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Getting to Know DARK MATTER

The University of Oregon Science Comics Fellowship Program

Our Earth is made up of matter known as “baryonic matter”, such as protons, neutrons, and electrons.

Our Sun and the other planets are also composed of baryons.


Our Sun is just one star out of billions of stars in the Milky Way,
and the Milky Way is just one of billions of galaxies in our Universe.

We can measure the mass of all of this known baryonic matter through various cosmological measurements.

However, this baryonic matter only makes up about 20% of the matter in the Universe.

total amount of matter

What is this missing piece?

Scientists believe that it could be a type of matter known as

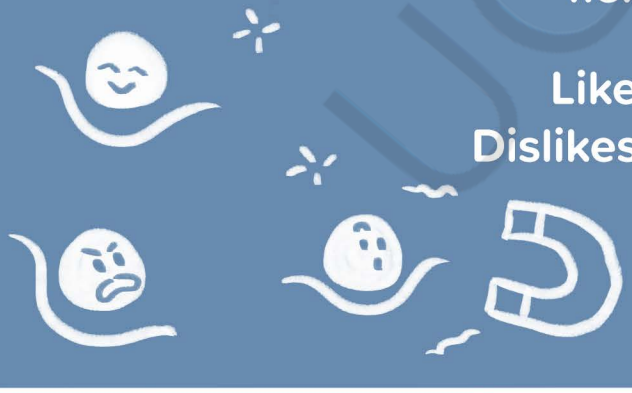
DARK MATTER

There are a few candidates for the identity of dark matter...

AXION

Axions were originally proposed to solve an orthogonal problem in particle physics, known as the strong-CP problem, but turned out to also be a good dark matter candidate. The axion's existence was postulated in 1977 by Roberto Peccei and Helen Quinn.

They can be produced in stars, resulting in a new way for stars to lose energy. Axions also convert to photons in the presence of a magnetic field and vice versa.



Likes: collective action

Dislikes: magnetic fields, light

WIMP

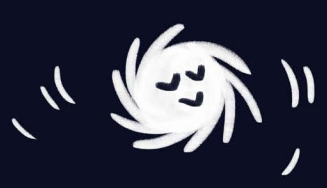
WEAKLY INTERACTING MASSIVE PARTICLE

WIMPs were first proposed as dark matter in the early 1980s. They have dominated the world of dark matter for the last several decades, but more recently interest has turned towards alternate candidates.
WIMPs gained popularity due to the “WIMP miracle”, a set of parameters (including mass and coupling strength) that give predictions that match the observed abundance of dark matter. WIMPs also occur naturally in models of supersymmetry.

Likes: miracles !
Dislikes: xenon and light

PRIMORDIAL BLACK HOLE

They originate from gravitational collapse of density fluctuations in the early Universe (less than one second after the Big Bang).
First proposed in 1966 by Zel'dovich and Novikov, the theory was elaborated on by Hawking in 1971.
They can be very light, 100,000 times less than a paperclip, but to be dark matter they must be heavier than 10^11 kg (any lighter and they would evaporate in the lifetime of the universe due to Hawking radiation).

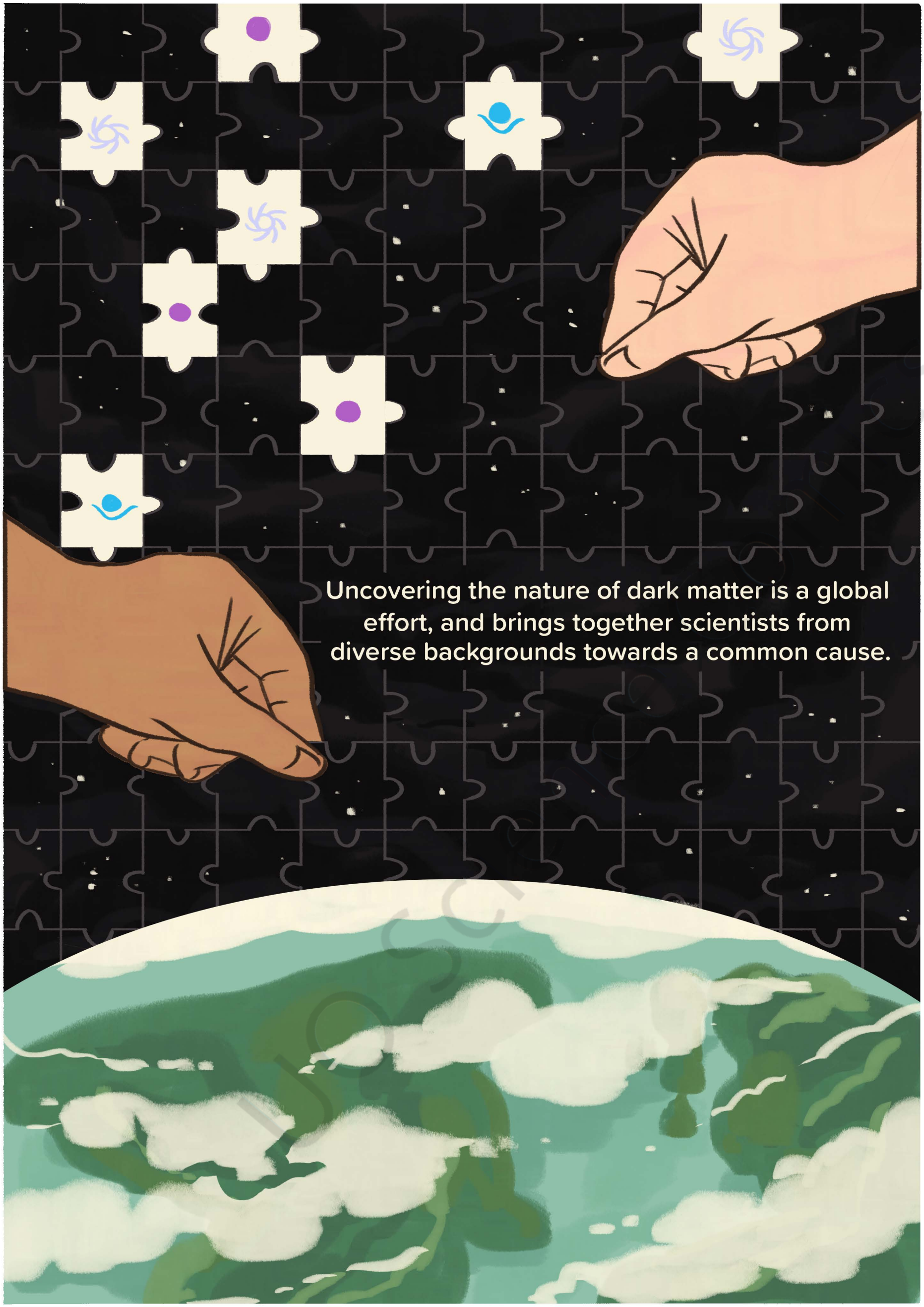


Likes: bending space time
Dislikes: photons/light

Scientists can search for dark matter using large underground detectors,

accelerators,
colliders,

and telescopes.


Uncovering the nature of dark matter is a global effort, and brings together scientists from diverse backgrounds towards a common cause.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This collective work may one day teach us what makes up the majority of our Universe.