The background is a gradient from deep red at the top to dark blue at the bottom, speckled with white stars. Overlaid on this are several faint, white circular and semi-circular patterns. Some of these patterns include tick marks and numbers, resembling a circular scale or a clock face. For example, one large circle on the left has numbers 40, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, and 260. Other smaller circles and arcs are scattered across the image, some with arrows indicating a direction of movement.

A DARK MATTER STUDY THROUGH THE HIGGS PORTAL

SAMANTHA REISENAUER
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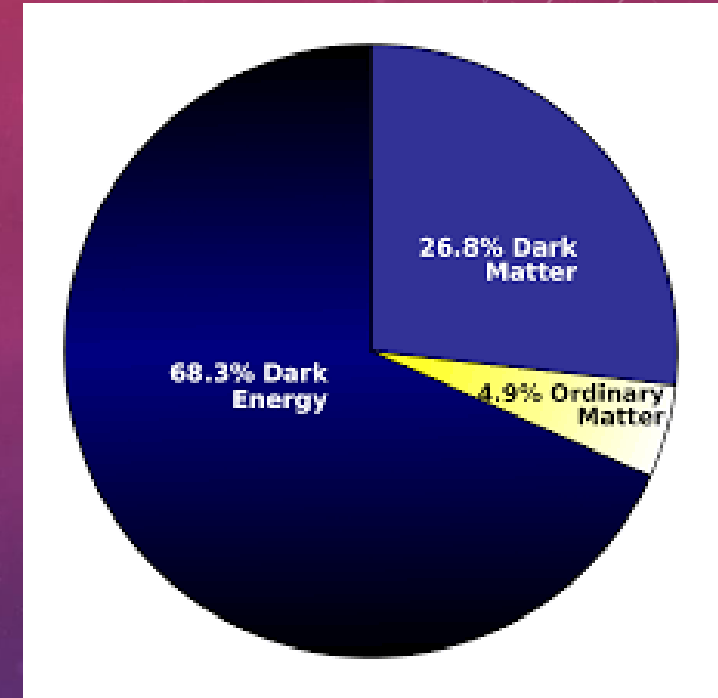
WHAT IS DARK MATTER AND HOW DO WE KNOW IT EXISTS?

Dark Matter (DM) is a form of mass-energy

- Electrically neutral
- Transparent
- Makes up 27% of universe
- May be a new type of particle

How do we know it exists?

- Galaxy rotation curves
- Gravitational Lensing Measurements

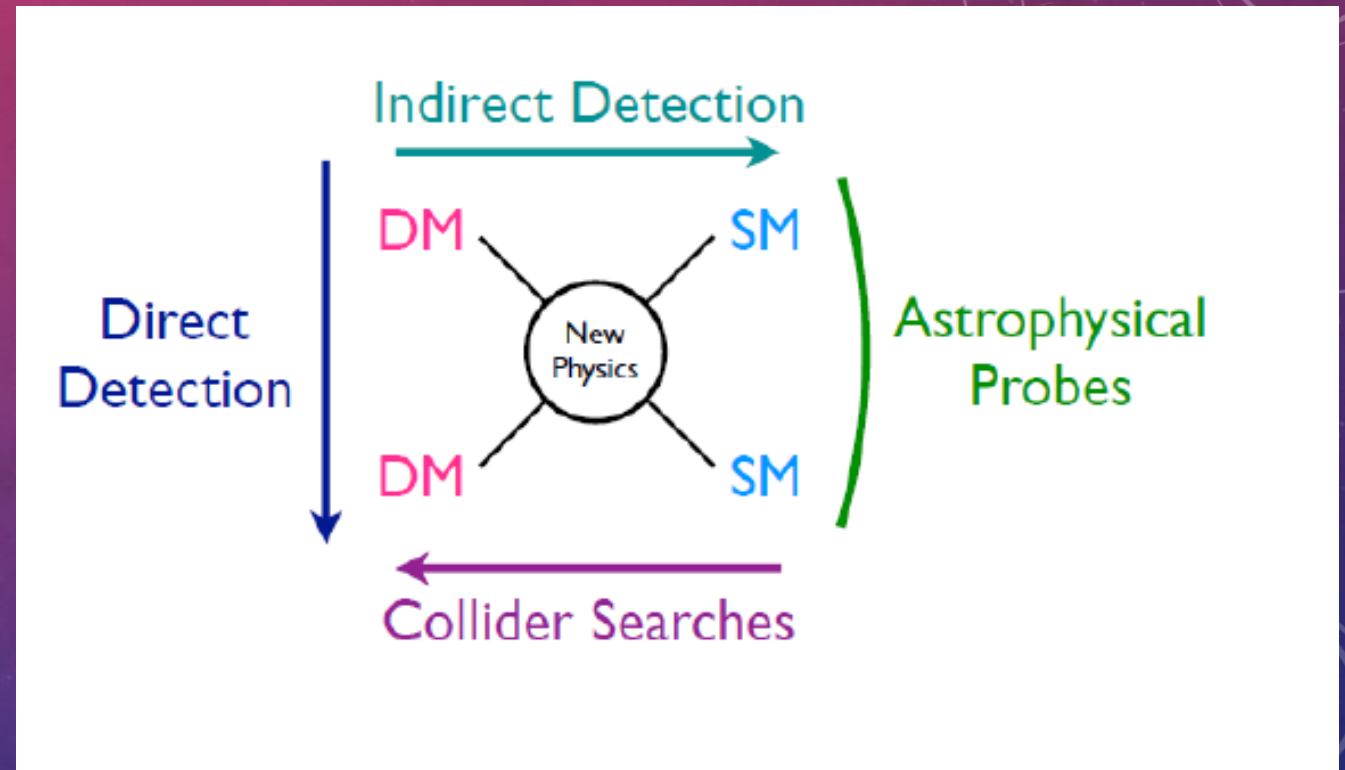


What are WIMPs?

- WIMPs are Weakly Interacting Massive Particles
- Typically 1 GeV-10,000 GeV (mass of proton)
- Proposed new DM particle

3 WAYS OF DETECTING DARK MATTER

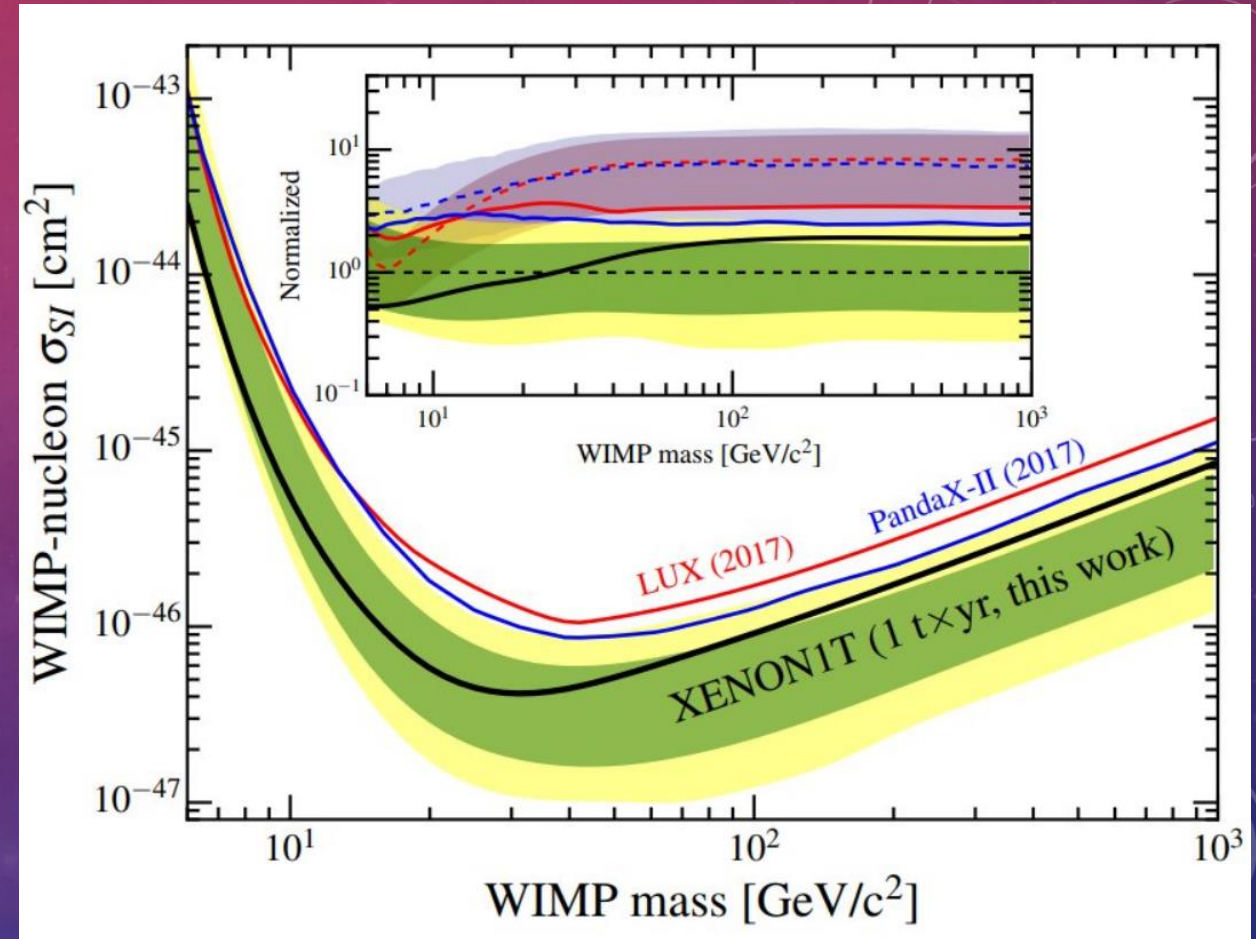
1. Direct Detection:
Wait for WIMPs to hit nuclei;
measure recoil of nucleus
2. Indirect Detection:
Look for Standard Model (SM)
particles left behind from WIMP
self-annihilation
3. Collider Experiments:
Treat WIMPs produced as missing
energy and momentum; use
conservation laws



Dr. Sinha, 2017

THEORY AND EXPERIMENT

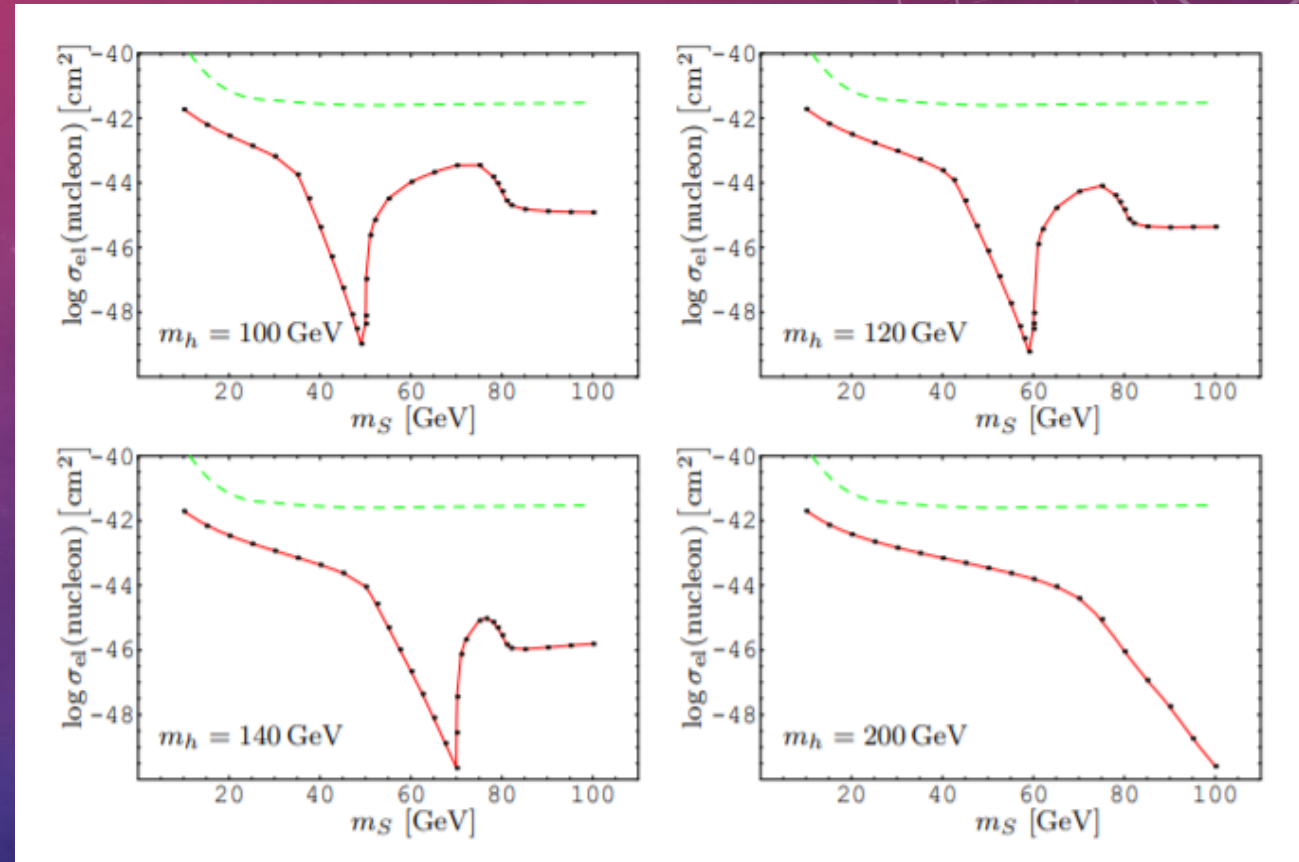
- The XENON1T Experiment
- Constraints on DM parameters
- Start with model; calculations based on WIMPs interaction with SM particles



Xenon1T.org

THE HIGGS PORTAL AND MY SUMMER RESEARCH

- Portals connect SM to dark sector
- The Higgs field gives particles mass
- Higgs portal is a model for mediation between SM and DM
- “The Minimal Model of Nonbaryonic Dark Matter: A Singlet Scalar,” C. P. Burgess et al.
- I will study their predictions and analyze the Higgs portal as a model for DM direct detection and attempt to reproduce their plots





QUESTIONS?

THANK YOU!