



JOHANNES GUTENBERG
UNIVERSITÄT MAINZ



Mainz Institute for
Theoretical Physics

Catch-up

Dark Matter in the Milky Way
Mainz, May 2-13 2016

Bringing together three communities: motivations

- Dark matter searches bring together Astronomy, Astrophysics, Cosmology, Particle Physics
- Virtuous interplay in all directions, but also... misinterpretation of jargon in all directions
- Need to question widely-used astrophysical assumptions in the astroparticle community
- Need to question assumptions behind widely-used particle physics models often created to solve “astro-simulations” problems

The Milky Way as a benchmark

Milky Way is crucial to understand the dark matter distribution within galaxies
(ultimately linked to our understanding of galaxy formation)

- What is the impact of Milky Way observations on dark matter searches and on simulations?
- How do hydrodynamical simulations contribute to understanding the Milky Way? (a seemingly special Galaxy, or a very normal one?)
- How can we use upcoming astronomical data to refine numerical simulations including baryons?
- How can we use upcoming astronomical data to constrain the dark matter distribution in the Milky Way?

Things we have learned

Baryons are crucial in any simulation to understand DM distribution.

Identification of MW-like halo currently does not follow one single criteria.

The “center” ($< 1\text{kpc}$ -ish) of MW-mass Galaxy is not suff. resolved in hydro-sims to be univocally agreed upon (contraction/expansion).

Impact of AGN feedback on MW-like galaxies yet unclear. Field in infancy.

Baryon and WDM effects are degenerate down to scales observable right now.

Which $f(v)$? Simulations agree on sizable difference between CDMO and Hydro case.

What about Hydro with (SIDM/WDM)? Effects on DD?

Things we have learned

DM is beyond WIMP paradigm: non-thermal, PBH, sterile neutrinos, gravitinos...

SUSY is not generally dead (and never will be). But your favorite model may be.

Galactic Center (gamma-ray) emission can not be explained by current astrophysics, it is solid against systematics, and pretty well characterized. GC excess lives.

Low-mass WIMP situation unclear:

- Intrinsic confusion from experimental data;

- Potential effects on small-masses (only) from $f(v)$.

Neutrino floor is a real bummer for DM direct detection (but: directionality, modulation, spectrum and non-standard interactions).

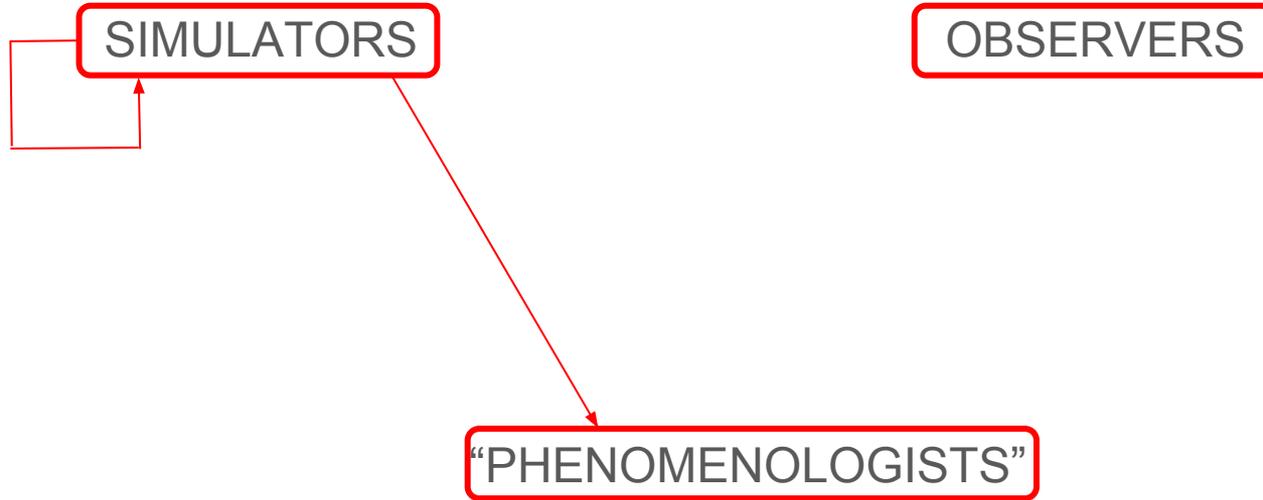
Inter-community synergies

SIMULATORS

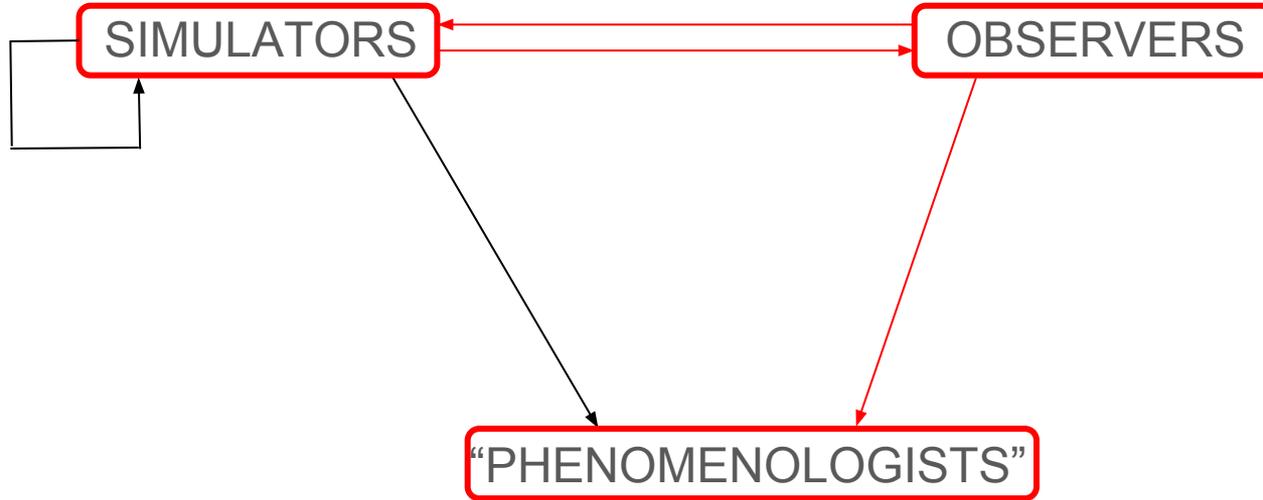
OBSERVERS

“PHENOMENOLOGISTS”

Inter-community synergies



Inter-community synergies



Logistics: timetable

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save questions for general discussion

Open talks:

discussions on selected hot topics

Q&A:

think of a question to ask to a member of another community

Journal club:

select and prepare a recent paper for discussion

Project brainstorming: think of what your contribution to this session might be

Add-ons:

schedule is dynamical, feel free to propose additional social activities or talks

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DARK MATTER IN THE MILKY WAY

MITP, May 2-13, 2016

– Second week, May 9-13 –

Your to-do list

Q&A

Think of a question you would like to pose to one of the other communities in the workshop.
Send it to dm16mw@gmail.com by **Mon, 14:00**.

Journal club

Identify (and read) a recent paper in your field to bring it to the attention of all at the journal club.
Send it to dm16mw@gmail.com by **Wed, 23:00**.

Project brainstorming

Sketch here the ideas you would like to discuss during the project brainstorming session:

1. _____
2. _____
3. _____
4. _____

Logistics: template

Your contribution to the general discussion

Please use the space below to write down your questions to each talk; they will feed the general discussion session on Fri, 10:15.

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4. _____

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