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WIRELESS CHARGING

Various brands are now making some high-end Mag Safe-compatible chargers. While some brands have succeeded in it, others are still struggling to find their way through it.

Details

MagSafe and How it Works

Wireless Charger/Power Bank: MagSafe is a technology introduced by Apple that combines a wireless charger with a power bank. It is designed to work seamlessly with devices that support wireless charging, such as iPhones.

Magnetic Connection: MagSafe utilizes a magnetic connection between the charger and the back of the compatible mobile phone, ensuring a secure and efficient charging process.

How MagSafe Works:

Device Compatibility: MagSafe chargers are specifically designed for devices that support wireless charging, such as the iPhone 12 and above models.

Magnetic Alignment: The MagSafe charger attaches to the back of the mobile phone through magnets. These magnets ensure a precise alignment between the charger and the device, optimizing the charging efficiency.

Circuit Completion: Once attached, the magnets on the MagSafe charger complete a circuit with the magnetic components on the back of the mobile

phone. This enables the flow of electric current between the charger and the device, initiating the charging process.

Charging Mechanism:

Wireless Charging: The wireless charging feature relies on the magnetic connection and alignment to transfer power from the MagSafe charger to the device.

Wired Charging: Some MagSafe power banks, like the Ambrane model mentioned, offer both wireless and wired charging options. Wired charging provides higher charging speeds.

Advantages of MagSafe:

Efficient Charging: The magnetic alignment ensures efficient power transfer.

Secure Connection: Strong magnetic hold prevents accidental detachment.

Compact Design: MagSafe power banks offer high capacity in a compact form factor.

Considerations:

Device Limitations: MagSafe chargers are primarily compatible with specific devices that support wireless charging.

Brand Variations: Various brands produce MagSafe-compatible chargers with differences in design, features, and pricing.

About Wireless Charging

Wireless charging is a technology that allows devices to charge without the need for physical cables.

It has gained significant popularity in recent years as a convenient and efficient method for powering up various electronic devices.

Principles of Wireless Charging:

Wireless charging is based on the principles of electromagnetic induction and resonance.

When an electric current passes through a coil in the charging pad (transmitter), it generates an electromagnetic field.

Placing a compatible device with a receiving coil near the pad allows the energy to be transferred wirelessly and converted back into electric current to charge the device.

Electromagnetic Induction:

Faraday's Law: Wireless charging relies on Faraday's law of electromagnetic induction, formulated by Michael Faraday. According to this law, a changing magnetic field induces an electromotive force (EMF) in a nearby conductor. In wireless charging, the transmitter coil generates a varying magnetic field, inducing an EMF in the receiver coil, initiating the flow of electric current.

Maxwell's Equations: James Clerk Maxwell's equations describe the behavior of electric and magnetic fields. The interplay of these fields is crucial in understanding the propagation and reception of electromagnetic waves, forming the basis for wireless charging

Resonant Inductive Coupling:

Resonance Frequency: Resonant inductive coupling involves tuning the frequencies of the transmitter and receiver coils to be closely matched. This resonance enhances the efficiency of power transfer. The system resonates at a specific frequency, allowing for optimal energy transfer between the coils.

Coupling Coefficient: The coupling coefficient, representing the degree of energy transfer between coils, is a critical parameter. Higher coupling coefficients result in more effective power transmission.

Wireless Power Transfer (WPT) Efficiency:

Ohmic and Eddy Current Losses: In the process of wireless power transfer, energy is dissipated due to ohmic losses in the coils and eddy current losses in surrounding materials. Optimizing the design of coils and using materials with minimal electrical resistance helps enhance efficiency.

Quality Factor (Q Factor): Q factor is a measure of the efficiency of resonant circuits. In wireless charging, a higher Q factor indicates lower energy losses during the transfer process.

Quantum Mechanics Aspects:

Quantum Inductance: At the quantum level, the concept of quantum inductance becomes relevant. It describes the response of a superconducting loop to changes in magnetic flux, which can be applied to the design of superconducting coils for more efficient wireless charging.

Quantum Tunneling: Quantum tunneling effects may influence the behavior of electrons in the coils, impacting the overall efficiency of wireless charging systems.

Material Science:

Magnetic Materials: The choice of materials for the coils is crucial. Soft magnetic materials with high permeability help in concentrating and directing the magnetic flux, improving the efficiency of energy transfer.

Dielectric Materials: Dielectric materials are used to insulate and separate the coils. Understanding the dielectric properties of materials aids in minimizing energy losses due to capacitance effects.

Electromagnetic Field Theory:

Hertzian Waves: The wireless charging process involves the generation of Hertzian waves, which are electromagnetic waves named after Heinrich Hertz. These waves propagate through space and are essential for the wireless transfer of energy.

Antenna Theory: The principles of antenna theory are relevant, especially in RF and microwave wireless charging technologies, where transmitting and receiving antennas play a crucial role in energy transfer.

Wireless Charging Technologies:

There are several wireless charging technologies, including:

Qi Wireless Charging: Qi is the most widely adopted standard, used by many smartphones and other devices. It operates through electromagnetic induction.

Resonant Wireless Charging: This technology uses resonant inductive coupling, allowing for greater spatial freedom and efficiency.

Radio Frequency (RF) Wireless Charging: Uses radio frequency signals to transfer power wirelessly.

Microwave Wireless Charging: Employs microwaves to transmit power over longer distances.

Components of Wireless Charging System:

Transmitter (Charging Pad): Generates the electromagnetic field.

Receiver (Device): Contains the coil to receive the energy and convert it into electric current.

Power Management System: Controls the power flow to optimize charging efficiency.

Applications of Wireless Charging:

Smartphones and Tablets: Many modern smartphones and tablets support wireless charging.

Wearables: Smartwatches, fitness trackers, and other wearables often utilize wireless charging.

Electric Vehicles (EVs): EVs can be charged wirelessly using inductive charging pads embedded in parking spaces.

Medical Devices: Wireless charging is used in various medical devices, including implants and wearable health monitors.

Advantages of Wireless Charging:

- **Convenience:** No need for physical cables.
- **Efficiency:** Advanced systems minimize energy loss during transmission.
- **Durability:** Reduced wear and tear on charging ports.
- **Reduced E-Waste:** As wireless charging becomes more common, it may contribute to reducing the need for disposable charging cables, potentially decreasing electronic waste.

Challenges and Considerations:

- **Efficiency Loss:** Some energy is lost during wireless transmission.
- **Compatibility:** Not all devices support wireless charging.
- **Cost:** Wireless charging components can add to the cost of devices.

TIDAL DISRUPTION EVENTS

In a collaborative effort between Syracuse University, the University of Leeds, and high school students in Syracuse, researchers are unraveling the mysteries of supermassive black holes (SMBHs) through the study of Tidal Disruption Events (TDEs).

TDEs provide a unique opportunity to probe dormant galactic centers, shedding light on the properties of both the engulfed stars and the massive black holes.

Details

Analytical Models:

Accretion Rate Analysis: Understanding the properties of stars and supermassive black holes involves calculating the accretion rate during TDEs, which provides key signatures of their masses.

Computational Efficiency: Analytical models, such as the "frozen-in" approximation, offer efficient ways to estimate accretion rates. The CN22 model, introduced in 2022, presents a novel analytical approach that aims to provide more accurate predictions.

Tidal Disruption Events

Definition: Tidal Disruption Events (TDEs) occur when a star ventures too close to a supermassive black hole (SMBH) or a compact object, experiencing intense tidal forces that tear it apart.

Discovery: First proposed by Rees in 1988, TDEs gained prominence with the advent of sensitive observational tools in the 21st century.

- **Rarity and Detection:** While TDEs are predicted to happen once every 10,000 to 100,000 years in a given galaxy, technological advancements, including upcoming observatories like the Vera C. Rubin Observatory, are expected to significantly increase the number of detected TDEs.

How They Work:

- **Black Hole Observation Challenge:** Black holes, being devoid of their own light, are challenging to observe directly. However, when a star comes into close proximity to a supermassive black hole, the tidal forces tear it apart, creating a luminous accretion disk as it spirals into the black hole.
- **Tidal Forces:** When a star passes within the tidal radius of a massive object, gravitational forces exerted on the near and far sides of the star vary significantly, causing tidal stretching.
- **Tidal Radius:** The critical distance from the massive object at which tidal forces overcome the star's self-gravity, leading to disruption.

Observational Signatures:

- **Flares of Light:** As the stellar debris falls towards the accreting object, it forms an accretion disk, emitting copious amounts of radiation across the electromagnetic spectrum.
- **X-ray and UV Emission:** High-energy X-rays and ultraviolet radiation characterize TDEs, making them detectable by space-based observatories such as Swift and Chandra.
- **Transient Events:** TDEs are transient phenomena, typically observable for several months to years, distinguishing them from constant sources.

Properties of TDEs:

- **Luminosity Variability:** TDEs exhibit a diverse range of luminosity profiles over time, influenced by factors like the black hole mass, accretion rate, and the star's composition.
- **Spectral Evolution:** Changes in the spectra of TDEs provide insights into the composition of the disrupted star and the accretion processes at play.

TDEs as Probes of Black Holes:

- **Black Hole Mass Estimates:** The study of TDEs allows astronomers to estimate the mass of the accreting black hole, providing valuable information about the demographics of SMBHs in distant galaxies.
- **Spin and Tilt:** Observations of TDEs can reveal information about the spin and tilt of black holes, contributing to our understanding of their formation and evolution.

Multi-messenger Astronomy:

Gravitational Waves: The potential simultaneous detection of gravitational waves and electromagnetic signals from TDEs opens new avenues for multi-messenger astronomy, providing complementary information.

SUBIKA PAINTINGS

The Subika Paintings of Manipur hold profound cultural significance, yet they face the threat of extinction due to neglect.

Details

Subika Paintings, intricately linked to the Meitei community's cultural history, are portrayed in six surviving manuscripts: Subika, Subika Achouba, Subika Laishaba, Subika Choudit, Subika Cheithil, and Thengrakhel Subika.

Experts estimate the existence of Subika paintings since the 18th or 19th century.

Key points about Subika Laishaba, a significant manuscript in this tradition

Cultural Motifs and Composition:

Subika Laishaba's paintings compose cultural motifs influenced by pre-existing features and cultural worldviews.

Visual language includes elements such as lines, shapes, forms, colors, and patterns, creating a unique composition.

Authentic Continuation of Tradition:

Subika Laishaba is considered a direct and authentic continuation of the Meitei cultural tradition, portraying visual images with cultural significance, meaning, and values.

Illustrations and Manuscript Materials:

The visual images in Subika Laishaba are painted on handmade paper, showcasing the indigenous preparation of materials.

The manuscript's materials include handmade paper or tree barks, demonstrating the rich heritage of manuscript painting.

Visual Language and Cultural Motifs:

Visual language in Subika Laishaba utilizes lines, shapes, forms, and colors to express cultural motifs.

Cultural values are embedded in the visual language, representing the Meitei community's identity.

Frame and Floral Motifs:

Illustrations are enclosed within a frame, consisting of two parallel Indian-red color lines.

Floral motifs are present at intersections, outlined with Indian-red color, filled with yellow-ochre, and featuring a black color dot.

Scheme for Rebate of State and Central Taxes and Levies (RoSCTL)

The Union Cabinet, led by Prime Minister Shri Narendra Modi, has approved the **extension of the Scheme for Rebate of State and Central Taxes and Levies (RoSCTL)** for the export of Apparel/Garments and Made-ups until March 31, 2026.

Scheme for Rebate of State and Central Taxes and Levies (RoSCTL)

Introduced on **March 7th2019,** this scheme aims to provide support to exporters selling textile internationally.

Eligibility:

Merchants or manufacturer-exporters directly exporting garments and apparel manufactured in India qualify for the RoSCTL scheme.

Entities **listed in the 'Denied Entity List of DGFT' cannot avail scheme benefits.**

An exporter can only avail RoSCTL benefits if they haven't utilized the RoDTEP scheme.

Implementation:

RoSCTL is implemented by the Department of Revenue, featuring end-to-end digitization for transferrable Duty Credit Scrip maintained in the customs system.

Benefits:

Enables exporters to reduce logistics and other costs, enhancing competitiveness in global markets.

Provides rebates on both State and Central taxes and

Tradeable Scrips:

Exporters receive Duty Credit Scrips for embedded taxes, which can be traded. These scrips can be utilized to pay basic customs duty for importing equipment, machinery, or other inputs.

Rebates under RoSCTL Scheme:

Eligible exporters receive rebates at rates specified by the Ministry of Textiles, aligned with State and Central taxes and levies for clothing and made-ups.

Central taxes eligible for refund include central excise duty on transportation fuel, embedded CGST, and compensation cess on coal production for electricity.

Refundable state taxes encompass VAT on transportation fuel, Mandi tax, duty of electricity, and embedded SGST on inputs for raw cotton production.

Restrictions on Rebate:

Ineligible goods for RoSCTL include those exported through trans-shipment, subject to minimum support price or export duty, deemed goods under Foreign Trade Policy, and goods manufactured in Special Economic Zones.

Goods taken into use after manufacturing or reconditioning, those not claimed in a shipping bill, or those from Domestic Tariff Areas to Special Economic Zones are ineligible.

Documents Required for RoSCTL Scheme:

- Importer Exporter Code (IEC)
- Shipping bills
- Digital signature certificate
- DGFT registration

RoDTEP Scheme:

Launch: Introduced in January 2021, RoDTEP replaced the MEIS Scheme, aligning with WTO compliance requirements. The scheme aims to neutralize

costs on exported goods by providing rebates on hidden central, state, and local duties, levies, and taxes.

Features:

Refunds SMEs for hidden costs in inputs for exported products, encouraging small exporters with duty scrips.

Addresses added-on GST in production and distribution, enhancing global competitiveness.

Refunds previously non-refundable duties and taxes, including those on electricity, Mandi Tax, Municipal Tax, VAT, Excise Duty, and more.

Emphasizes automation and digitization for quick and efficient processing of refunds.

Eligibility: The scheme covers 10,342 export items, including textiles and apparel, with detailed tariff lines accessible through the DGFT's website.

Wheat Blast

Researchers who have modeled for the first time how wheat blast will spread in the future found the fungal disease could reduce global wheat production by 13% until 2050.

About Wheat Blast:

Wheat blast, **caused by** the plant **fungus Magnaporthe oryzae**, is a fast-acting, **severe disease of wheat** that **causes bleaching of the heads**.

Magnaporthe oryzae **can infect many grasses**, including barley, lolium, rice, and wheat, **but specific isolates** of this pathogen **generally infect limited species**; that is, **wheat isolates infect preferably wheat plants** but can use several more cereal and grass species as alternate hosts.

It **spreads through infected seeds, crop residues,** and **spores** that can travel long distances in the air.

It **thrives in warm and humid conditions**, making regions with such climates particularly susceptible.

The pathogen is also **resistant to fungicides**.

The seriousness of the disease is indicated by the fact that **crops are burnt to avoid this disease.**

Effects:

It causes progressive **bleaching of the heads, lower yields,** and **poor seed quality**.

Stems and leaves are discoloured, with dark brown, eye-shaped lesions on leaves.

Sometimes **dark grey spores** can be seen.

It can **shrivel and deform the grain** in less than a week from the first symptoms.

History of the Outbreak:

First found in Brazil in 1985, it spread quickly through South America, infecting around three million hectares of wheat within a decade.

In 2016, it made it across to Bangladesh, and **in 2020**, it was **confirmed in Africa**, in crops in Zambia.