Grounded AI Study Recon

Research Prompt:

>

Contents

Search Results

Introduction to Superconductors

Search terms:

- *Definition of superconductors*
- *Properties of superconductors*

Search Term	Relevant Excerpt	Citation Source
Definition of superconductors	... Together, they offer a comprehensive guide to how the power of machine learning could help overcome challenges which have held back the creation of new technologies built with superconducting components. Superconductors are a unique group of lightweight materials which can generate strong magnetic fields and transfer or store large amounts of energy. They are also capable of conducting electricity with zero resistance, a property which sets them apart from all other conductive materials, which lose energy as heat when current flows through them. ...	University news - AI and big data roadmap ... - University of Glasgow
Definition of superconductors	A superconductor is a material that achieves superconductivity, which is a state of matter that has no electrical resistance and does not allow magnetic fields to penetrate. An electric current in a superconductor can persist indefinitely. ...	What is a superconductor? | Live Science
Definition of superconductors	Superconductivity ** arXiv:2305.03404** (cond-mat)...	[2305.03404] Charge-Density Waves vs. Superconductivity: Some ...
Properties of superconductors	The research is still going on to understand and utilise these extraordinary properties of superconductors in various fields of technology. Such properties of superconductors are listed below- Zero Electric Resistance (Infinite Conductivity) Meissner Effect: Expulsion of magnetic field Critical Temperature/Transition Temperature Critical Magnetic Field Persistent Currents Josephson Currents Critical Current Zero Electric Resistance or Infinite Conductivity In Superconducting state, the superconducting material shows the zero electric resistance (infinite conductivity)....	Properties of Superconductors | Electrical4U
Properties of superconductors	... However, if you want to cool huge parts & all the transmission wires within the plant to complete zero, probably you will waste more energy. Properties of Superconductor The superconducting materials show some amazing properties which are essential for current technology. The research on these properties is still going on to recognize and utilize these properties in various fields which are listed below. ...	Superconductor : Types, Materials, Properties and Its Applications
	... How does superconductivity work? When normally conductive elements and compounds with electromagnetic properties are	What is

Properties of superconductors	cooled to low temperatures, they display two important properties of superconductors: they present no resistance to an electric current, and they generate a magnetic field. Thus they enter a superconducting state....	superconductivity? – TechTarget Definition

Types of Superconductors

Search terms:

- *Conventional superconductors*
- *High-temperature superconductors*
- *Unconventional superconductors*

Search Term	Relevant Excerpt	Citation Source
Conventional superconductors	This is in contrast to unconventional superconductors, which do not. Conventional superconductors can be either type-I or type-II. Most elemental superconductors are conventional. Niobium and vanadium are type-II, while most other elemental superconductors are type-I. Critical temperatures of some elemental superconductors: Element T c (K) Al 1.20...	Conventional superconductor - Wikipedia
Conventional superconductors	This is in contrast to unconventional superconductors, which do not. Conventional superconductors can be either type-I or type-II. Most elemental superconductors are conventional....	Conventional superconductor - Wikipedia
Conventional superconductors	... The mechanism and physical basis for this change in state is not, at present, fully understood. Type 2 superconductors are typically metallic compounds and alloys. Discovery of the Superconductor Superconductivity was first discovered in 1911 when mercury was cooled to approximately 4 degrees Kelvin by Dutch physicist Heike Kamerlingh Onnes, which earned him the 1913 Nobel Prize in physics....	Superconductor Definition, Types, and Uses
High-temperature superconductors	... In 1986, scientists discovered a new class of copper-oxide materials that exhibited superconductivity, but at much higher temperatures than the metals and metal alloys from earlier in the century. These materials are known as high-temperature superconductors. While they still must be cooled, they are superconducting at much warmer temperatures-some of them at temperatures above liquid nitrogen (-321 degrees F)....	DOE Explains...Superconductivity | Department of Energy
High-temperature superconductors	... This discovery held the promise of revolutionary new technologies. It also suggested that scientists may be able to find materials that are superconducting at relatively high temperatures. Since then, many new high-temperature superconducting materials have been discovered using educated guesses combined with trial-and-error experiments, including a class of iron-based materials....	DOE Explains...Superconductivity | Department of Energy
	... In the case of cuprates and iron compounds, technical difficulties such as getting the right ratios of particular elements of particular elements during the synthesis of	

High-temperature superconductors	crystals of these novel superconducting materials present hurdles, both in time and efficacy. Currently, huge strides are being made to physically determine and actualize superconductors at even higher temperatures. Many elements and compounds like cuprates, graphene, metallic hydrogen, hydrates and hydrides are being tested for higher-temperature superconductivity. ...	Superconductivity: Past, Present and Future - ICJS - International ...
Unconventional superconductors	Unconventional superconductivity refers to superconductors where the Cooper pairs are not bound together by phonon exchange but instead by exchange of some other kind, e.g. spin fluctuations in a superconductor with magnetic order either coexistent or nearby in the phase diagram. Such unconventional superconductivity has been known experimentally since heavy fermion CeCu 2 Si 2 , with its strongly correlated 4f electrons, was discovered to superconduct below 0.6 K in 1979....	Unconventional superconductivity - NASA/ADS
Unconventional superconductors	... Title:Unconventional Superconductivity Authors:G. R. Stewart Download a PDF of the paper titled Unconventional Superconductivity, by G. R. Stewart Download PDF > Abstract: Conventional superconductivity, as used in this review, refers to > electron-phonon coupled superconducting electron-pairs described by BCS > theory. Unconventional superconductivity refers to superconductors where the > Cooper pairs are not bound together by phonon exchange but instead by > exchange of some other kind, e. g. spin fluctuations in a superconductor > with magnetic order either coexistent or nearby in the phase diagram. Such > unconventional superconductivity has been known experimentally since heavy > fermion CeCu2Si2, with its strongly correlated 4f electrons, was discovered > to superconduct below 0.6 K in 1979....	Unconventional Superconductivity
Unconventional superconductors	... (Good explanations of superconductivity and the latest news about room temperature superconductors and other advances in the field). Superconducting Magnets. Wikipedia, The Free Encyclopedia....	Superconductive magnet design - Questions and Answers in MRI

Current State of Superconductors

Search terms:

- *Breakthroughs in superconductivity research*
- *Recent advancements in superconductors*

Search Term	Relevant Excerpt	Citation Source
Breakthroughs in superconductivity research	... After they observed a cuprate superconducting at 30 kelvins, researchers soon found others that superconduct above 100, and then above 130 kelvins. The breakthrough launched a widespread effort to understand the tougher glue responsible for this "high-temperature" superconductivity. Perhaps electrons bunched together to create patchy, rippling concentrations of charge....	High-Temperature Superconductivity Understood at Last | Quanta ...
Breakthroughs in superconductivity research	... (Ginsberg, 2018; OpenStax College 'High-temperature Superconductors' n.d.) Despite the complicated science, investigations of superconductivity has gained traction. The discovery of the Meissner effect, which explores the magnetic properties of superconductors, by Walther Meissner and Robert Oschenfield sparked more interest in superconductivity....	Superconductivity: Past, Present and Future - ICJS - International ...
Breakthroughs in superconductivity research	... Researchers are now trying to find and develop superconductors that work at higher temperatures, which would revolutionize energy transport and storage. Who discovered superconductivity? The credit for the discovery of superconductivity goes to Dutch physicist Heike Kamerlingh Onnes....	What is a superconductor? | Live Science
Recent advancements in superconductors	... Superconductors have a wide variety of everyday applications, from MRI machines to super-fast maglev trains that use magnets to levitate the trains off the track to reduce friction. Researchers are now trying to find and develop superconductors that work at higher temperatures, which would revolutionize energy transport and storage. Who discovered superconductivity? ...	What is a superconductor? | Live Science
Recent advancements in superconductors	A team of South Korean researchers say the science fiction fantasy is closer to reality than ever before with what they claim is a revolutionary breakthrough in superconductors. The researchers published their findings July 22 - immediately sending the close-knit scientific community into a viral lather. ...	LK-99 superconductor research breakthrough could mark 'new era ...
	... Superconductors are characterized by the	

Recent advancements in superconductors	absence of any kind of resistance to the flow of electrons whatsoever. Since the discovery of superconductivity, research has identified many materials that can be turned into superconductors. However, the transition temperature varies for each material....	What is superconductivity? – TechTarget Definition

Applications of Superconductors

Superconducting Power Transmission

Search terms:

- *Advantages of superconducting power transmission*
- *Superconducting power cables*

Search Term	Relevant Excerpt	Citation Source
Advantages of superconducting power transmission	... Superconducting transmission lines are difficult to implement since it often costs more to fund and maintain the lines that the power companies lose in electrical losses in conventional lines. However, in the right settings the energy saved presents one possible advantage to using superconducting lines rather than the traditional transmission lines. (c) 2010 Matthew Yankowitz....	Superconducting Power Transmission
Advantages of superconducting power transmission	... For a standard 3-phase single-core cable run at 132kV full load, the total losses in a conventional transmission cable is estimated to be on the order of 30 to 40 W/m for each wire [3]. Superconducting Transmission Cables The obvious advantage of superconducting transmission lines is they have no resistive losses in the bulk. If superconducting transmission lines had no other sources of power dissipation, the choice between types of transmission lines would be easy....	Superconducting Power Transmission
Advantages of superconducting power transmission	... Many materials, both single elements and compound elements, have demonstrated high temperature superconductivity. This makes it easier and more cost-effective to employ superconductors in a variety of applications. A popular example of superconductivity is a cube or ball of metal floating above a superconductor....	What is superconductivity? – TechTarget Definition
	... Superconducting power cables will make it possible to expand the power grid in	

Superconducting power cables	critical areas without having to dig up half the city, says Anders Jensen, Chief Technology Officer in NKT. The superconducting power cables is extremely compact compared to conventional cable technology and can become a key enabler of the transition to renewable energy in urban areas due to the high power-to-size ratio. The SuperLink is expected to have a power rating of 500 MW and will be installed between two substations in Munich using existing ducts to keep the construction work at a minimum. ...	NKT is developing the prototype for the world's longest ...
Superconducting power cables	Cities will see the biggest increase in electricity demand, so finding ways to boost urban power supplies is a priority. Superconducting cables make it possible to transmit massive amounts of electricity in a very small space, making them the perfect candidate for congested urban grids. Our market-proven superconducting cables are transforming urban power....	Superconductivity - Nexans
Superconducting power cables	... The SuperLink is expected to have a power rating of 500 MW and will be installed between two substations in Munich using existing ducts to keep the construction work at a minimum. Facts: SuperLink Superconducting power cables enable power-dense transmission carrying a large amount of electric power in a very compact cable design	NKT is developing the prototype for the world's longest ...

Magnetic Resonance Imaging (MRI)

Search terms:

- *Benefits of superconducting MRI systems*
- *Superconducting magnets in MRI*

Search Term	Relevant Excerpt	Citation Source
Benefits of superconducting MRI systems	... Site preparation can frequently run into several $100,000s including room radiofrequency (RF) shielding, possible magnetic shielding, floor reinforcement, vibration mitigation and a very reliable uninterruptible power supply (UPS). Superconducting magnets at 1.5 T and above allow functional brain imaging, MR spectroscopy and superior SNR and/or improved time and spatial resolution. Magnets above 1.5 T have additional challenges from RF heating of the subject, and increased artifacts from susceptibility and RF penetration among others. ...	Magnets (types) | Radiology Reference Article | Radiopaedia.org
Benefits of superconducting MRI systems	... These devices are used in medical facilities to make images of organs and structures inside the body. Most MRIs generate a strong magnetic field using superconductors, which allow for the highest-quality imaging. By using MgB2 superconducting wire for MRI background coils, the company hopes to help MRI producers drive down the cost of MRIs....	Superconductors Enable Lower Cost MRI Systems | NASA Spinoff
Benefits of superconducting MRI systems	... That pressure is equivalent to the interior of giant planets like Jupiter, which makes it impractical for everyday applications. Room-temperature superconductors would allow for the electrical transmission of energy with no losses or waste, more efficient maglev trains, and cheaper and more ubiquitous use of MRI technology....	What is a superconductor? | Live Science
Superconducting magnets in MRI	... Essentially, any time you need a really strong magnetic field or electric current and don't want your equipment to melt the moment you turn it on, you need a superconductor. Superconductors allow the powerful electromagnets in MRI machines to work without melting the machine. (Image credit: Getty Images/ Thomas Barwick) "One of the most interesting applications of superconductors is for quantum computers,"	What is a superconductor? | Live Science

	said Alexey Bezryadin, a condensed matter physicist at the University of Illinois at Urbana-Champaign....	
Superconducting magnets in MRI	... They are also capable of conducting electricity with zero resistance, a property which sets them apart from all other conductive materials, which lose energy as heat when current flows through them. Superconductors are currently used in magnetic resonance imaging, or MRI, which has enabled major advances in medical and cancer diagnostics by creating detailed scans of the body. They have also underpinned promising advancements in particle accelerators, high-performance computing, energy storage and more. ...	University news - AI and big data roadmap ... - University of Glasgow
Superconducting magnets in MRI	... Technologically, wires opened whole new uses for superconductors, including wound coils to create powerful magnets. In the 1970s, scientists used superconducting magnets to generate the high magnetic fields needed for the development of magnetic resonance imaging (MRI) machines. More recently, scientists introduced superconducting magnets to guide electron beams in synchrotrons and accelerators at scientific user facilities. ...	DOE Explains...Superconductivity | Department of Energy

Quantum Computing

Search terms:

- *Superconducting quantum processors*
- *Superconducting qubits*

Search Term	Relevant Excerpt	Citation Source
Superconducting quantum processors	... We > also entangle up to 12 qubits in a GHZ state with $55.8 \pm 1.8\%$ fidelity, > which is above the genuine multipartite entanglement threshold of 1/2. These > results represent a viable modular approach for large-scale superconducting > quantum processors. Subjects: | Quantum Physics (quant-ph) \---|--- Cite as: | arXiv:2302.02751...	Low-loss interconnects for modular superconducting quantum ...
Superconducting quantum processors	... Title:Superconducting Quantum Computing: A Review Authors:He-Liang Huang, Dachao Wu, Daojin Fan, Xiaobo Zhu Download a PDF of the paper titled Superconducting Quantum Computing: A Review, by He-Liang Huang and 3 other authors Download PDF > Abstract: Over the last two decades, tremendous advances have been made for > constructing large-scale quantum computers. In particular, the quantum > processor architecture based on superconducting qubits has become the > leading candidate for scalable quantum computing platform, and the milestone > of demonstrating quantum supremacy was first achieved using 53 > superconducting qubits in 2019. In this work, we provide a brief review on > the experimental efforts towards building a large-scale superconducting > quantum computer, including qubit design, quantum control, readout > techniques, and the implementations of error correction and quantum > algorithms....	Superconducting Quantum Computing: A Review
Superconducting quantum processors	... Superconductors allow the powerful electromagnets in MRI machines to work without melting the machine. (Image credit: Getty Images/ Thomas Barwick) "One of the most interesting applications of superconductors is for quantum computers," said Alexey Bezryadin, a condensed matter physicist at the University of Illinois at Urbana-Champaign. Because of the unique properties of electrical currents in superconductors, they can be used to construct quantum computers. ...	What is a superconductor? | Live Science
Superconducting qubits	... "For example, the current in a superconducting loop can flow clockwise and counterclockwise at the same time. Such a state constitutes an example of a superconducting qubit. " What's the latest in superconductor research? ...	What is a superconductor? | Live Science

Superconducting qubits	... (Image credit: Getty Images/ Thomas Barwick) "One of the most interesting applications of superconductors is for quantum computers," said Alexey Bezryadin, a condensed matter physicist at the University of Illinois at Urbana-Champaign. Because of the unique properties of electrical currents in superconductors, they can be used to construct quantum computers. "Such computers are composed of quantum bits or qubits....	What is a superconductor? | Live Science
Superconducting qubits	... These materials also expel magnetic fields as they transition to the superconducting state. Superconductivity is one of nature's most intriguing quantum phenomena. It was discovered more than 100 years ago in mercury cooled to the temperature of liquid helium (about -452 degrees F, only a few degrees above absolute zero)....	DOE Explains...Superconductivity | Department of Energy

Particle Accelerators

Search terms:

- *Advancements in superconducting accelerator technology*
- *Superconducting magnets in particle accelerators*

Search Term	Relevant Excerpt	Citation Source
Advancements in superconducting accelerator technology	... Researchers in biology, chemistry and physics will use LCLS-II to probe fundamental pieces of matter, creating 3-D movies of complex molecules in action, making LCLS-II a powerful, versatile instrument at the forefront of discovery. The project is coming together thanks largely to a crucial advance in the fields of particle and nuclear physics: superconducting accelerator technology. DOE's Fermilab and Thomas Jefferson National Accelerator Facility are building the superconducting modules necessary for the accelerator upgrade for LCLS-II. ...	A million pulses per second: How particle accelerators are powering ...
Advancements in superconducting accelerator technology	... However, widespread use of accelerators is limited by their cost, size, and dependence on complex support systems. Scientists are overcoming these limitations with new advances in accelerator technology. These advances include new approaches to SRF design....	New Prototype Advances Particle Accelerators for Industry and ...
	... This deeper understanding will pave the way for scientists to create better drugs.	

Advancements in superconducting accelerator technology	Scientists also intend to use LCLS-II to research superconductors, bringing the machine's use of accelerator technology full circle. Current superconductors are limited by their need for specific, low temperatures....	A million pulses per second: How particle accelerators are powering ...
Superconducting magnets in particle accelerators	and energy-efficient rapid cycling magnets for particle accelerators are critical for particle physics research. Their performance determines how frequently a circular particle accelerator can receive a bunch of particles, propel them to higher energy, send them to an experiment or target station, and then repeat all over again. ...	Particle accelerator magnet sets record using high-temperature ...
Superconducting magnets in particle accelerators	... In the 1970s, scientists used superconducting magnets to generate the high magnetic fields needed for the development of magnetic resonance imaging (MRI) machines. More recently, scientists introduced superconducting magnets to guide electron beams in synchrotrons and accelerators at scientific user facilities. In 1986, scientists discovered a new class of copper-oxide materials that exhibited superconductivity, but at much higher temperatures than the metals and metal alloys from earlier in the century....	DOE Explains...Superconductivity | Department of Energy
	... However, because superconductors have no electrical resistance, no heat is generated, and the electromagnets can generate the necessary magnetic fields. Similar	

Superconducting magnets in particle accelerators	superconducting electromagnets are also used in maglev trains, experimental nuclear fusion reactors and high-energy particle accelerator laboratories. Superconductors are also used to power railguns and coilguns, cell phone base stations, fast digital circuits and particle detectors. ...	What is a superconductor? | Live Science

Conclusion

Search terms:

- *Challenges in superconductivity research*
- *Future prospects of superconductors*

Search Term	Relevant Excerpt	Citation Source
Challenges in superconductivity research	... The materials included several metals and an alloy of niobium and titanium that could easily be made into wire. Wires led to a new challenge for superconductor research. The lack of electrical resistance in superconducting wires means that they can support very high electrical currents, but above a "critical current" the electron pairs break up and superconductivity is destroyed....	DOE Explains...Superconductivity | Department of Energy
Challenges in superconductivity research	... " What's the latest in superconductor research? The first challenge for today's researchers is "to develop materials that are superconductors at ambient conditions, because currently superconductivity only exists either at very low temperatures or at very high pressures," said Mehmet Dogan, a postdoctoral researcher at the University of California, Berkeley. The next challenge is to develop a theory that explains how the novel superconductors work and predict the properties of those materials, Dogan told Live Science in an email. ...	What is a superconductor? | Live Science
Challenges in superconductivity research	... In the future, new superconductor technologies could also create breakthroughs in wind power generation, fusion energy, electric and hydrogen-powered transport, and aerospace applications helping the world achieve net-zero. However, a series of tough challenges have so far prevented the widespread adoption and commercialisation of superconducting technology across the full spectrum of industries. Aside from MRIs, there are currently very few superconducting devices in commercial use, with many still confined to research facilities. ...	University news - AI and big data roadmap ... - University of Glasgow
Future prospects of superconductors	... It supposedly superconducts at room temperature under a pressure of merely ten thousand atmospheres. In theory, this is	A superconductor "breakthrough" raises

	another major step toward a practical superconductor. Yet the announcement was met with skepticism rather than acclaim. ...	serious doubts - Big Think
Future prospects of superconductors	Superconductors offer enormous technical and economic promise for applications such as high-speed hovertrains, MRI machines, efficient power lines, quantum computing, and other technologies. However, their usefulness is limited since superconductivity requires extremely low temperatures....	Superconductor Breakthrough: Scientists Discover an Invisible ...
Future prospects of superconductors	... Even though a complete understanding of the quantum mechanism is yet to be discovered, scientists have found ways to enhance superconductivity (increase the critical temperature and critical current) and have discovered many new families of high-temperature superconducting materials. Each new superconducting material offers scientists an opportunity to get closer to understanding how high-temperature superconductivity works and how to design new superconducting materials for advanced technological applications. Superconductivity Facts Superconductivity was discovered in 1911 by Heike Kamerlingh-Onnes....	DOE Explains...Superconductivity | Department of Energy