

MADMAX

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MADMAX Latest News

The MADMAX collaboration has published the first results of its search for dark photons using a prototype detector.

What is MADMAX?

- **MADMAX** stands for **Magnetised Disk and Mirror Axion Experiment**.
- It is a **research initiative** designed to detect **dark matter candidates** such as **axions** and **dark photons**.
- The **detector** consists of a **stack of dielectric (sapphire) disks** and a **reflective mirror**, forming a **resonator system**.

What are Dark Photons?

- **Dark photons** are **hypothetical particles** similar to **photons (light particles)** but with **mass**.
- They are proposed components of **galactic dark matter halos**.
- Under specific conditions, **dark photons** can **convert into ordinary photons**, with the **frequency of conversion** depending on the **mass of the dark photon**.

How does the MADMAX Detector Work?

- The **core detection mechanism** involves boosting the **conversion of dark photons to microwave photons**.
- This is achieved using a **resonator** composed of **parallel dielectric disks** that enhance conversion probabilities.
- A **curved mirror** focuses the resulting **microwave signals** into a **horn antenna** that connects to a **microwave receiver**.

Key Features of the MADMAX Setup

- **Resonators larger than the wavelength** of expected dark photon signals, enabling detection at **higher frequencies** (~20 GHz).
- Ability to **tune resonance frequencies** by **adjusting disk positions**, thereby expanding the **mass range coverage**.
- **Signal identification** relies on detecting a **narrow peak** in **Fourier space** that stands out from **thermal noise**.

Experimental Findings

- The **first prototype run** did **not detect dark photon signals**.
- However, the **instrument functioned successfully**, detecting signals with a **sensitivity three orders of magnitude** better than prior methods.
- This run covered a **previously unexplored range of parameters** in just one experiment.

MADMAX FAQs

Q1: What are axions?

Ans: Axions are hypothetical elementary particles proposed to solve the strong CP problem in quantum chromodynamics (QCD).

Q2: Why are axions significant in physics?

Ans: They are strong candidates for cold dark matter, which is believed to make up most of the universe's mass.

Q3: What are dark photons?

Ans: Dark photons are theoretical particles that may mediate interactions in the dark matter sector, similar to how regular photons mediate electromagnetic interactions.

Source: **PHY**

Source: <https://vajiramandravi.com/current-affairs/madmax/>

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