




- JCP HEP School 1st Lecture

Introduction to Dark Matter and Indirect Detection

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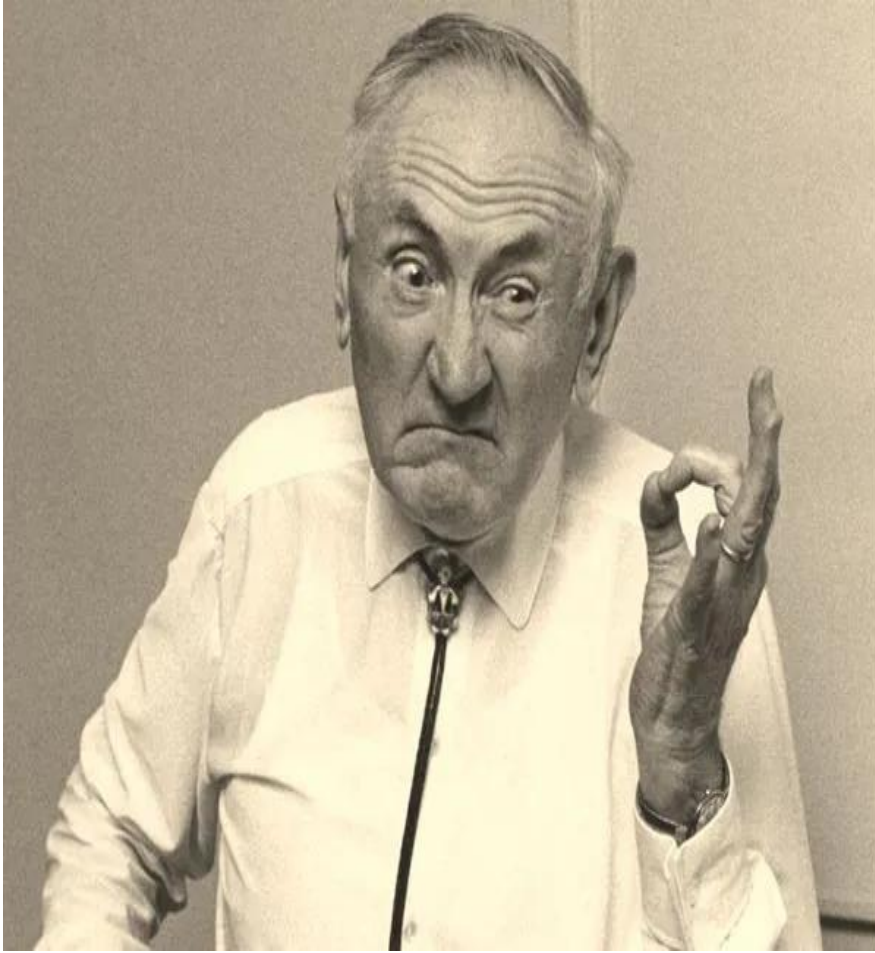
NASA, ESA, and J. Lotz and the HFF Team (STScI)

A deep field image from the Hubble Frontier Fields project, showing a vast number of galaxies in various shapes and sizes, including spiral, elliptical, and irregular forms, set against a black background. The image is a composite of multiple exposures, showing galaxies at different distances and orientations. Some galaxies are bright and clear, while others are faint and distant. The overall effect is a dense field of cosmic objects.

Contents

1. What is Dark Matter and Why must it exist?
2. Thermal Relics and the WIMP Paradigm
3. Limitations of WIMP and Currents Status
4. Dark Matter Indirect Detection

What is Dark Matter?

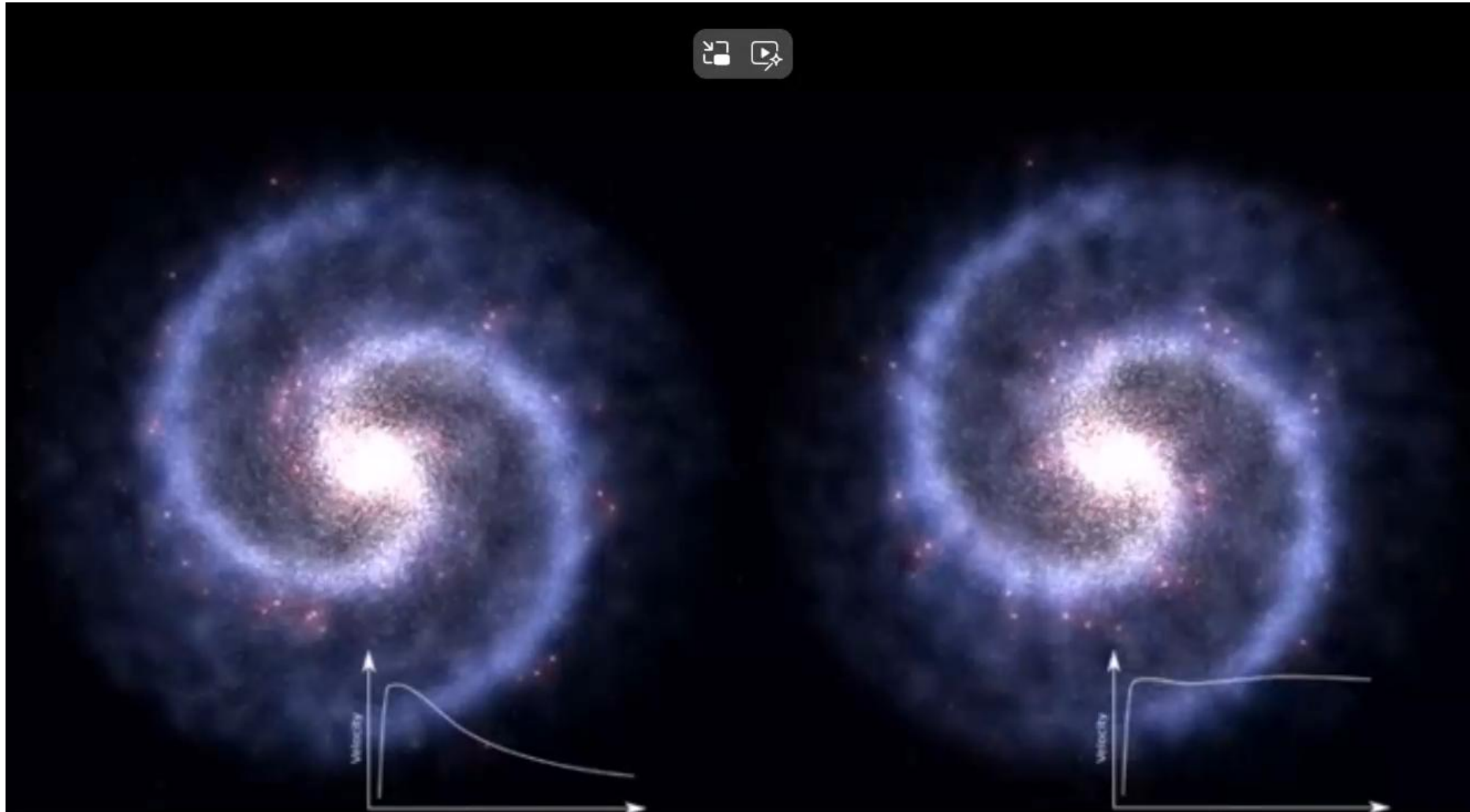


Fritz Zwicky - Nick D'Alto, Smithsonian magazine



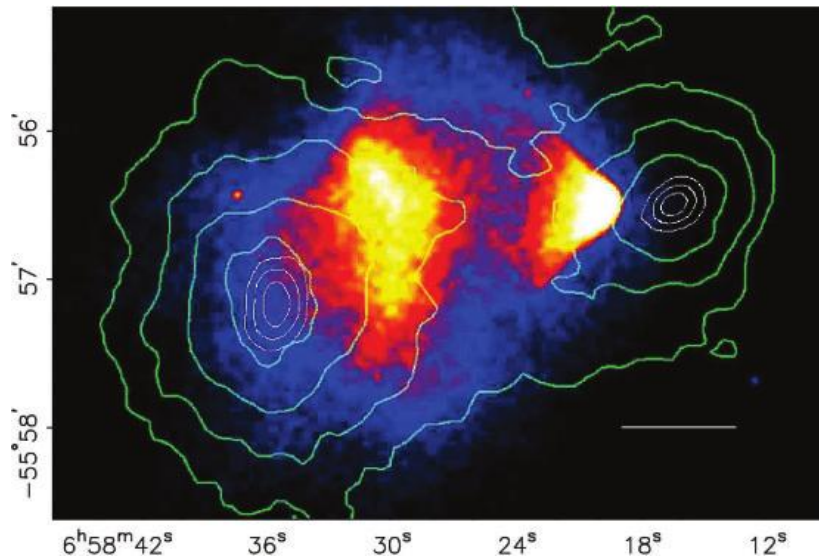
Coma cluster - Estonia

Galaxy rotation curve



Bullet Cluster

NASA's James Webb Space Telescope NIRCam



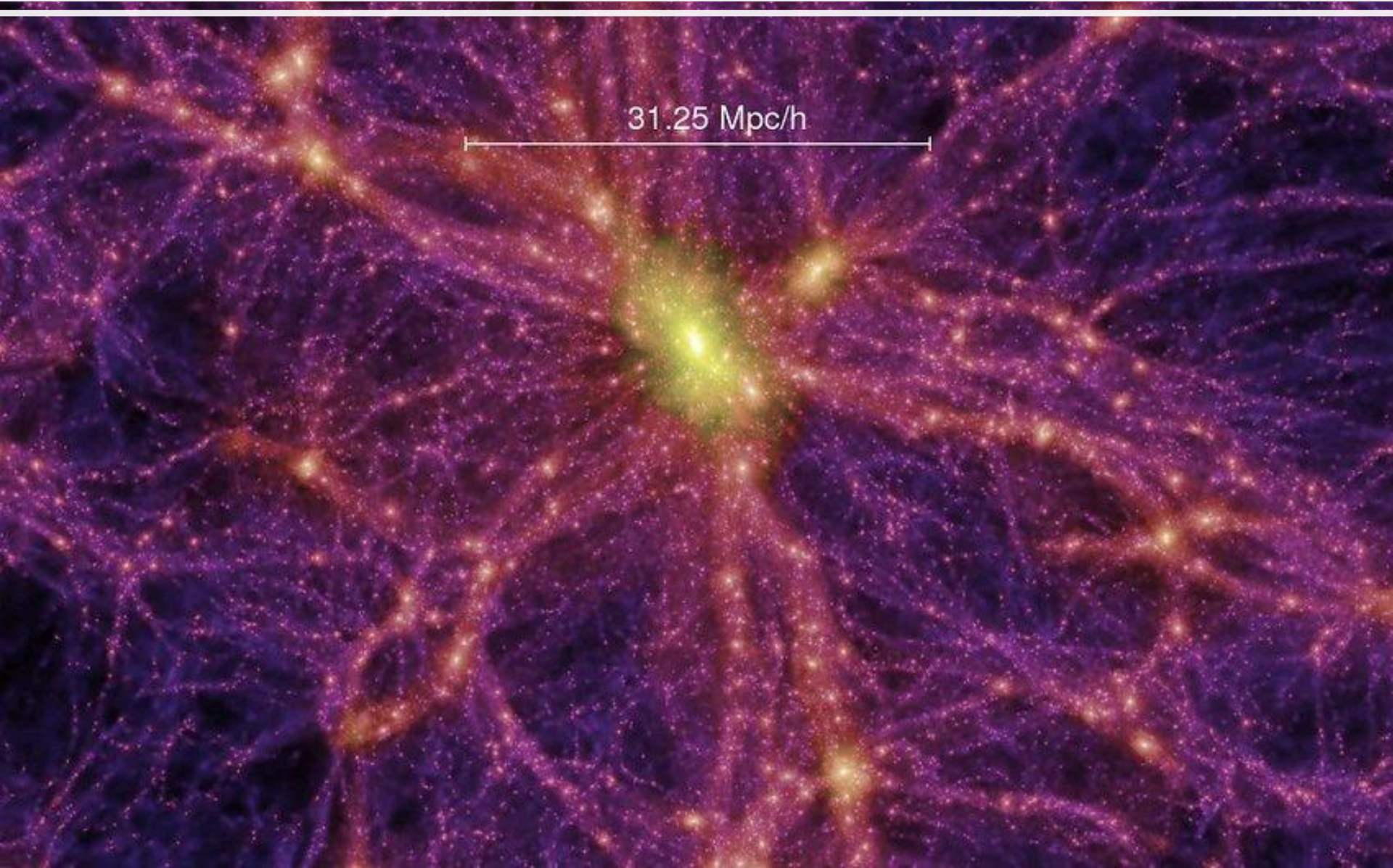
NONBARYONIC DARK MATTER IN COSMOLOGY, Del Popolo



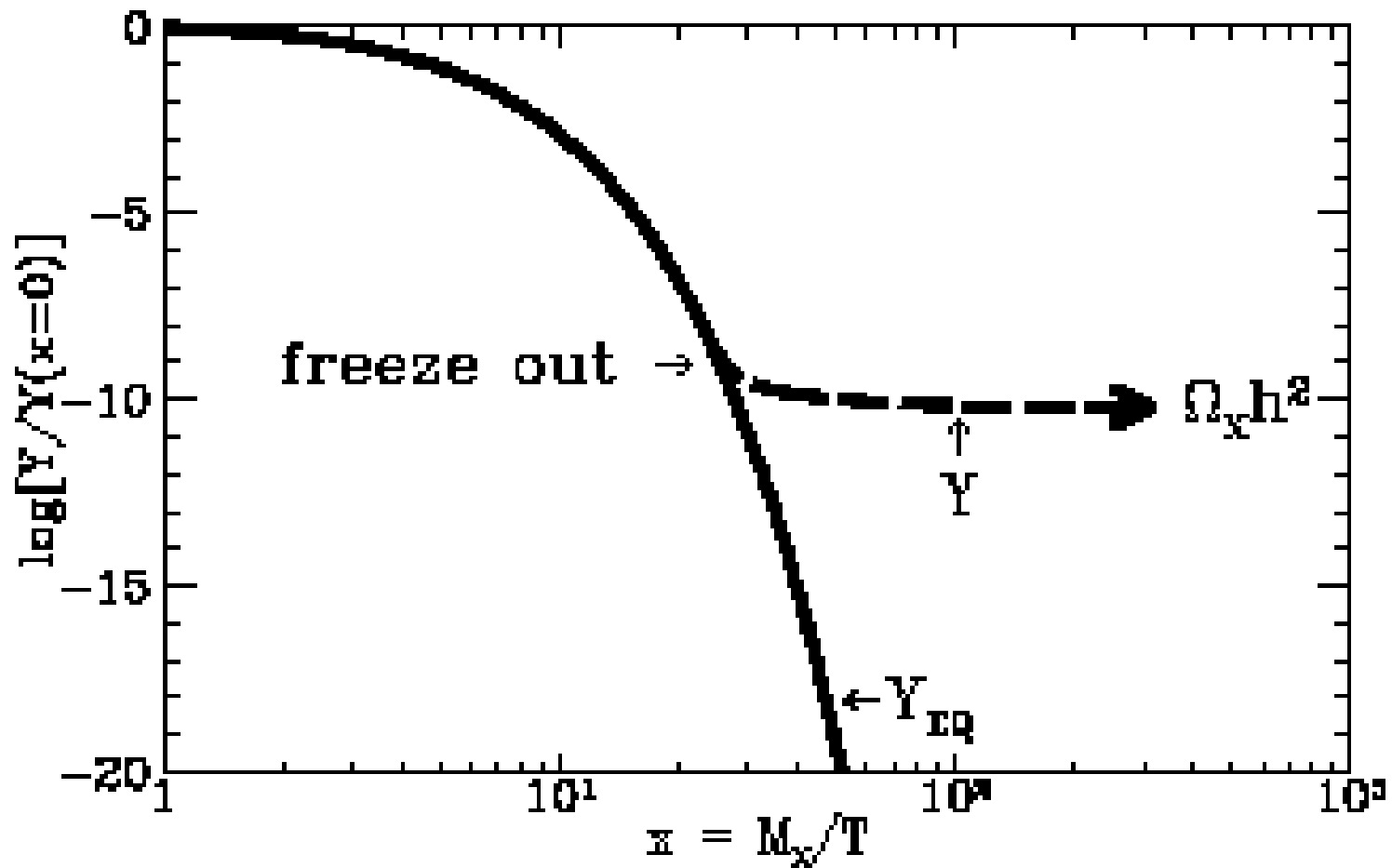
VERITAS Dark Matter search in dwarf spheroidal galaxies: an extended analysis, Chiara Giuri

Large Scale Structure

The Virgo consortium, German Astrophysical Virtual Observatory

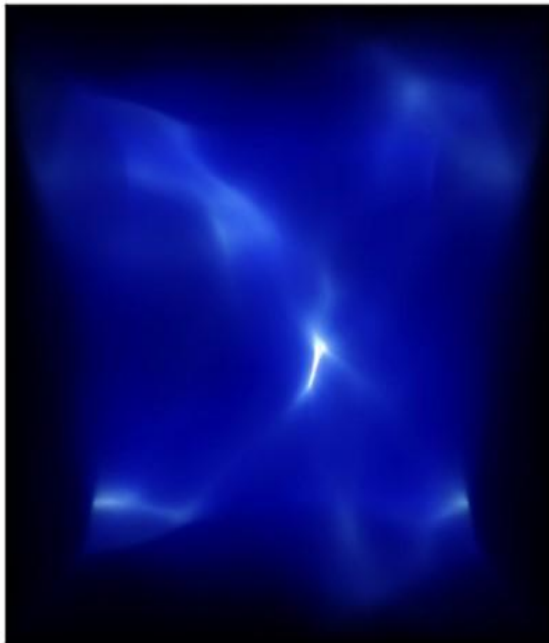


Thermal freeze-out



LSS with HDM, WDM, CDM

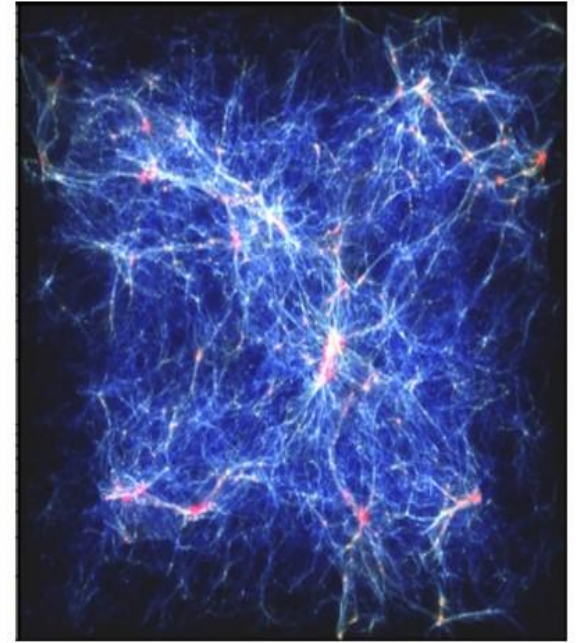
HDM : 0.1 keV

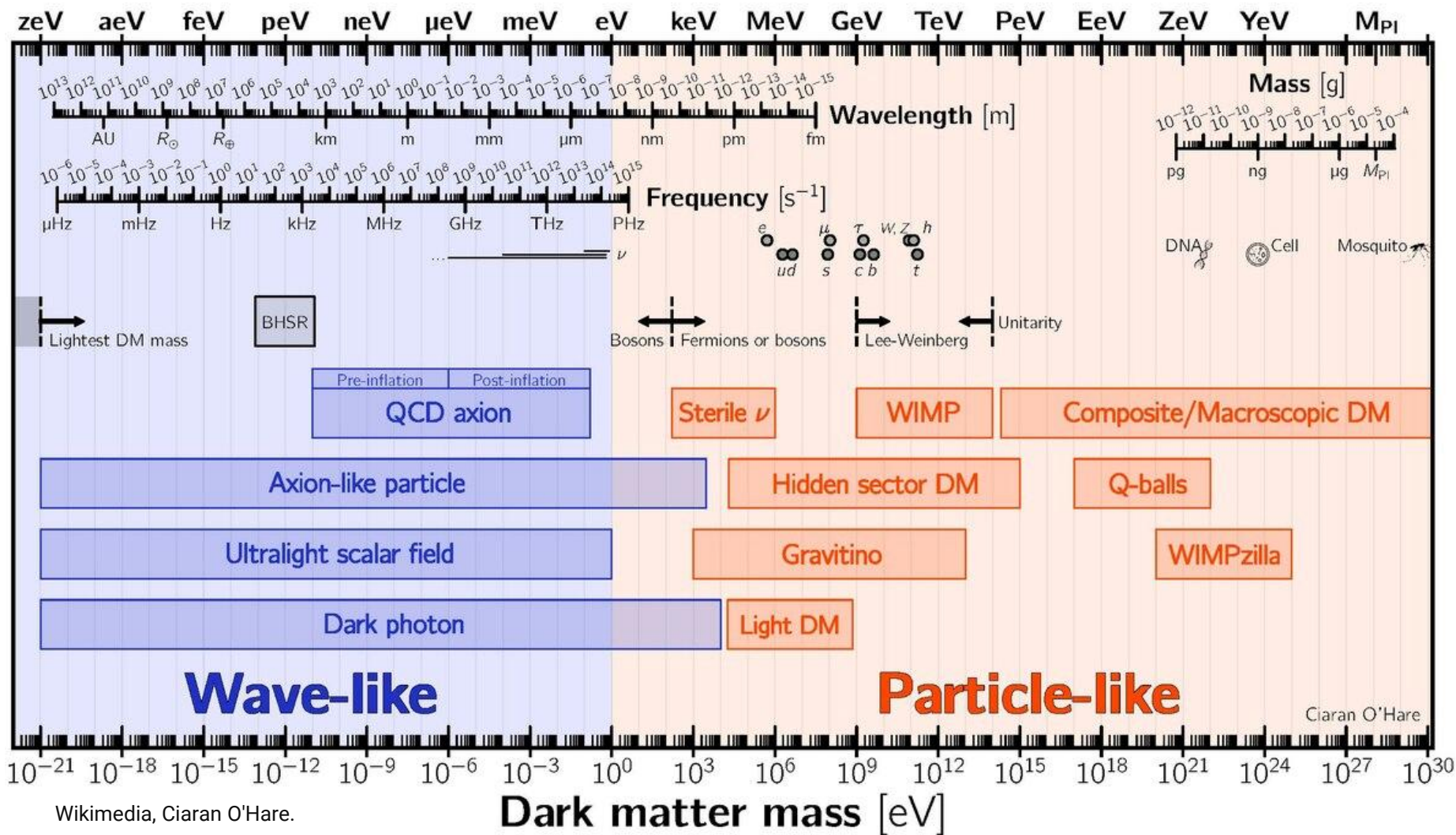


WDM : 0.5 keV

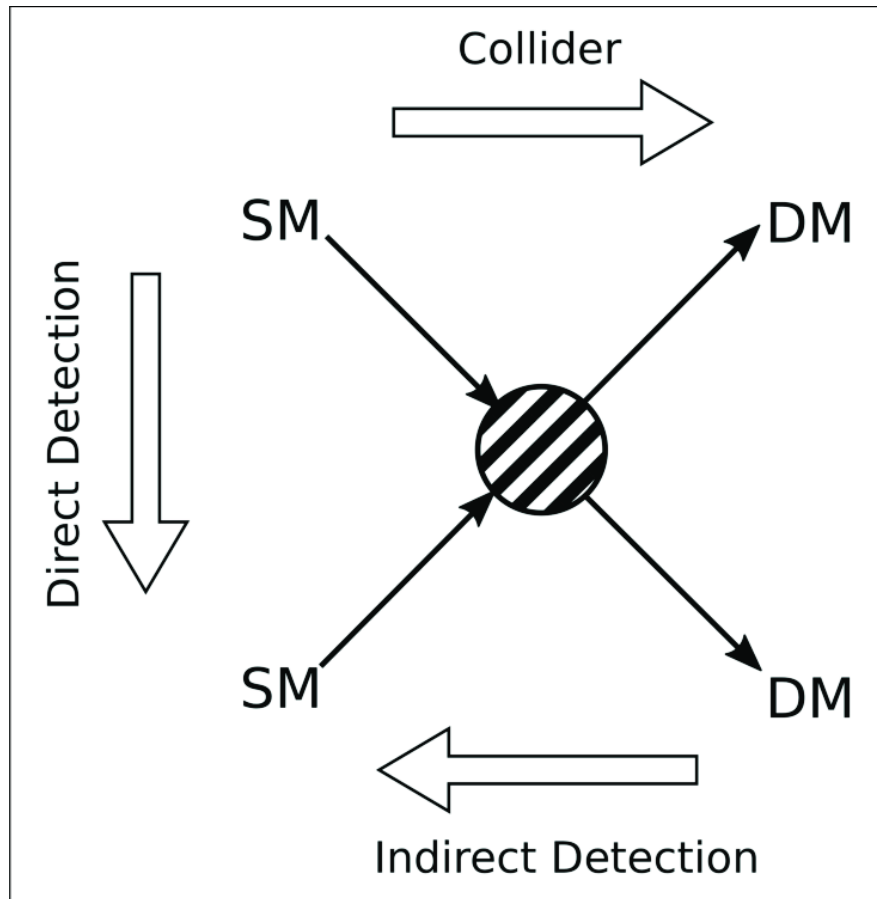


CDM (mass \gtrsim GeV)

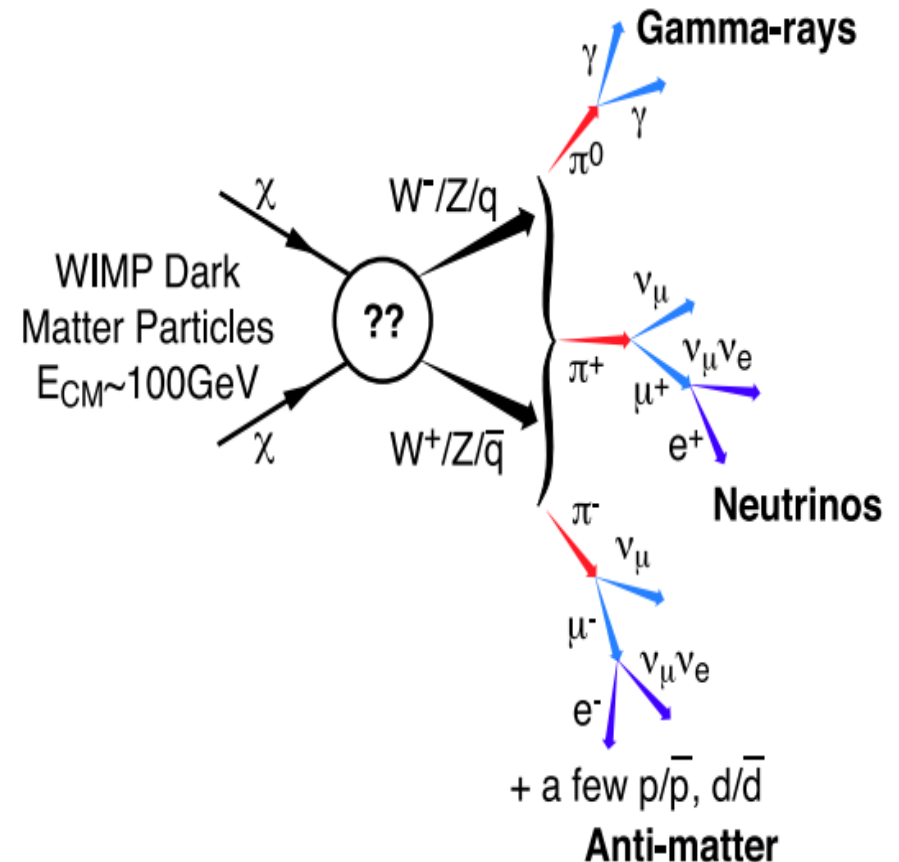




Indirect detection



WIMP dark matter searches with the ATLAS detector at the LHC,
Stefano Giagu



Escape2020, Indirect Detetion Methods

The landscape of dark matter annihilation into neutrinos

