Dark Matter in the Milky Way

Mainz, May 2-13 2016

SOC: A. Di Cintio, F. Iocco, M. Pato, C. Weniger

Workshop funded by MITP

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?

Specific questions

(i) **SIMULATIONS**

What is the current agreement of different simulations in respect to the dark matter distribution within our Galaxy?

What are the most important physical processes one needs to take into account at Milky Way scales (i.e. AGN feedback, SNae feedback)?

Do hydrodynamical simulations behave similarly when different underlying dark matter particles are included (i.e. WDM, SIDM)?

How can we design future simulations in view of the available astronomical data?

Specific questions

(ii) **OBSERVATIONAL DATA**

What are the most important properties (e.g. stellar proper motions) we need in order to constrain the potential of our Galaxy?

Which future experiments could be useful for this purpose and what are their limitations?

Specific questions

(iii) **DIRECT DARK MATTER SEARCHES**

What is the single most important input from simulations and observations for direct searches?

What can we learn about the dark matter velocity distribution from simulations and observations in the coming decade?

How well can we measure the local dark matter density with upcoming observations over the coming decade?

Specific questions

(iii) **INDIRECT DARK MATTER SEARCHES**

What is the single most important input from simulations and observations for indirect searches?

What is the dark matter distribution close to the Galactic centre?

Can we agree on the baryonic effects on the dark matter distribution over the coming decade?

Can we ever detect dark matter substructure from its gravitational effects only?

Logistics: timetable

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10:00-10:15	**Coffee**	**Coffee**	**Coffee**	**Coffee***	**Coffee**	**10:00-10:15**
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Coffee/Lunch/Dinner: note that Thu, May 5 is holiday

Review talks: save questions for general discussion
Open talks: discussions on selected hot topic

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Q&A: think of a question to ask to a member of another community
Journal club: select and prepare a recent paper for discussion
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More details about the second week on next Monday...

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MITP, May 2-13, 2016
– First week, May 2-6 –

Your to-do list

☐ **1-slider**
Prepare one slide stating an open problem in your field.
Send it to dm16mw@gmail.com **by Mon, 23:00**.

☐ **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 Tue, 23:00**.

☐ **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 Tue, 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 Tue, 16:00.

Review talk: "Simulations", Aaron Dutton & Matthieu Schaller

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

Review talk: "Indirect detection", Francesca Calore & Tim Linden

1. _____
2. _____
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Review talk: "Direct detection", Nassim Bozorgnia & David Cerdeño

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