court without any pictors lead, due to themal functiators or other internal pictoress. This is essentially the "roless from" of the duelos, and a lower dark court rate is desirable for high-prediction measurements, especially in too-digit or insight adults applications, where halve courts can significantly inspact the accuracy of before number result. Doc.

Photon Number Resolution

This indicates the detector's addity to discriminate between different numbers of incident, photose. A high-resolution detector can distinguish between one, how these, or more photose aming simultaneously or nearly simultaneously at the detectors. The resolution is often inrived by the detector's invitation coles and the statis $\frac{1}{2}$ instruct of the photon detection process.

Timing Resolution (Jitter)

Timing resolution, or Jillen credes to the precision with which the detector can measure the annual time of photoms. This is particularly important in applications interfaced protom counting or when provide throng Information in necessary to Interpret the quantum states of photoms. Lower Jitter corresponds to more precise temporal resolution, allowing for finer trancompatible measurements.

Dead Time

Dead time is the period immediately following a detection event during which the detector is unable to registre another photon. During this time, any incorring photons will not be detected forhard ead time allow for higher control grades and are particularly important in high-flux situations where photon events occur in repid succession.

Saturation

Solution occurs when the number of indiver photons exceeds the detector's ability to count them accuracy landing to a passe in the occur tate segredies of horeseed photon flux. The assumption level great using the first the detector's counting capability before the accuracy of photon number resolution degrades.

Linearity refers to the detector's ability to maintain accurate photon counting as the photon flux

increases. A finance response means the detected signal increases proportionally to the number of incident phytics, crucial for quantitatively accountie measurements over a range of light introficies. Crosstalk

In detector arrays or multi-pixel detectors, crosstalk measures the extent to which a signal in o pixel or detector element affects the signal in another. Lower crosstalk is critical for accurate

spatial resolution and photon counting when multiple directors are used in proximity. Each of these figures of metric plays acrucial risk in determinishing the utilizability of ARR dedector for specific applicability. Advances in director technology continue to Inspecifi these metrics, publishing the boundaries of quantum measurement capabilities and making new operimetrics an technologies in the quantum materia.



LLM-based chatbots landscape

current capabilities and limitations in quantum science

future use cases in quantum science



LLM-based chatbots landscape

image generated with DALL-E

ChatGPT 4.0 overall architecture



Custom Instructions (i)

What would you like ChatGPT to know about you to provide better responses?

I am working in the quantum science and technology fields as a generalist engineer, author and teacher. I want to understand many facets of quantum computing, communications and sensing. I am interested in both quantum physics and quantum technologies, hardware and software. I wrote a generalist book on quantum technologies but I am not a quantum physicist by training. 371/1500

How would you like ChatGPT to respond?

Avoid using lists in responses. Respond in the most scientifically detailed way. Always create pictures in 16/9 format when using Dall-E. Provide up to date references and sources whenever possible.

#1 define your user profile

#2 learn prompt engineering



current capabilities and limitations in quantum science

image generated with DALL-E

some current amazing use cases

basic quantum science knowledge

You

Can you explain the difference between John Clauser and Alain Aspect experiments on entanglement and the invalidation of Bell inequalities?

0

ChatGPT

John Clauser and Alain Aspect are both pivotal figures in the experimental study of quantum entanglement and the testing of Bell's inequalities, which are central to our understanding of the non-classical correlations predicted by quantum mechanics. Their experiments, conducted in different eras with different methodologies, significantly contributed to the field of quantum physics by providing strong evidence against local hidden variable theories and in favor of quantum mechanics. Let's delve into the differences between their experiments and how they relate to the invalidation of Bell's inequalities.

John Clauser's Experiments

John Clauser, along with Stuart Freedman, conducted one of the first significant experimental tests of Bell's inequalities in the early 1970s. Their experiment was designed to test the theoretical predictions made by John Bell in 1964. Bell \checkmark sorem proposed that if the world were governed by

figures of merit

You

can you describe the figures of merit of photon number resolving detectors?

0



ChatGPT

Photon Number Resolving (PNR) detectors are pivotal instruments in quantum optics and quantum information processing, capable of distinguishing between different numbers of incident photons. Their performance is characterized by several key figures of merit, which determine their suitability for various applications, including quantum computing, quantum cryptography, and optical quantum information processing. Understanding these figures of merit is essential for evaluating the effectiveness and efficiency of PNR detectors in specific quantum experiments or technologies.

Quantum Efficiency (QE)

Quantum Efficiency refers to the probability that an incident photon will produce a detectable signal. A high QE is crucial for ensuring that the detector can accurately count the number of photons without missing too many of them. It's a primary measure of the detector's sensitivity, with values typically expressed as a percentage. Higher QE means that the detector is more likely to accurately represent the number of photons that strike it.

Dark Count Rate

The Dark Count Rate measures the frequency at which a detector registers a count without any photon input, due to thermal fluctuations or other internal processes. This is essentially the "noise floor" of the device, and a lower dark count rate is desirable for high-precision measurements, especially in low-light or single-photon applications, where false counts can significantly impact the accuracy of photon number resolution.

Photon Number Resolution

This indicates the detector's ability to discriminate between different numbers of incident photons. A high-resolution detector can distinguish between one, two, three, or more photons arriving simultaneously or nearly simultaneously at the detector. The resolution is often limited by the detector's intrinsic noise and the statis \checkmark nature of the photon detection process.

Timing Resolution (Jitter)

Timing resolution, or jitter, refers to the precision with which the detector can measure the arrival time of photons. This is particularly important in applications involving time-correlated photon counting or when precise timing information is necessary to interpret the quantum states of photons. Lower jitter corresponds to more precise temporal resolution, allowing for finer time-correlated measurements.

Dead Time

Dead time is the period immediately following a detection event during which the detector is unable to register another photon. During this time, any incoming photons will not be detected. Shorter dead times allow for higher counting rates and are particularly important in high-flux situations where photon events occur in rapid succession.

Saturation

Saturation occurs when the number of incident photons exceeds the detector's ability to count them accurately, leading to a plateau in the count rate regardless of increased photon flux. The saturation level gives an upper limit to the detector's counting capability before the accuracy of photon number resolution degrades.

Linearity

Linearity refers to the detector's ability to maintain accurate photon counting as the photon flux increases. A linear response means the detected signal increases proportionally to the number of incident photons, crucial for quantitatively accurate measurements over a range of light intensities.

Crosstalk

In detector arrays or multi-pixel detectors, crosstalk measures the extent to which a signal in one pixel or detector element affects the signal in another. Lower crosstalk is critical for accurate spatial resolution and photon counting when multiple detectors are used in proximity.

Each of these figures of merit plays a crucial role in determining the suitability of a PNR detector for specific applications. Advances in detector technology continue to improve these metrics, pushing the boundaries of quantum measurement capabilities and enabling new experiments and technologies in the quantum realm.

DE

You

can you show the figures of merit of TWPAs used in superconducting qubits readout and their differences with traditional JPAs?



ChatGPT

Traveling Wave Parametric Amplifiers (TWPAs) and Josephson Parametric Amplifiers (JPAs) are both critical technologies used for the readout of superconducting qubits. They amplify quantum signals with minimal added noise, a crucial requirement for preserving the fragile quantum information encoded in the qubits. However, they operate based on somewhat different principles and thus exhibit distinct figures of merit that affect their suitability for various applications in quantum computing and quantum information processing.

Traveling Wave Parametric Amplifiers (TWPAs)

TWPAs amplify signals by exploiting the nonlinearity of superconducting materials in a waveguide, where the signal to be amplified travels along the waveguide and gains energy from a pump tone. The key figures of merit for TWPAs include:

- Bandwidth: TWPAs typically offer a broad bandwidth, often ranging from a few GHz up to 10 GHz or more. This wide bandwidth allows for the simultaneous amplification of signals over a broad range of frequencies, making TWPAs suitable for systems that require the readout of multiple qubits simultaneously.
- Gain: The gain of TWPAs can be substantial, typically 20 dB or more, but it is evenly distributed across their operational bandwidth. The uniform gain across a wide bandwidth is advantageous for applications requiring consistent amplification over a range of frequencies.
- Saturation Power: TWPAs generally exhibit higher saturation power compared to JPAs. This
 means they can handle stronger signals before the gain starts to compress, making them
 suitable for applications where signal levels vary widely.
- **Noise Figure:** The noise performance of TWPAs is excellent, with added noise close to the quantum limit. However, it might be slightly higher than that of the best JPAs due to the distributed nature of amplification and the engineering trade-offs for wide bandwidth.
- Nonlinearity: The nonlinearity in TWPAs is distributed along the transmission line, which can lead to more complex interactions between the signal, idler, and pump waves, potentially affecting the amplifier's performance.

Josephson Parametric Amplifiers (JPAs)

JPAs amplify signals using the nonlinearity of Josephson junctions in a resonant circuit. Their figures of merit often reflect their operation in a narrower bandwidth but with exceptional noise performance.

- Bandwidth: JPAs typically have a narrower bandwidth than TWPAs, usually on the order of tens to hundreds of MHz. This narrow bandwidth is due to the resonant nature of the JPA design, which focuses amplification around a specific frequency.
- ' **Gain:** The gain of JPAs can be very high, often exceeding 20 dB, but it is concentrated within their narrow operational bandwidth. This high gain at a specific frequency makes JPAs ideal for applications requiring the amplification of signals at a known, fixed frequency.
- Saturation Power: JPAs have lower saturation power compared to TWPAs. This limitation means that JPAs can be more easily saturated by strong signals, requiring careful signal management to avoid gain compression.
- Noise Figure: JPAs are renowned for their exceptional noise performance, often adding the minimum possible noise (half a quantum of noise) to the signal they amplify. This makes JPAs especially valuable for quantum computing applications, where preserving the quantum state's integrity is paramount.
- 'Nonlinearity: The nonlinearity in JPAs is hir 'v localized around the Josephson junctions, allowing for precise control over the amplification process but also limiting the bandwidth.

You

what are the various types of lasers (wavelengths, power, etc) that are used to control cold atom qubits?



ChatGPT

In the field of quantum computing and quantum information processing with cold atom qubits, lasers play a crucial role in trapping, cooling, manipulating, and detecting atoms. The specific types of lasers used can vary widely depending on the atomic species being controlled, the desired quantum operations, and the experimental setup. However, certain characteristics such as wavelength, power, and coherence properties are tailored to interact precisely with the specific energy levels and transitions of the atoms in use. Here's an overview of the various types of lasers commonly employed in controlling cold atom qubits, highlighting their wavelength and power characteristics:

Cooling and Trapping Lasers

 Magneto-Optical Trap (MOT) Lasers: These lasers are used for cooling and trapping atoms via the magneto-optical trapping technique. The wavelengths are chosen to match the specific atomic transitions that allow for cooling, typically in the visible to near-infrared range. For example, for Rubidium (Rb) atoms, a common choice for cold atom experiments, lasers operating around 780 nm (for Rb-87) are used. The power of these lasers can range from a few mW to several hundred mW, depending on the size of the MOT and the number of atoms needed.

Repumping Lasers

Repumping Lasers: These are used to pump the atoms back to the ground state if they fall into a
metastable state during the cooling process. The wavelength matches the transition needed to
return the atoms to the cycle of states involved in cooling and trapping. For Rb-87, this might
involve a laser close to 780 nm but tuned to a different transition than the primary cooling laser.

Optical Dipole Trap (ODT) Lasers

• High-Power IR Lasers: For creating optical dipole traps, high-power infrared lasers are used, typically in the 1064 nm range. These lasers can have powers ranging from a few watts to several tens of watts, creating a potential well that can trap and hold the atoms in place. The precise wavelength can be adjusted to minimize state and the emission rates while maximizing the depth of the optical potential.

Two-Photon Transition Lasers

• Narrow Linewidth Lasers for Precision Spectroscopy: For inducing two-photon transitions, which are often used in manipulating the internal states of the atoms or for precision measurements, lasers with very narrow linewidths and stable frequencies are required. These lasers might operate in a range that is specific to the two-photon transition being utilized. For example, for cesium (Cs) atoms, transitions near 852 nm might be used for cooling, with additional lasers for two-photon transitions in different spectral regions, depending on the specific states involved.

Raman Lasers

• Raman Transition Lasers: These are used for state manipulation, enabling transitions between hyperfine ground states of the atoms through a two-photon process. The wavelengths are chosen based on the specific energy level spacing of the atom, which can be in the near-infrared to visible range. The power is typically lower, in the mW to tens of mW range, but the lasers must have very stable frequencies and often require phase coherence between them.

Lattice Lasers

• **Optical Lattice Lasers:** For creating optical lattices, which are periodic potential landscapes used to trap atoms in a regular array, lasers with wavelengths in the visible to near-infrared range are used. The power can vary widely depending on the lattice geometry and depth, but coherence and stability are crucial for maintaining the lattice structure.

Rydberg State Excitation Lasers

• UV to Near-IR Lasers for Rydberg Excitation: To excite atoms to high-lying Rydberg states, which are used in quantum gates and entanglement operations in cold atom quantum computing, lasers ranging from ultraviolet to near-infrared are employed, depending on the atom and the specific Rydberg state targeted. These lasers need to have significant power to achieve the necessary excitation rates and often require precise control over the pulse duration and timing.

inventories

You

I am currently studying how superconducting qubits chips are manufactured. Could you make an inventory of the materials (elements) used in this process? I would like to understand their role, meaning in which part of the circuit they are used. I would like to know their advantages and shortcomings when several of them can be used to build the same element. I would like to know how these materials are deposited on the circuit (sputtering, MBE, etc).

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ChatGPT

Manufacturing superconducting qubit chips involves a sophisticated process that incorporates various materials, each selected for its unique properties that are conducive to quantum computing applications. These materials play crucial roles in different parts of the superconducting circuits, such as the qubits themselves, the interconnects, the resonators, and the substrate. The deposition techniques used to apply these materials onto the circuit are critical for defining the quality and performance of the qubits.

Materials Used in Superconducting Qubit Chips

- 1. Niobium (Nb) and Aluminum (Al): These are the primary materials for the superconducting elements of the qubit circuits, including the Josephson junctions. Niobium offers a high critical temperature and is widely used in RF SQUIDs, while aluminum is preferred for its excellent superconducting properties at very low temperatures and its ability to form high-quality oxide layers for tunnel barriers in Josephson junctions.
- Silicon (Si) and Sapphire (Al2O3): These materials are commonly used as substrates for superconducting qubits due to their low loss at microwave frequencies, which is crucial for maintaining quantum coherence. Sapphire is often chosen for its excellent thermal and dielectric properties, whereas silicon is preferred for its compatibility with traditional semiconductor fabrication techniques.
- 3. Aluminum Oxide (AlOx): This is used to form the tunnel barrier in Josephson junctions through the oxidation of aluminum. The quality of the aluminum oxide layer is pivotal for the performance of the Josephson junctions, impacting the critical current and, by extension, the qubit's energy levels.
- 4. Copper (Cu) and Gold (Au): These are used for wiring and interconnects due to their excellent conductivity. Gold is particularly valued for its resistance to oxidation, ensuring longevity and reliability of the connections.

Advantages and Shortcomings

- **Niobium** is favored for its higher critical temperature, making it more robust to thermal fluctuations. However, it is more challenging to integrate with other materials compared to aluminum.
- Aluminum is preferred for its ability to easily form a high-quality oxide layer for Josephson junctions, but it has a lower critical temperature than niobium, which necessitates operation at lower temperatures.
- **Sapphire** substrates offer superior dielectric properties and thermal stability, but they are more expensive and difficult to process than silicon substrates.
- Silicon substrates are widely used due to their lower cost and compatibility with conventional semiconductor processes, though they may introduce more loss at microwave frequencies than sapphire.

Deposition Techniques

- **Sputtering:** A widely used technique for depositing thin films of metals like niobium and aluminum. It is favorable for its simplicity and control over film thickness and composition.
- Molecular Beam Epitaxy (MBE): This technique is used for creating high-quality semiconductor heterostructures. It offers excellent control over the growth process at the atomic level, beneficial for materials requiring precise layer thicknesses and composition, such as the tunnel barriers in Josephson junctions.
- **Thermal Oxidation:** Specifically used for the formation of aluminum oxide layers in Josephson junctions. Aluminum layers are exposed to oxygen at elevated temperatures to grow a controlled oxide layer.
- Atomic Layer Deposition (ALD): Used for depositing thin films with atomic layer precision. This
 technique is particularly useful for creating uniform and conformal insulating layers, essential for
 reducing loss in superconducting circuits.

E)

You

how about tantalum and indium?

ChatGPT

Tantalum (Ta) and Indium (In) are two additional materials that find applications in the manufacturing of superconducting qubit chips, each contributing unique properties that can enhance the performance and fabrication of superconducting circuits.

Tantalum (Ta)

Tantalum is a material with superconducting properties that are advantageous for certain types of superconducting qubits and components.

- Role and Advantages: Tantalum's higher critical temperature compared to aluminum, along with its strong superconducting properties, makes it a suitable choice for fabricating superconducting resonators and qubits. It is particularly valued for its ability to form robust and reliable superconducting films that can support high-quality factors in resonators, which is critical for maintaining coherence in superconducting qubits.
- Shortcomings: The challenges with tantal $\sqrt{1}$ include its relatively more complex processing requirements compared to more commonly used superconductors like aluminum. This

Indium (In)

Indium is not typically used as a primary material for the superconducting elements themselves but plays a critical role in the assembly and interconnection of superconducting qubit components.

- **Role and Advantages:** Indium is often used as a material for bonding and interconnects due to its excellent thermal conductivity and malleability. It can be used to create low-resistance contacts between different parts of the superconducting circuit or between the chip and its package. This is particularly important for ensuring efficient thermalization of the components, a critical aspect for operating at the millikelvin temperatures required for superconducting qubits.
- **Shortcomings:** One limitation of indium is its softness and low melting point, which can pose challenges in terms of mechanical stability and reliability over long-term operation or at higher temperatures.
- **Deposition Techniques:** Indium can be deposited using thermal evaporation or by direct application in the form of indium solder or indium bumps for chip bonding. These techniques are chosen for their ability to create strong, reliable thermal and electrical connections, essential for the low-temperature environment in which superconducting qubits operate.

simple maths and logic

You

let's do some symbolic mathematics

can you show a unitary matrix corresponding to the application of a CNOT gate on 2 qubits in a 4 qubit register?

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ChatGPT

The unitary matrix corresponding to the application of a CNOT gate on the second and third qubits in a 4-qubit register is a 16×16 matrix, structured to represent the operation across the entire register. Here's how the matrix looks:

Γ1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0]
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
_						- (- 1									_

plot creation

(uploaded) FidelityClusters.csv

can you create a scatter plot in log-log scale with the qubit number and the two qubit gate error rates?

new could you use a different color and a circle for each point, related to the company name? and invert the X and the Y?

can you provide the Python code to generate this plot?

now can you change the Y scale and create marks for each possible values instead of the powers of 10, and put the Y scale at the right of the chart? can you show the resulting chart?

could you use a log scale on Y? and use labels in % for the X axis? well, in Y, I needed to have a log scale and the ticks corresponding to the values in the plot



Scatter Plot: Two-Qubit Gate Error Rates vs. Number of Qubits (Log-Log Scale)

result after 5 minutes



what took me >10 hours in 2023

coding

python	ပြီ Copy code	🍦 qiski	t_code_assistant.py \times	\triangleright ~ \square ··
from diskit import Aer		1	<pre>from qiskit import QuantumCircuit</pre>	
from diskit algorithms import Shor		2	<pre>from qiskit.primitives import Samp</pre>	oler
from diskit.algorithms import shor		3	<pre>from quantum_serverless import sav</pre>	/e_result
from diskit. Utils import quantuminstance		4		
		5	# Define a Bell circuit, run it us	ing the Qiskit Sampler
# Setting up the quantum instance (simulator)			primitive (not the Runtime one)	
<pre>backend = Aer.get_backend('aer_simulator')</pre>		6	<pre># take the quasi_dists result from</pre>	Sampler and save it using
<pre>quantum_instance = QuantumInstance(backend, shots=1024)</pre>			save_result from quantum_serverles	S
# Number to be factored			<pre>circuit = QuantumCircuit(2)</pre>	
N = 15 # Example number to factor			circuit.h(0)	
$m_{\mu} = 10 \# \text{ Example number to factor}$			circuit.cx(0, 1)	
Hum_dubits - 10 # Humber of dubits			circuit.measure_all()	
# Initialize Shor's algorithm with the number of qubits			sampler = Sampler()	
<pre>shor = Shor(num_qubits=num_qubits, quantum_instance=quantum</pre>	_instance)		<pre>quasi_dists = sampler.run(circuit)</pre>	.result().quasi_dists
# Execute the algorithm to factorize the number			save result(quasi dists)	
<pre>result = shor.factor(N)</pre>				
<pre># Print the result aroutt['total_counts'])</pre>			Watsonx in	Qiskit,
print(resurt ractors], resurt cotar_counts])			O4T pro	iect.

Python, PHP, ...

coding with ChatGPT 4.0

quiz creation

E

You

I am a teacher in quantum computing. Create an educational quiz with 8 questions on quantum computing with multiple choices and the related responses. Multiple responses are possible in some of the questions in the quiz, with between 1 and 3 good responses out of 4. The level of the quiz should correspond to master's degree level. It can test the ability to understand circuit quantum programming.



ChatGPT

Certainly! Below is an educational quiz designed for master's degree level students with a focus on quantum computing and the understanding of circuit quantum programming. The questions range from fundamental concepts to more applied aspects of quantum computing.

Quiz: Mastering Quantum Computing

Question 1: What is the fundamental unit of quantum information?

- A) Bit
- B) Byte
- C) Qubit
- D) Quantum gate
- * Correct Answer: C) Qubit

Question 2: Which of the following are properties of quantum entanglement? (Multiple answers possible)

- A) Two or more qubits become interconnected such that the state of one cannot be described without the state of the others.
- B) Changing the state of one entangled qubit instantaneously changes the state of the other, regardless of distance.
- C) Entangled qubits always have opposite spins.
- D) Entanglement allows classical bits to be teleported.
- Correct Answers: A) and B)

Question 3: What is the purpose of a quantum gate in a quantum circuit?

- A) To measure the qubits
- B) To initialize the qubits to a known state
- C) To perform classical logical operations
- D) To manipulate the quantum states of the qubits
- * Correct Answer: D) To manipulate the quantum states of the qubits

Question 4: Which of the following quantum gates is used to create superposition?

- A) X-gate
- B) Z-gate
- C) Hadamard gate
- D) CNOT gate
- · Correct Answer: C) Hadamard gate

Question 7: What is the significance of the Bell state in guantum computing?

- A) It represents the fastest quantum algorithm for database search.
- B) It is a type of quantum error correction code.
- C) It is an example of a maximally entangled state of two qubits.
- D) It is used to benchmark the speed of quantum processors.
- Correct Answer: C) It is an example of a maximally entangled state of two qubits.

Question 8: Which of the following are applications of quantum computing? (Multiple answers possible)

- A) Quantum simulation
- B) Database management
- C) Quantum cryptography
- D) Drug discovery
- Correct Answers: A), C), and D)

Question 5: In quantum error correction, what is the purpose of syndrome measurement?

- A) To reset the qubits to their initial state
- B) To directly correct errors in the gubits without measuring them
- C) To identify the type of error that occurred without disturbing the quantum information
- D) To entangle additional gubits for error correction
- * Correct Answer: C) To identify the type of error that occurred without disturbing the quantum information

Question 6: Which of the following statements are true about the no-cloning theorem in quantum computing? (Multiple answers possible)

- A) It states that it is impossible to create an identical copy of an arbitrary unknown quantum state.
- B) It implies that quantum information cannot be copied to protect against eavesdropping in quantum communication.
- C) It allows quantum algorithms to solve problems faster than classical algorithms.
- D) It prohibits the cloning of quantum states but allows for the cloning of classical states. Ł
- Correct Answers: A) and B)

crafting a NQI memo for policy makers

You

Let's say I am quantum scientist in a small European country and I want to convey to the government the message that it should fund a national quantum initiative to fund research and startup development in this burgeoning field, given it is already competitive and many countries have launched such initiatives. can you write a memo that would persuade my government to implement such a plan for \$300M?

0



ChatGPT

Certainly! Below is a template for a persuasive memo that could be adapted to your needs:

Let's say I am quantum scientist in a small European country and I want to convey to the government the message that it should fund a national quantum initiative to fund research and startup development in this burgeoning field, given it is already competitive and many countries have launched such initiatives, can you write a memo that would persuade my government to implement such a plan for \$300M?

ChatGPT

Certainly! Below is a draft of a persuasive memo aimed at convincing your government to fund a national quantum initiative.

To: [Recipient's Name], [Recipient's Title] From: [Your Name], Quantum Scientist Date: [Date] Subject: Proposal for a National Quantum Initiative - A Strategic Investment in Our Nation's Future

Executive Summary:

This memo proposes the establishment of a National Quantum Initiative (NQI) with an investment of \$300 million. This initiative is crucial for positioning [Country's Name] as a leader in the rapidly evolving field of quantum science and technology. With many countries already investing heavily in quantum research and development, it is imperative for our national competitiveness and security that we do not fall behind in this critical field.

Background:

Quantum technology, representing the next frontier of scientific advancement, promises revolutionary changes in computing, communication, and sensing. It holds the potential to solve complex problems beyond the reach of classical computers, ensuring advancements in material science, pharmaceuticals, and encryption. Globally, nations like the United States, China, and members of the European Union have already recognized its potential, investing billions into quantum research and startups.

The Need for a National Quantum Initiative:

- Competitiveness in Global Science and Technology: As quantum technology rapidly evolves, not
 participating at this juncture means falling behind in a critical area of future technology and innovation.
- Economic Opportunities: The global quantum computing market is projected to reach [Projected Value] by 2030. An early investment in quantum technologies will position [Country's Name] to capture a significant share of this market, fostering economic growth and job creation.
- National Security: Quantum computing poses unique challenges and opportunities in the realm of cybersecurity. Developing domestic quantum capabilities is vital for safeguarding our national security interests.
- Support for Academia and Startups: A national initiative will provide much-needed funding for academic
 research and support the growth of quantum startups, driving innovation and technological breakthroughs.

Proposed Allocation of \$300 Million Investment:

- Research and Development: \$150 million for advancing quantum computing, communication, and sensing technologies.
- Infrastructure Development: \$50 million for establishing state-of-the-art quantum laboratories and research facilities.
- Education and Workforce Training: \$30 million for developing educational programs and training the next generation of quantum scientists and engineers.
- Startup and Industry Support: \$40 million for grants and incentives to encourage quantum technology startups and industry collaborations.
- International Collaboration and Standards: \$30 million for participating in international quantum research projects and contributing to global standards in quantum technology.

Conclusion:

Investing in a National Quantum Initiative is not just about keeping pace with global trends; it is about seizing an opportunity to lead in a transformative technology that will shape the future. This initiative will not only bolster [Country's Name]'s position in the global scientific community but also stimulate economic growth and ensure national security.

Your support for this initiative will be a testament to our country's commitment to innovation and progress. I urge you to consider this proposal for the future prosperity and security of our nation.

Attachments:

- 1. Detailed Budget Breakdown
- 2. Comparative Analysis of Global Quantum Initiatives
- 3. Projected Impacts and ROI Analysis

Feel free to adjust this memo to better suit the specific context and needs of your country and government.

Could you add a part which contains some key performance indicators of success of such a plan?

ChatGPT

Absolutely, including Key Performance Indicators (KPIs) is crucial for demonstrating how the success of the National Quantum Initiative can be measured. Here's an addition to the memo incorporating this aspect:

Key Performance Indicators (KPIs) for the National Quantum Initiative:

To ensure the effectiveness and impact of the National Quantum Initiative (NQI), the following KPIs are proposed. These indicators will help in monitoring progress and measuring success over time:

1. Research and Development Outcomes:

- Number of peer-reviewed scientific publications in quantum sciences.
- Patents filed and granted in quantum technologies.
- Breakthrough technologies developed.
- 2. Infrastructure Development and Utilization:
 - Completion of quantum laboratories and research facilities within the set timelines.
 - Utilization rate of new quantum facilities by researchers and industry partners.
- 3. Educational Program Success:
 - Number of quantum science and technology courses and programs established.
 - Enrollment and graduation rates in quantum-related educational programs.
 - Partnerships established with educational institutions for quantum science programs.
- 4. Startup and Industry Growth:
 - Number of startups founded in the quantum technology sector.
 - Amount of private investment attracted by quantum startups.
 - Industry collaborations and partnerships formed.
- 5. International Collaboration and Leadership:
 - Number and impact of international research collaborations entered.
 - · Contributions to global standards in quantum technology.
 - Recognition and awards in international quantum science forums.
- 6. Economic and Job Market Impact:
 - Jobs created in the quantum technology sector.
 - · Growth in the domestic quantum technology market size.
 - Contribution to the GDP from the quantum technology sector.
- 7. National Security Enhancements:
 - Developments in quantum cryptography and secure communication.
 - Implementation of quantum technologies in national security applications.
- Public Engagement and Awareness:
 - Public awareness programs conducted.
 - Media coverage and public outreach effectiveness.

Monitoring and Reporting:

An annual report will be published to evaluate the progress against these KPIs, ensuring transparency and accountability in the execution of the National Quantum Initiative. Regular assessments will also enable adaptive management strategies to enhance the program's effectiveness throughout its implementation phase.

These KPIs provide a comprehensive framework to assess the progress and success of the National Quantum Initiative, ensuring that the investment not only aligns with the nation's strategic objectives but also delivers tangible outcomes.

Can you also generate the "Comparative Analysis of Global Quantum Initiatives" that you mentioned in the memo?

ChatGPT

Creating a detailed "Comparative Analysis of Global Quantum Initiatives" involves extensive research and data compilation, which is beyond the scope of this platform. However, I can outline a structure and provide key elements that should be included in such an analysis. This will serve as a quide for you or a research team to develop a comprehensive report.

Comparative Analysis of Global Quantum Initiatives

1. Introduction:

- Purpose of the analysis.
- · Brief overview of the importance of quantum technology globally.

2. Methodology:

- Criteria for selecting the countries and initiatives included in the analysis.
- Data sources and collection methods.
- 3. Global Overview of Quantum Initiatives:

Recommendations for policymakers and stakeholders.

9. Appendices:

- Detailed data tables and charts.
- List of consulted sources and references.

10. Acknowledgments:

Credits to contributors and organizations involved in the analysis.

This structure serves as a comprehensive template for conducting a thorough comparative analysis. The actual development of this report would require gathering data from various sources, including academic publications, government reports, industry analyses, and international policy documents.

can you consolidate everything here and translate it into Serbo-Croatian?

ChatGPT

Certainly! I will consolidate the memo with the added sections on Key Performance Indicators and the outline for the Comparative Analysis of Global Quantum Initiatives, and then provide the translation in Serbo-Croatian. Consolidated Memo:

To: [Recipient's Name], [Recipient's Title] From: [Your Name], Quantum Scientist Date: [Date] Subject: Proposal for a National Quantum Initiative - A Strategic Investment in Our Nation's Future

Executive Summary:

This memo proposes the establishment of a National Quantum Initiative (NOI) with an investment of \$300.

can you consolidate everything here and translate it into Serbo-Croatian?

ChatGPT

 Major research institutions and corporate players involved. 	Proposed Allocation of \$500 Million investment:				
 Government policies and regulatory environment for quantum technologies. 	 Research and Development: \$150 million 				
 Partnerships and international collaborations. 	 Infrastructure Development: \$50 million 				
 Education and workforce development programs. 	 Education and Workforce Training: \$30 million 				
5. Comparative Analysis:	 Startup and Industry Support: \$40 million 				
 Side-by-side comparison of the initiatives based on: 	 International Collaboration and Standards: \$30 million 				
 Investment size and allocation. 	Key Performance Indicators (KPIs):				
 Research and development output. 	Research and Development Outcomes				
 Commercial and industrial impact. 	Infrastructure Development and Utilization				
 Workforce development and educational outreach. 	Educational Program Success				
 Policy and regulatory frameworks. 	Startup and Industry Growth				
 International presence and collaboration. 	International Collaboration and Leadership				
6. Key Findings:	Economic and Job Market Impact				
 Highlights of what works well in various initiatives. 	National Security Enhancements				
 Gaps and areas of improvement. 	 Public Engagement and Awareness 				
 Benchmarking against best practices. 	Comparative Analysis of Global Quantum Initiatives:				
7. Implications for [Your Country]:	 An outline is provided for conducting a comprehensive comparative analysis. 				
 Lessons learned and their applicability to your national context. 	Conclusion:				
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 Strategies to leverage global trends and findings for the national initiative. 8 Conclusion:

Summary of key insights.

Investing in the NOI is essential for the future prosperity and security of our nation, ensuring our position in the global scientific community and stimulating economic growth.

Attachments:

1. Detailed Budget Breakdown

2. Comparative Analysis of Global Quantum Initiatives

Projected Impacts and ROI Analysis

Translation in Serbo-Croatian:

Za: [Ime primaoca], [Titula primaoca] Od: [Vaše ime], Kvantni naučnik Datum: [Datum] Predmet: Prijedlog za Nacionalnu kvantnu inicijativu - Strateška investicija u budućnost naše nacije

Izvršni rezime:

Ovaj memorandum predlaže uspostavljanje Nacionalne kvantne inicijative (NQI) s ulaganjem od 300 miliona dolara kako bi se [Ime države] pozicioniralo kao lider u kvantnoj nauci i tehnologiji. Inicijativa je vitalna za nacionalnu konkurentnost, ekonomski rast i sigumost.

Potreba za Nacionalnom kvantnom inicijativom:

- Konkurentnost u globalnoj nauci i tehnologiji
- Ekonomske prilike
- Nacionalna sigurnost
- Podrška akademiji i startupima

Predložena alokacija od 300 miliona dolara ulaganja:

- Istraživanje i razvoj: 150 miliona dolara
- Razvoj infrastrukture: 50 miliona dolara
- Obrazovanje i obuka radne snage: 30 miliona dolara
- Podrška startupima i industriji: 40 miliona dolara
- Međunarodna saradnja i standardi: 30 miliona dolara

Ključni pokazatelji uspeha (KPIs):

- Rezultati istraživanja i razvoja
- Razvoj i korišćenje infrastrukture
- Uspeh obrazovnog programa
- Rast startupa i industrije
- Međunarodna saradnja i liderstvo
- Ekonomski i tržišni uticaj na zapošljavanje
- Unapređenja nacionalne sigurnosti
- Angažovanje i osvešćivanje javnosti

Komparativna analiza globalnih kvantnih inicijativa:

Daje se okvir za sprovođenje sveobuhvatne komparativne analize.

Zaključak:

Ulaganje u NQI je neophodno za buduću prosperitet i sigumost naše nacije, osiguravajući našu poziciju u globalnoj naučnoj zajednici i stimulisanje ekonomskog rasta.

Prilozi:

- 1. Detaljan raspored budžeta
- 2. Komparativna analiza globalnih kvantnih inicijativa
- 3. Projekcije uticaja i analiza povrata na investiciju

This translation covers the essential points of the memo, tailored for a Serbo-Croatian speaking audience.

Could you add a part in the memo that would explain how to leverage European Union funding in the implementation of this National Quantum Initiative?

ChatGPT

Certainly! Adding a section about leveraging European Union funding for the National Quantum Initiative is a great strategy, especially considering the EU's interest in advancing quantum technologies. Here's an addition to the memo: Leveraging European Union Funding for the National Quantum Initiative

Strategic Alignment with EU Objectives: The National Quantum Initiative (NQI) must align with the strategic objectives and areas of interest outlined by the European Union in its quantum technology and research programs. This includes objectives under Horizon Europe, the European Quantum Communication Infrastructure (EuroQCI), and other relevant EU initiatives.

EU Funding Opportunities:

- Horizon Europe Funds: Identify and apply for quantum-related calls under the Horizon Europe program. These funds can support research and innovation projects, collaborative efforts with EU member states, and development of quantum infrastructure.
- Digital Europe Programme: Explore funding under the Digital Europe Programme, which focuses on digital technologies including quantum computing.
- Partnership on Quantum Technologies: Engage in the Partnership on Quantum Technologies, a joint
 initiative between the EU and member states to support quantum research and innovation.

Collaborative Projects and Networks:

- European Quantum Flagship: Participate in the European Quantum Flagship initiative, aiming to consolidate and expand European scientific leadership and excellence in quantum research.
- Networking with EU Quantum Consortia: Foster relationships with existing quantum technology consortia and networks within the EU to collaborate on projects and share expertise.
- Public-Private Partnerships: Encourage public-private partnerships that leverage EU funding to
 promote innovation and commercialization in the quantum sector.

Proposal Development and Submission:

- Proposal Writing Teams: Form specialized teams for developing and submitting proposals to EU funding calls. These teams should be adept in EU proposal requirements and include members with expertise in quantum technologies.
- Regular Monitoring of EU Calls: Keep a regular watch on EU funding calls relevant to quantum technologies to ensure timely and competitive applications.

Maximizing the Impact of EU Funds:

- Complementary Funding: Use EU funds to complement national investments in the NQI, ensuring a
 more extensive and impactful implementation of the initiative.
- Demonstrating European Value: In applications, emphasize how the NQI will contribute to Europe's leadership in quantum technologies and address broader EU goals like digital sovereignty and innovation leadership.

Conclusion:

Integrating European Union funding strategies into our National Quantum Initiative not only enhances the scope of our quantum projects but also aligns [Country's Name]'s quantum ambitions with broader European technological and strategic objectives. This approach will maximize the impact and reach of our NQI, positioning [Country's Name] as a key player in the European quantum ecosystem.

This section outlines how to effectively integrate European Union funding sources and strategies into the National Quantum Initiative, leveraging EU's focus on advancing quantum technologies. It suggests aligning with EU objectives, tapping into various EU funding programs, participating in EU quantum networks and projects, and ensuring that proposals highlight the contribution to Europe's quantum ambitions.

Could you be more precise in the kinds of EU programs the country could leverage, like EuroQCI and EuroHPC?

ChatGPT

Certainly! Including specific European Union programs like EuroQCI (European Quantum Communication Infrastructure) and EuroHPC (European High-Performance Computing) will add precision to the memo. Here's an enhanced section detailing these programs:

Leveraging Specific EU Programs for the National Quantum Initiative EuroQCI (European Quantum Communication Infrastructure):

- Objective: EuroQCI aims to build a secure quantum communication infrastructure that spans the entire EU, including its overseas territories. It focuses on enhancing cybersecurity through quantum technology.
- Opportunity: Collaborate on projects under EuroQCI to develop and integrate secure quantum communication systems within [Country's Name]. This includes quantum key distribution (QKD) networks and satellite-based quantum communication.
- Funding and Partnerships: Identify funding opportunities under EuroQCI for infrastructure development
 and research in quantum communication. Form partnerships with EU member states and private entities
 involved in the EuroQCI initiative.

EuroHPC (European High-Performance Computing):

- Objective: EuroHPC seeks to develop a world-class supercomputing ecosystem in Europe. Although
 primarily focused on classical computing, its infrastructure and research can significantly complement
 quantum computing initiatives.
- Opportunity: Leverage EuroHPC resources for quantum computing research, especially in areas where highperformance computing (HPC) intersects with quantum algorithms and simulations.
- Funding and Collaboration: Apply for EuroHPC funding for projects that integrate HPC and quantum computing. Collaborate with existing EuroHPC centers and initiatives to foster synergies between HPC and quantum technologies.

Horizon Europe:

- Clusters and Missions: Focus on relevant clusters and missions within Horizon Europe, particularly those
 pertaining to digital, industry, space, and health, where quantum technology applications are pivotal.
- Research and Innovation Actions (RIA): Participate in RIAs focusing on quantum technologies to develop new knowledge and integrate it into marketable products and services.
- Innovation and Technology Transfer: Engage in projects aimed at transferring quantum technology from research to market, utilizing Horizon Europe's support for innovation activities.

Digital Europe Programme:

- Quantum Technology Development: Target areas in the Digital Europe Programme that fund the development and deployment of quantum technologies.
- Skills and Capacity Building: Utilize the program's focus on skills and capacity building to train a workforce
 adept in quantum technologies, ensuring a talent pipeline for the NQI.

Enhanced Coordination with EU Policies:

- Alignment with EU Digital Strategy: Align NQI objectives with the EU's broader digital strategy, ensuring
 that [Country's Name]'s quantum initiative contributes to Europe's digital sovereignty.
- Participation in Policy Discussions: Actively participate in EU policy discussions and working groups on quantum technologies to influence and align with EU-wide quantum strategies. Conclusion:

By strategically leveraging these specific EU programs, the National Quantum Initiative will not only secure necessary funding and support but also integrate [Country's Name] into the larger European quantum network. This alignment with EU's quantum and computing initiatives presents an opportunity to amplify the impact and reach of our national efforts in quantum science and technology.

This enhanced section provides a more detailed overview of how the National Quantum Initiative can align with and benefit from specific EU programs such as EuroQCI, EuroHPC, Horizon Europe, and the Digital Europe Programme. It emphasizes collaboration, funding opportunities, and policy alignment to maximize the benefits from these EU initiatives.

recent improvement

You

is rubidium 87 a boson or a fermion?



ChatGPT

Rubidium-87 (⁸⁷Rb) is a boson. This is determined by its total spin, which is an integer value. Bosons are characterized by integer spins, whereas fermions have half-integer spins. The nucleus of ⁸⁷Rb has 37 protons (an odd number, giving it half-integer spin) and 50 neutrons (an even number, giving it integer spin). When combined, the total spin of the nucleus is an integer, and since the total atomic spin results from both the nucleus and the electron configuration, ⁸⁷Rb behaves as a boson. This property makes ⁸⁷Rb particularly useful in Bose-Einstein condensate experiments and other areas of quantum research. You

but I read somewhere that rubidium 87 can also be a fermion.

0

ChatGPT

The statement that Rubidium-87 (⁸⁷Rb) can be considered a fermion is not accurate according to standard definitions and properties of bosons and fermions. ⁸⁷Rb, with 37 protons and 50 neutrons, results in a nucleus with an overall integer spin. The total angular momentum (spin) of an atom, which determines its bosonic or fermionic nature, combines the spins of the nucleus and the electrons. For ⁸⁷Rb, the atomic spin is an integer, classifying it as a boson, not a fermion.

Fermions are particles that follow Fermi-Dirac statistics and have half-integer spins, which means they obey the Pauli exclusion principle. Examples include electrons, protons, and neutrons themselves, but not typically whole atoms in their ground state like ⁸⁷Rb.

Bosons, on the other hand, have integer spins and follow Bose-Einstein statistics, allowing them to occupy the same quantum state without restriction. ⁸⁷Rb atoms can condense into a Bose-Einstein condensate, a state of matter whe ultiple atoms occupy the same space and quantum state, which is a characteristic behavior of bosons.







- Nucleus: The nucleus of rubidium-87 has both even numbers of protons and neutrons. These particles are classified as fermions due to their half-integer spin, but in even numbers, they contribute a combined spin of zero.
- 2. Valence Electron: While a single electron is a fermion with half-integer spin, the specific configuration of rubidium-87's electron orbitals results in the valence electron's spin pairing with another electron in a lower orbital. This pairing cancels out their individual spins effectively, leading to a net spin of zero for the valence electron.

what doesn't work yet

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chart describing Shor integer factoring algorothm



chart describing various qubit types

creating schemas: wrong content and labelling (Dall-E). Missing generative adversarial (GAN) features. get qubit fidelities: mistakes + not done anymore (Bard). researcher biographies: lots hallucinations (Bard). finding missing data in papers: not there yet. analyzing charts in scientific papers: not there yet. summarizing scientific papers: simplistic. **reasoning** in complex situations: possible but not there.



existing and future applications in quantum science

capabilities in quantum science

	now	later	harder	
learning	provide definitions	more detailed definitions		
studying	symbolic maths quiz creation	charts creation creativity create and correct exercices		
reviewing papers	simplistic reviewing capability	finding missing elements	critical view buildup charts analyzis	
writing papers	create layout, rewriting, translations		making hypothesis	
coding	helps save time with coding and debugging	broader coding capabilities		
ideation			making hypothesis finding avenues	
collaborative research	translations meeting transcripts actions follow-up			
experimental design	propose basic setup	propose more detailed setup compare vendor offerings		



creating a quantum science domain-specific LLM-based chatbot

natural sciences

DARWIN SERIES: DOMAIN SPECIFIC LARGE LANGUAGE MODELS FOR NATURAL SCIENCE

A PREPRINT

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healthcare

LARGE LANGUAGE MODELS IN HEALTHCARE AND MEDICAL DOMAIN: A REVIEW

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chemistry

ORGANA: A Robotic Assistant for Automated Chemistry Experimentation and Characterization

> Kourosh Darvish^{1,2†*}, Marta Skreta^{1,2†}, Yuchi Zhao^{1†}, Naruki Yoshikawa^{1,2}, Sagnik Som¹, Miroslav Bogdanovic¹, Yang Cao¹, Han Hao¹, Haoping Xu^{1,2}, Alán Aspuru-Guzik^{1,2†}, Animesh Garg^{1,2,3‡}, Florian Shkurti^{1,2‡}

chips design

SpecLLM: Exploring Generation and Review of VLSI Design Specification with Large Language Model

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Using LLM such as ChatGPT for Designing and Implementing a RISC Processor: Execution, Challenges and Limitations

Shadeeb Hossain [ORCID ID: 0000-0002-5224-7684], Aayush Gohil, Yizhou Wang

ChipNeMo: Domain-Adapted LLMs for Chip Design

Mingjie Liu[§], Teodor-Dumitru Ene[§], Robert Kirby[§], Chris Cheng[§], Nathaniel Pinckney[§], Rongjian Liang[§] Jonah Alben, Himyanshu Anand, Sanmitra Banerjee, Ismet Bayraktaroglu, Bonita Bhaskaran, Bryan Catanzaro Arjun Chaudhuri, Sharon Clay, Bill Dally, Laura Dang, Parikshit Deshpande, Siddhanth Dhodhi, Sameer Halepete Eric Hill, Jiashang Hu, Sumit Jain, Brucek Khailany, George Kokai, Kishor Kunal, Xiaowei Li Charley Lind, Hao Liu, Stuart Oberman, Sujeet Omar, Sreedhar Pratty, Jonathan Raiman, Ambar Sarkar Zhengjiang Shao, Hanfei Sun, Pratik P Suthar, Varun Tej, Walker Turner, Kaizhe Xu, Haoxing Ren NVIDIA



ChatQuantum

CoolQuantumPBeQuantQuantumGPTQuantumHelp

EuroQuant

QuantumPower

will be covered at



conference

May 21th, 2024, Station F



get the presentation slides

How AI, LLMs and quantum science can empower each other?

Olivier Ezratty¹

¹ author of the Understanding quantum technologies book, Paris, France, olivier@oezratty.net

Large Language Models (LLMs) based chatbots such as OpenAI's ChatGPT 4.0 and Google's Bard are emblematic of the broader generative artificial intelligence advances. They have garnered substantial attention in academic, economical and policy making discourses. This paper aims to examine the intersection of LLMs chatbots with quantum science and technology, focusing on their potential to empower research methodologies and pedagogical approaches within these disciplines. It explores with many examples the capabilities of LLM-based tools by assessing their existing and potential future utility in various academic functions and in the industry. These range from facilitating basic question-and-answer interactions to more complex activities such as software development, writing scientific paper, scientific papers reviewing, experiments preparation, research ideation and fostering collaborative research practices in quantum science. The rapid evolution of LLMs and other related tools implementing various forms of so-far primitive reasoning suggests they have the potential to significantly alter the research and educational landscapes, similarly to the transformative impact of the Internet and its associated tools. Accordingly, this paper suggests the creation of a quantum science domain specific LLM based chatbot using open source models and scientific corpus. It also contextualizes LLM-based chatbots within the broader spectrum of machine learning technologies which are already used in the advancement of quantum science and technology. It then quickly explores how quantum computing might or might not further advance machine learning applications and language-based models. The conclusion is that AI may have a profound impact in shaping the trajectory of quantum science research, education, and technology developments while the other way around is quite uncertain, at least in the short to mid-term.

https://www.oezratty.net/wordpress/2024/ai-and-quantum-empower-each-other/



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