

Future Observations and Simulations for Dark Matter

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@eteq

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Giacconi Fellow

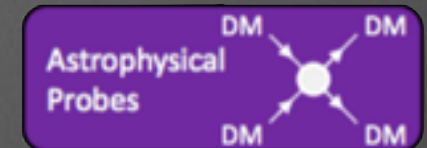
SOME present and
Future Observations and
Simulations for Dark Matter
on ~galaxy scales

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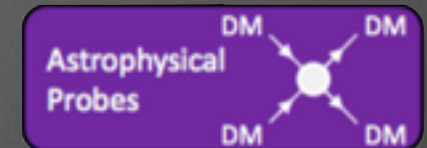
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DM Probes at Galaxy Scales: Observations



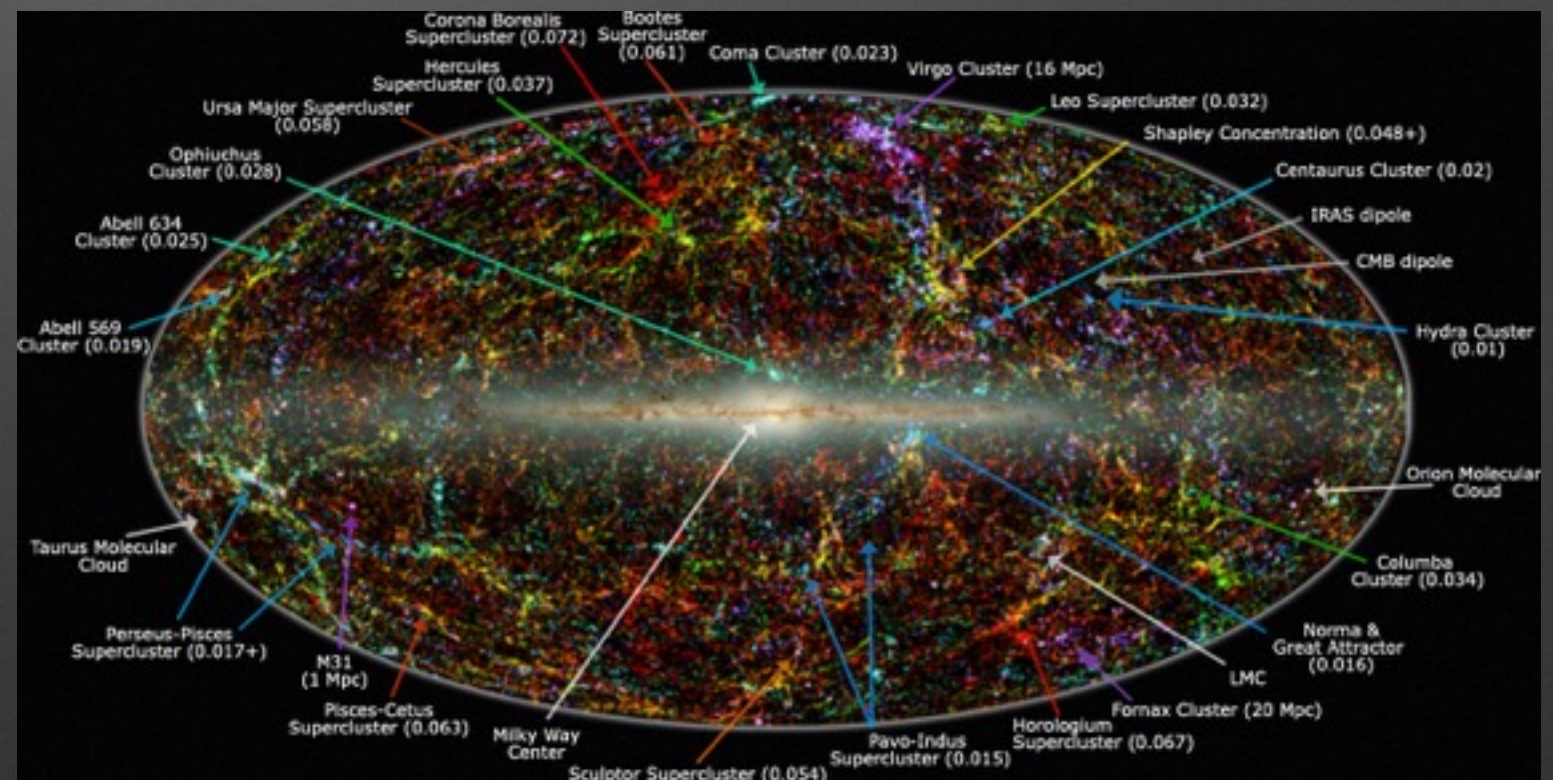
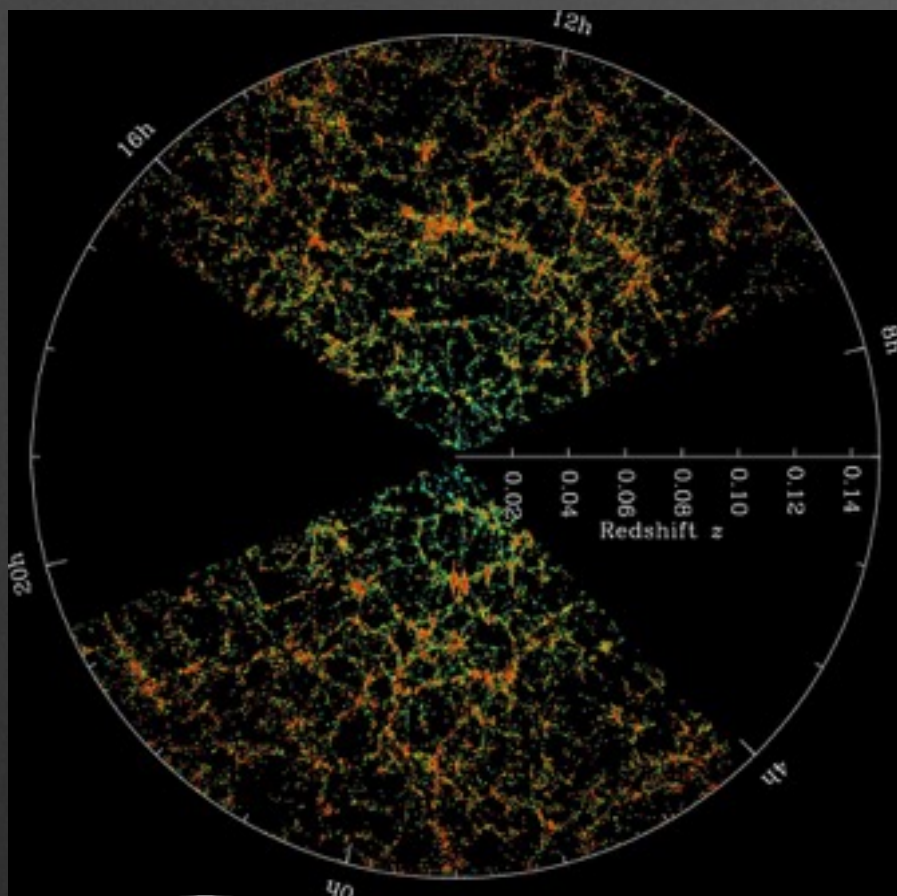
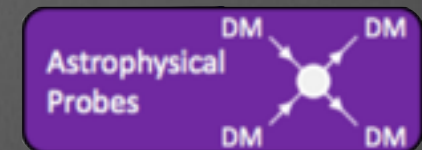
DM Probes at Galaxy Scales: Observations

- Where do we have data now?



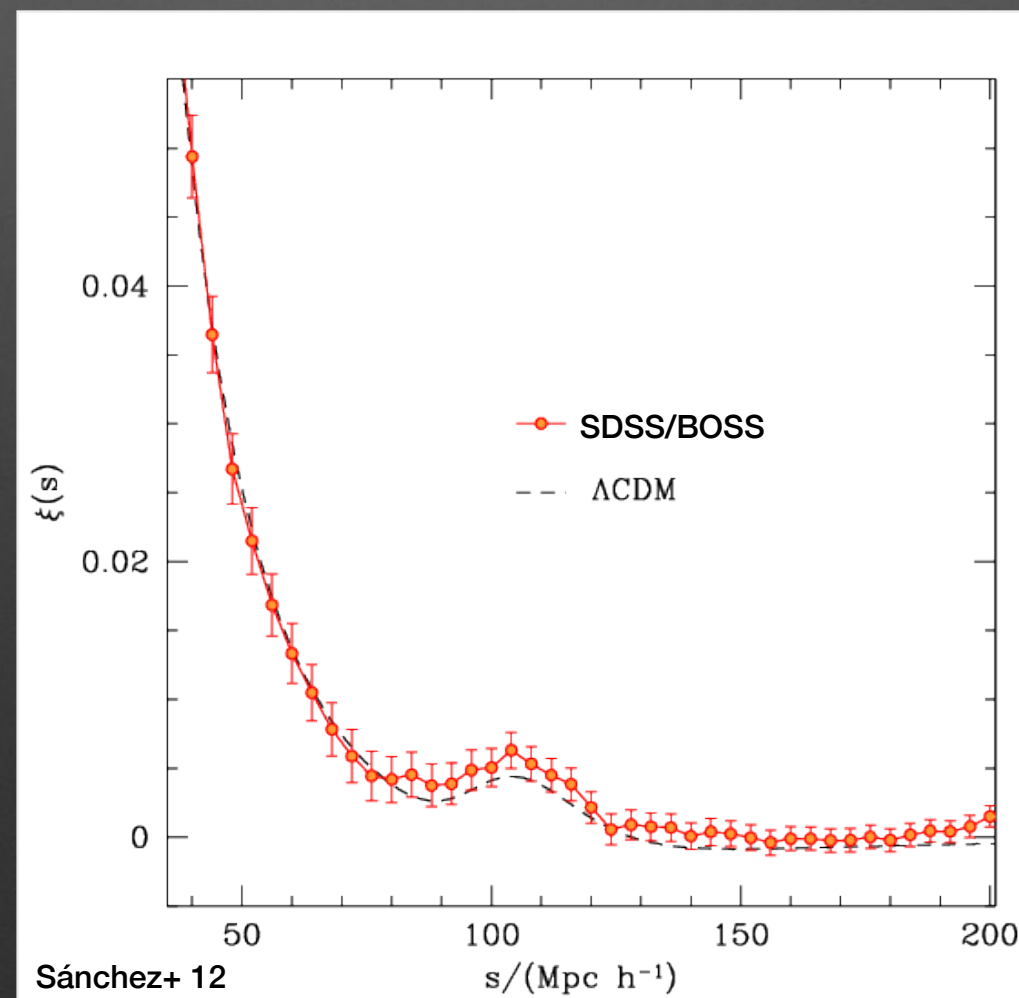
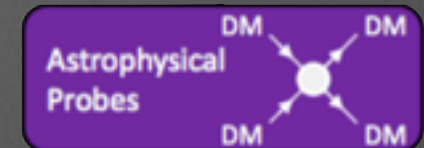
DM Probes at Galaxy Scales: Observations

- Where do we have data now?
- Large-scale structure: very solid



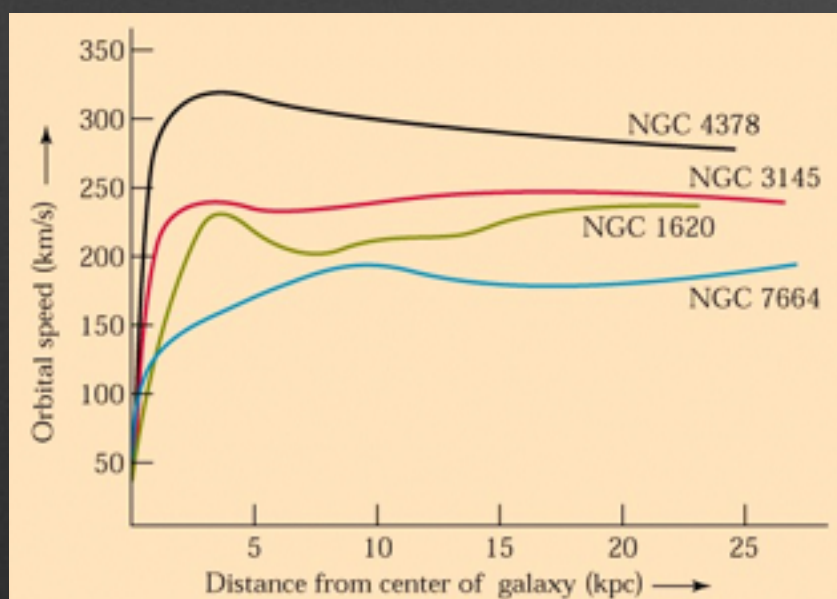
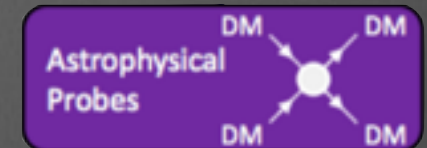
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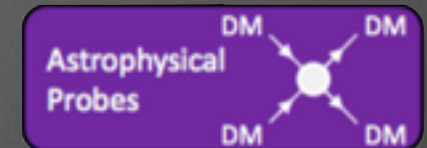
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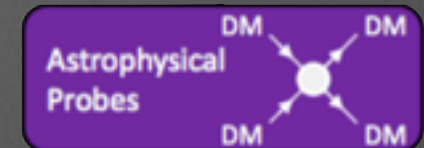
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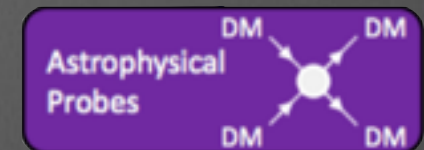
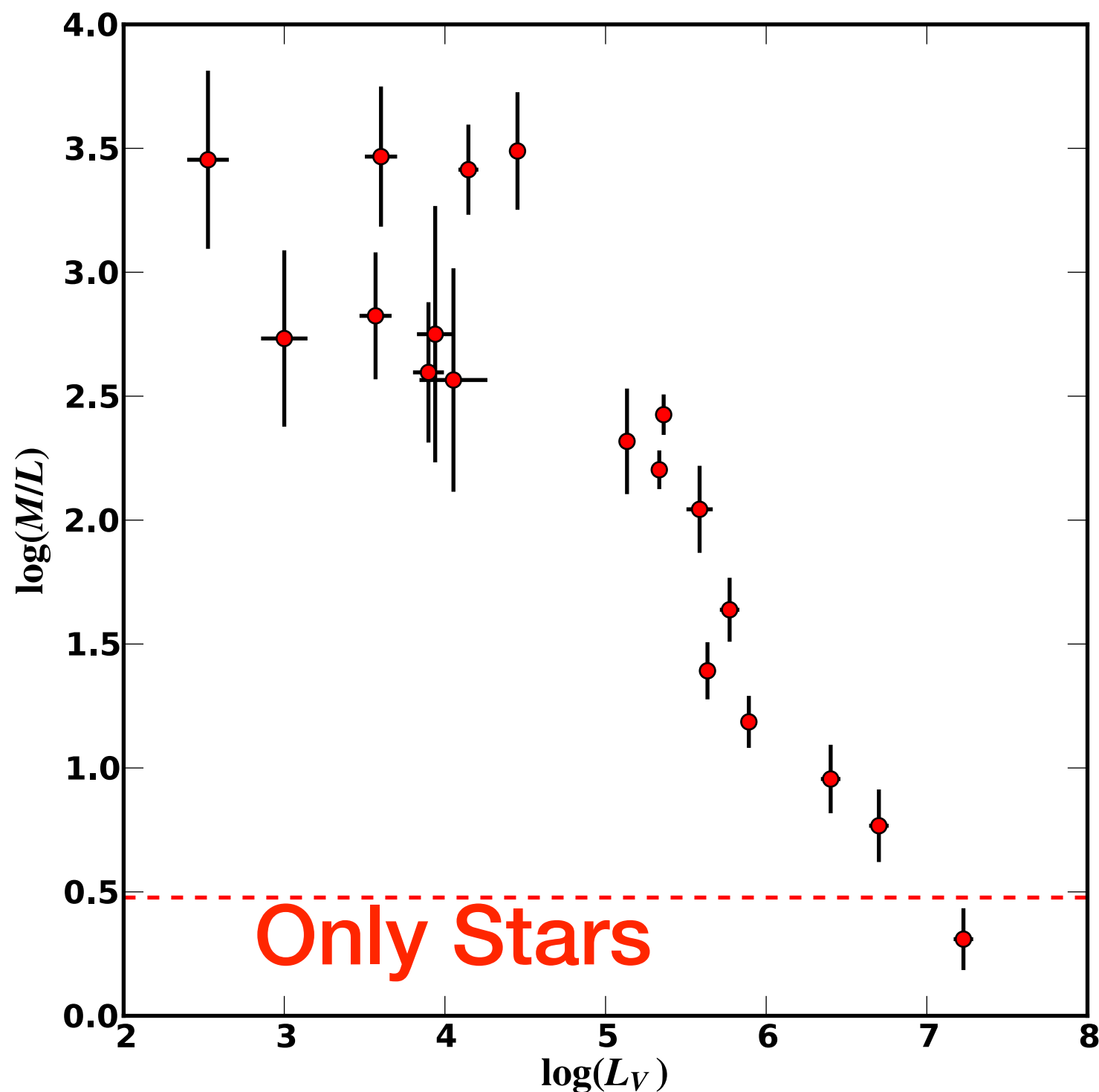


DM Probes at Galaxy Scales: Observations

- Where do we have data now?
 - Large-scale structure: very solid
 - Cluster-to-L
big picture
- So that leaves the faint things: smaller scales (& higher redshift)

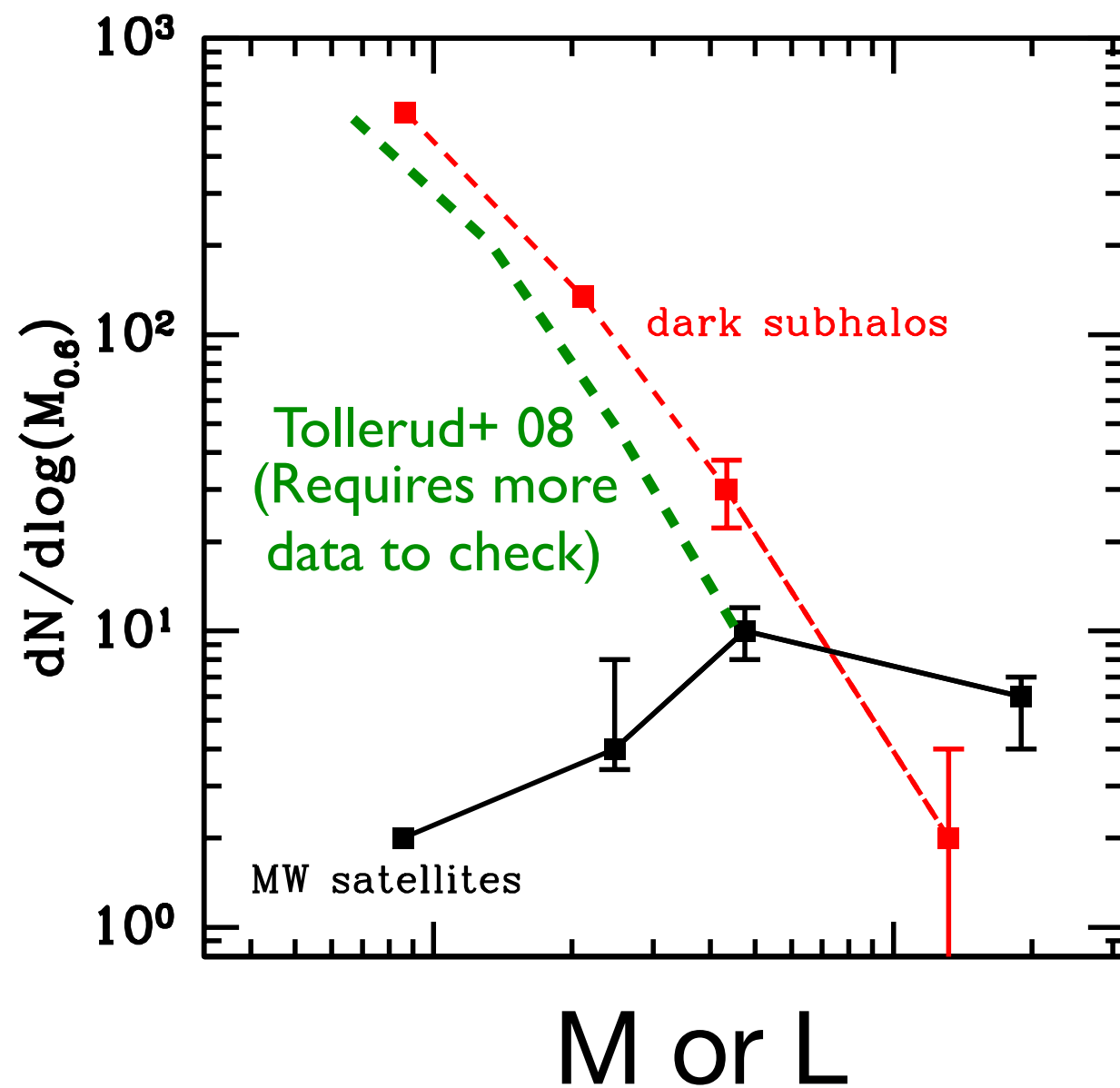


DM Probes at Galaxy Scales: Observations

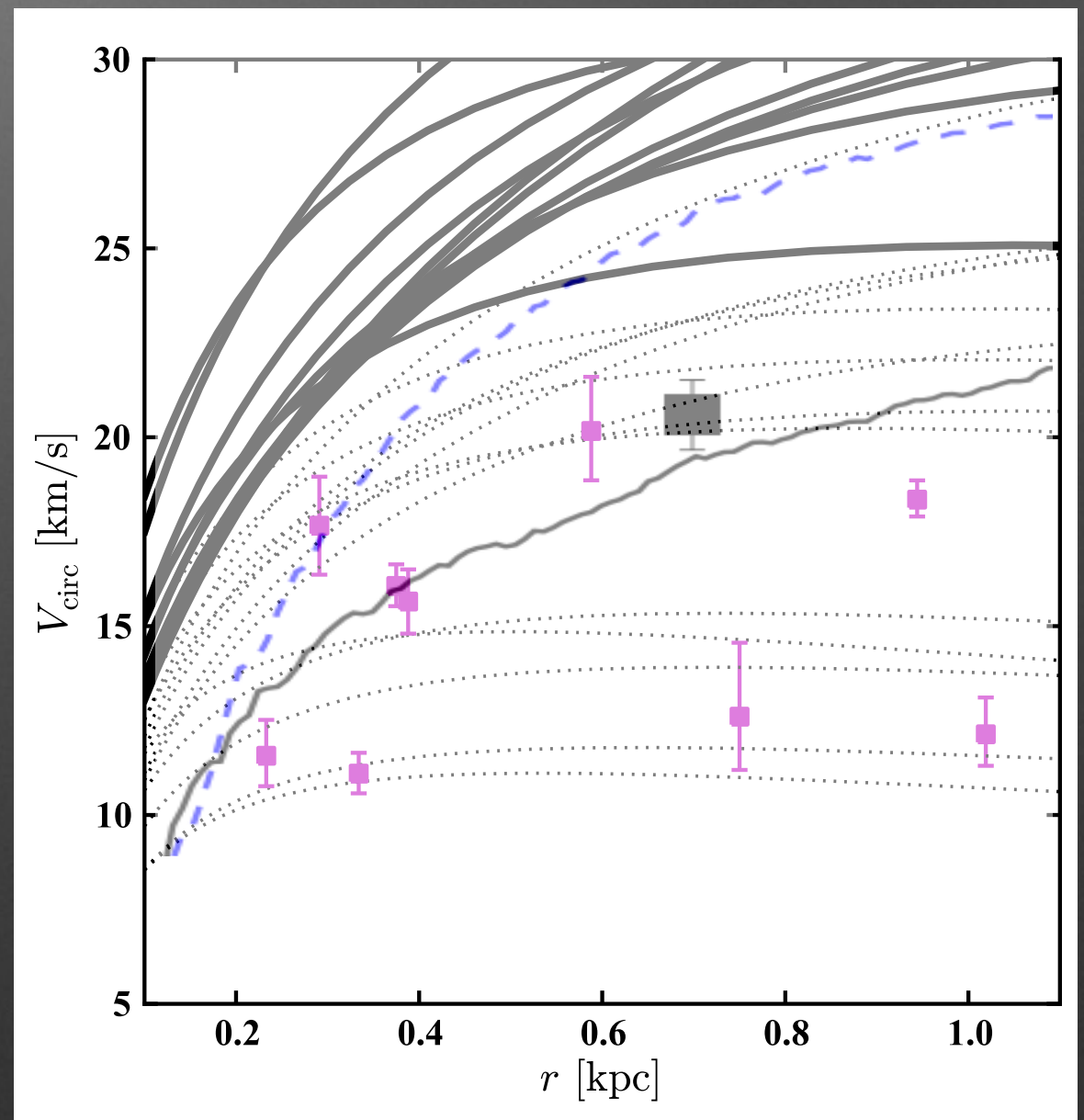


DM dominates
for faint-enough
dwarfs

Small Scale: Problems *and* Solutions abound

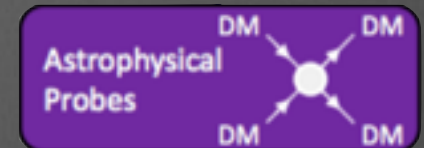


Missing Satellites

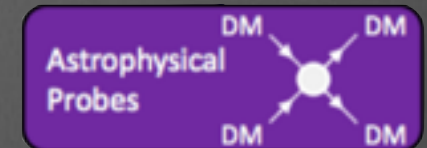


Too Big To Fail

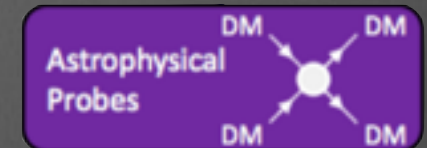
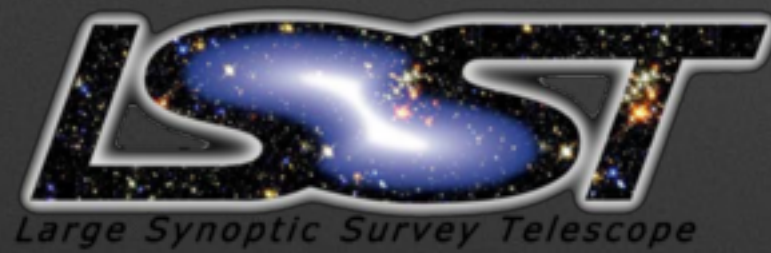
Next Decade of Dwarf Scale DM Probes



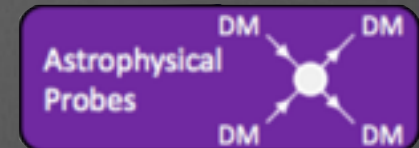
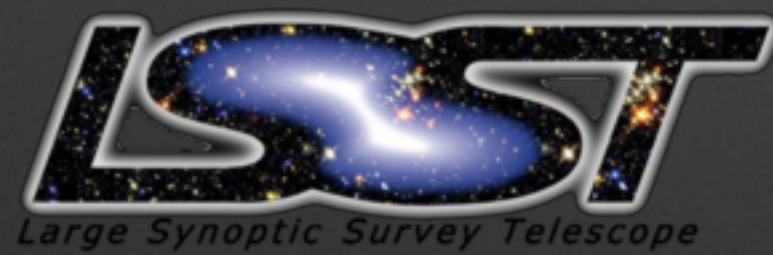
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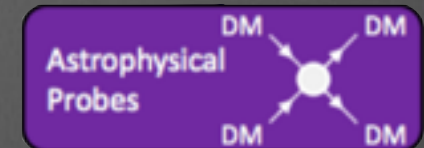
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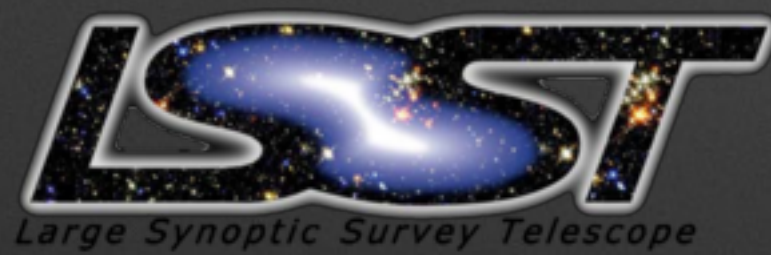
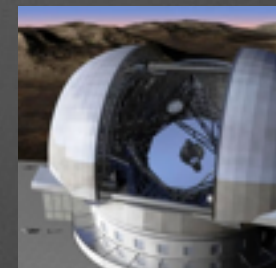
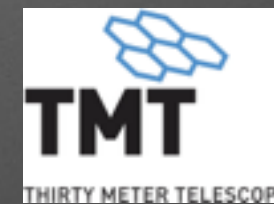
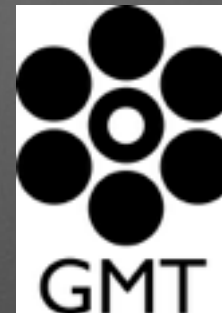
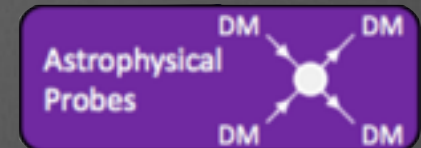
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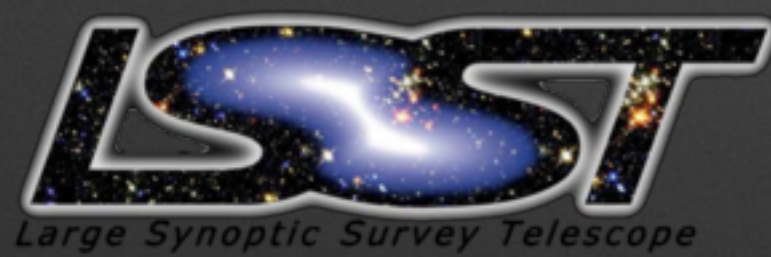
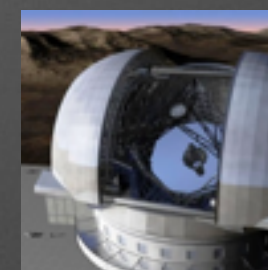
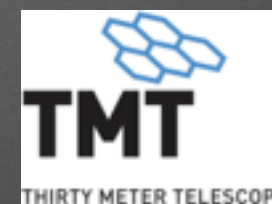
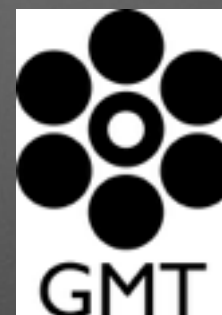
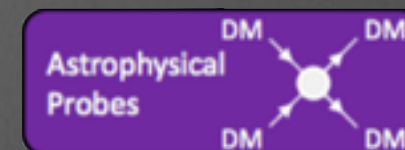
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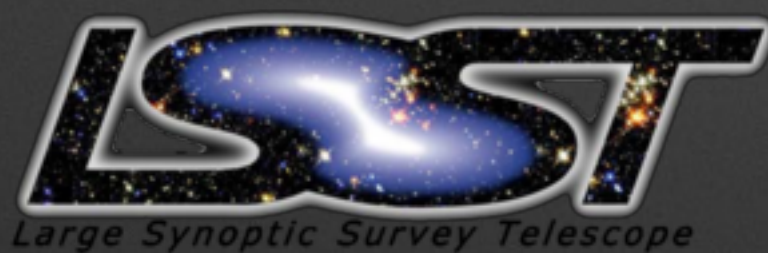
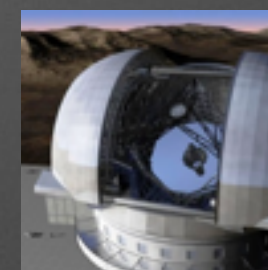
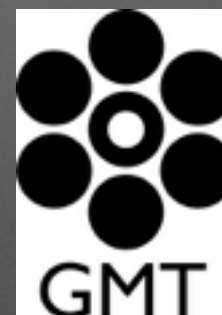
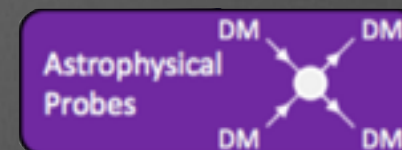
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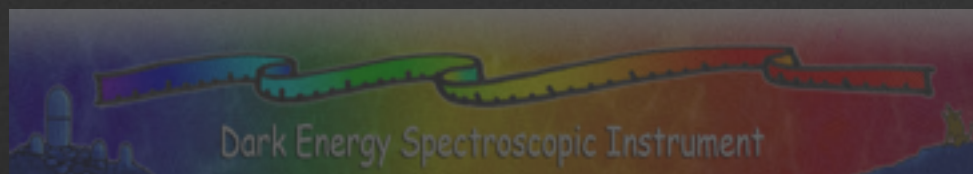
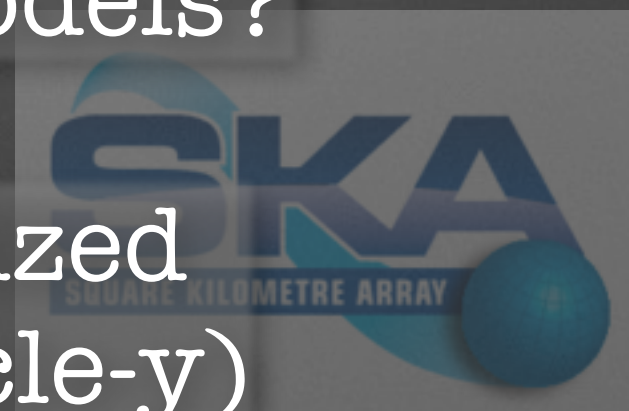
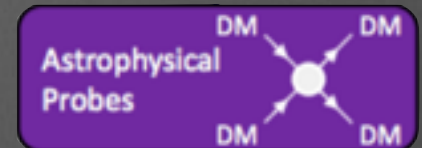
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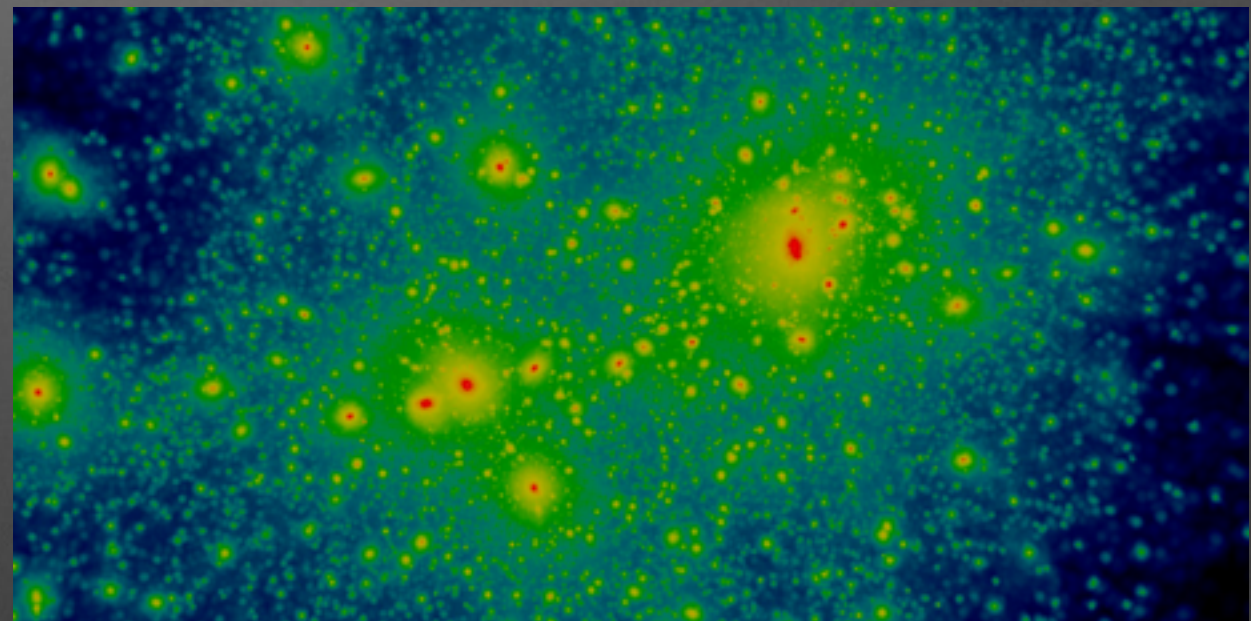
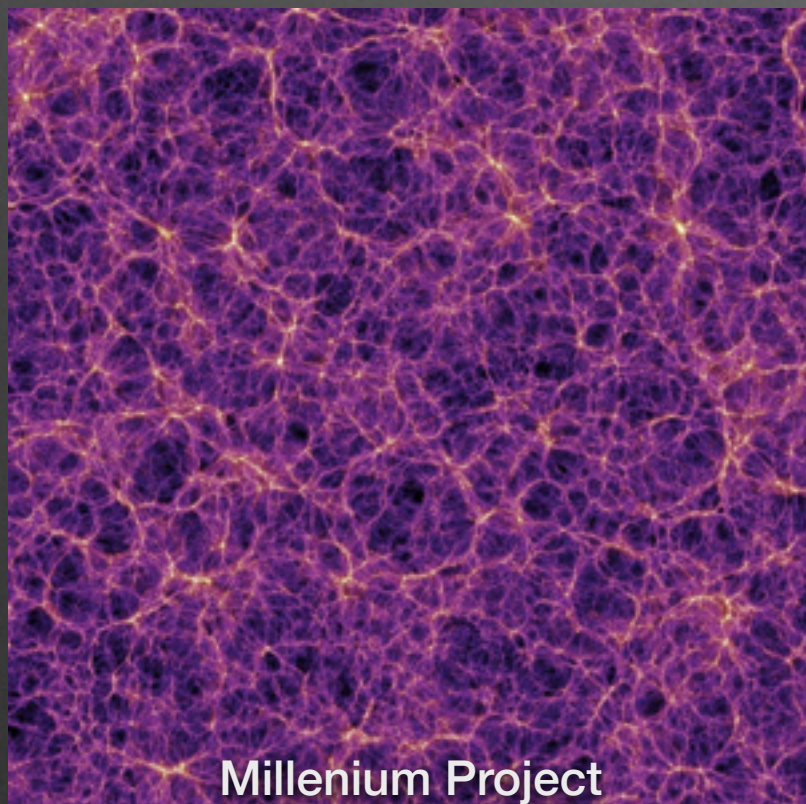
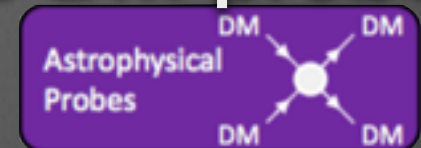
Is it sufficient to judge
“success” on whether
they address enough
specific comparisons
to DM theory/models?

Or is a generalized
(probably particle-y)
framework needed?

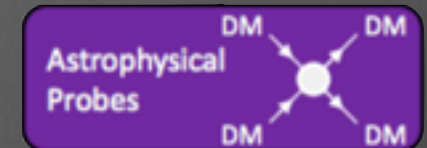


DM Probes at Galaxy Scales: Simulations

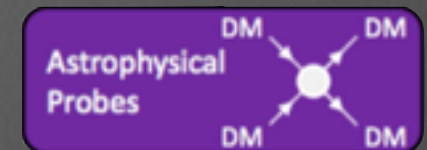
- Necessary for *any* attempt to use galaxies as DM probes
- CDM-only: understand things pretty well



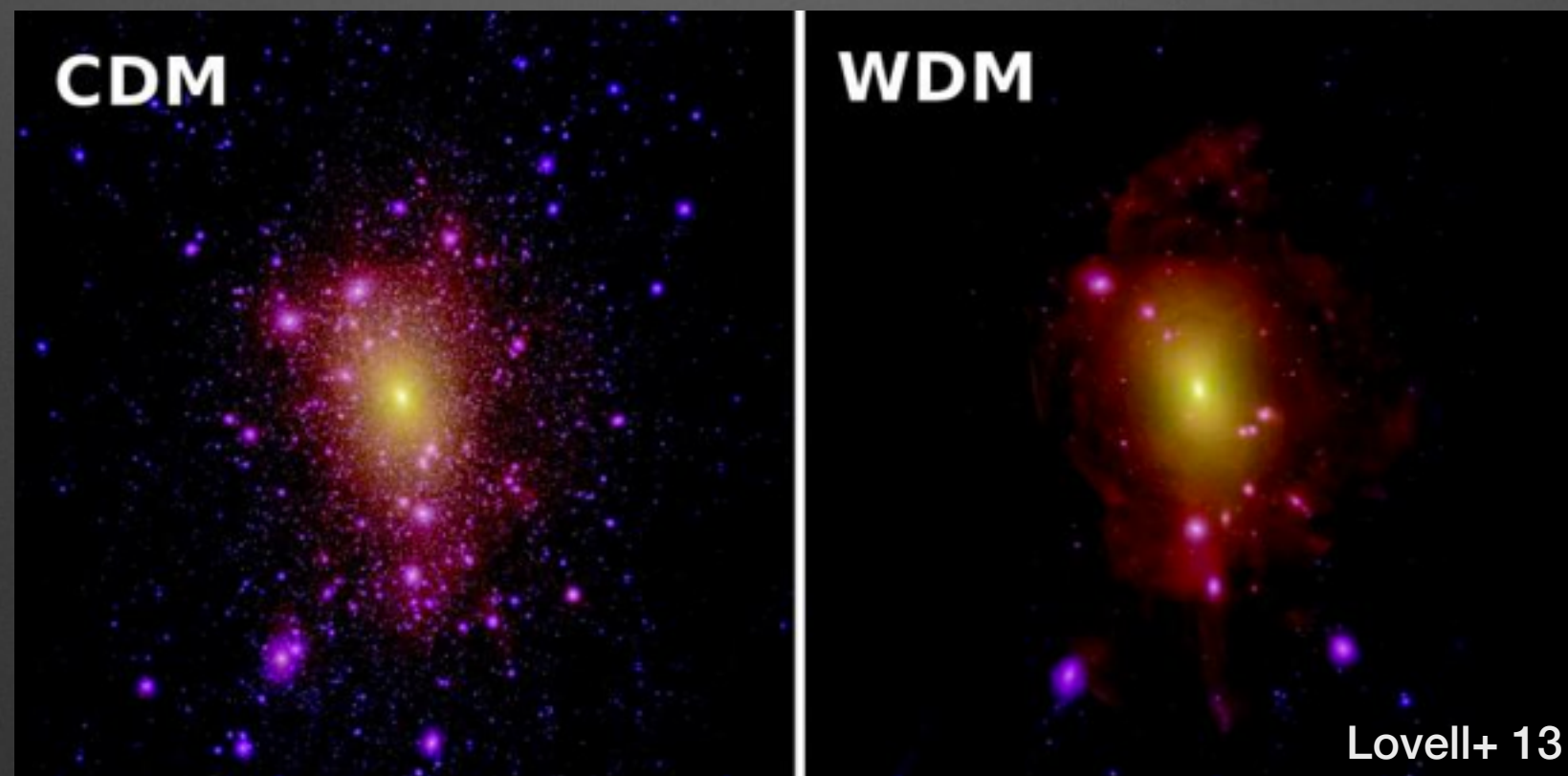
Future of Large Sims: Alternate DM



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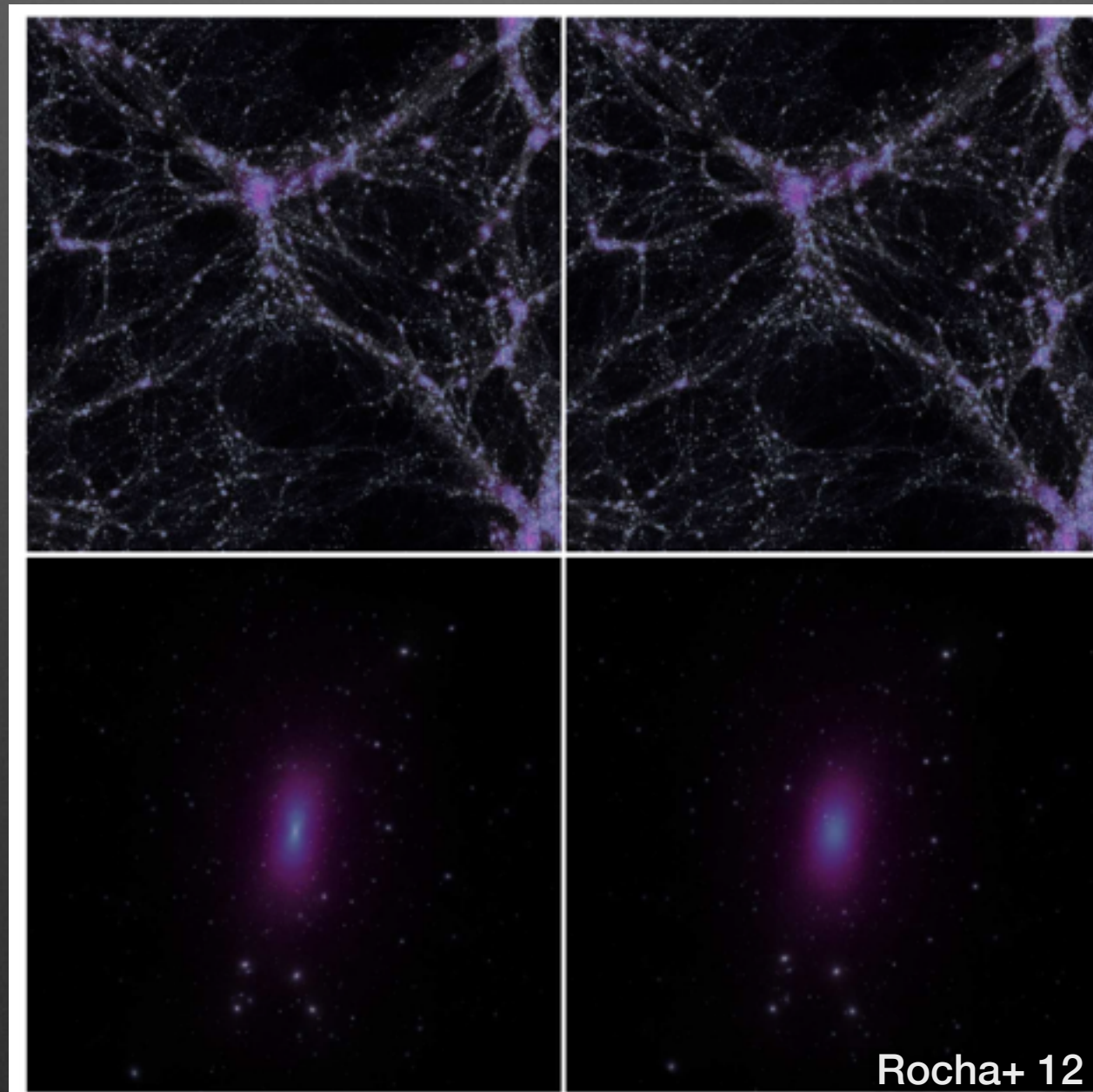
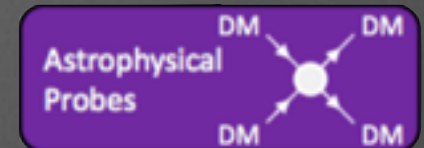


- WDM

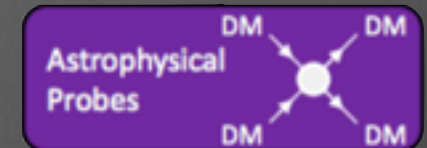


Future of Large Sims: Alternate DM

- WDM
- SIDM

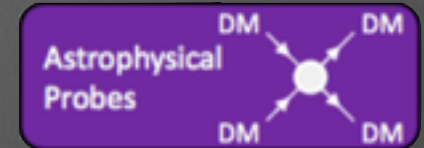


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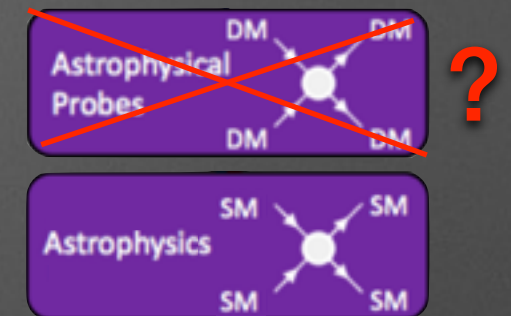
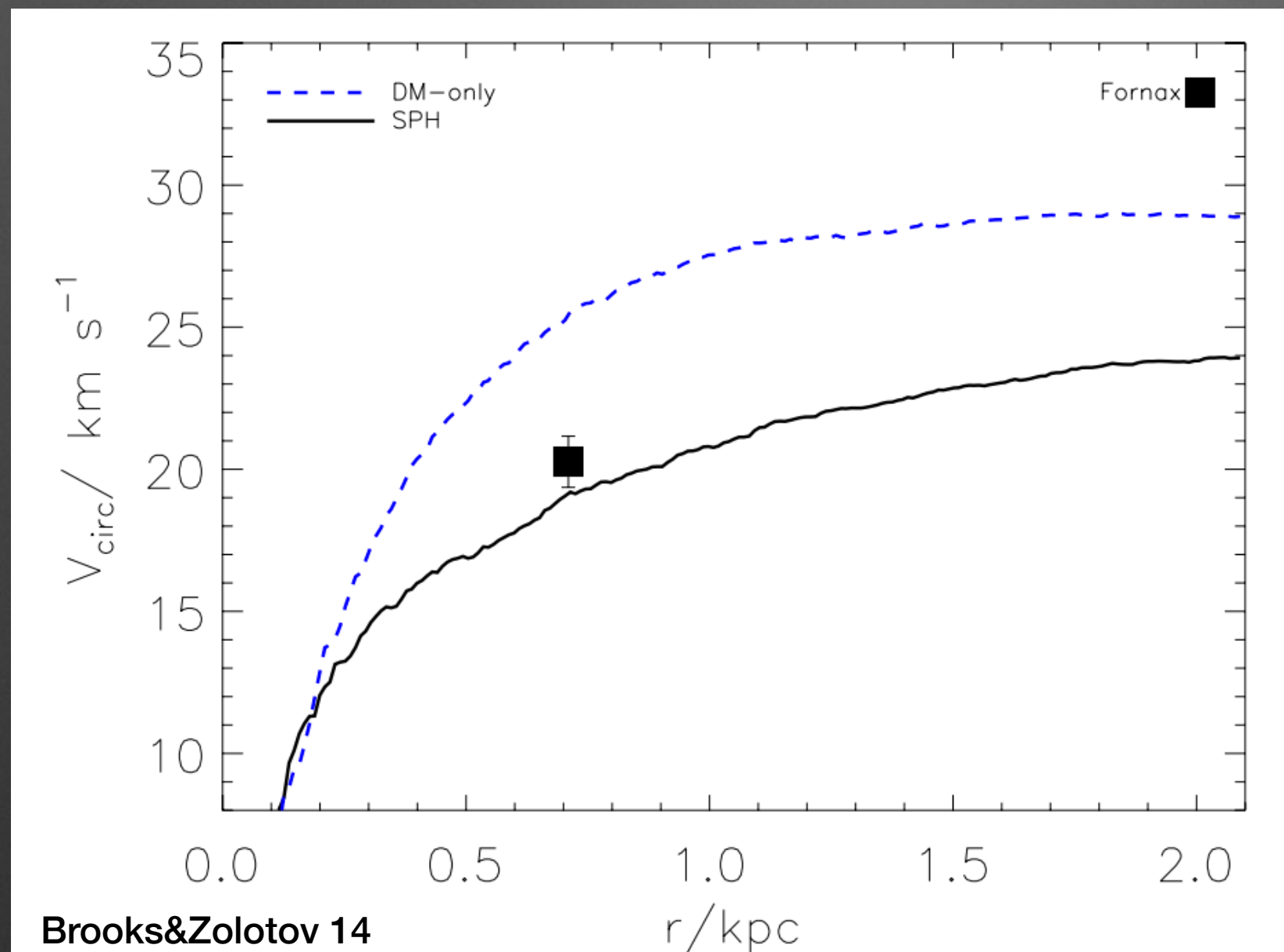
- WDM
- SIDM
- Probably lots of stuff we haven't thought up yet?

Future of Large Sims: Alternate DM



- WDM
- SIDM
- Probably lots of stuff we haven't thought up yet?
- So how do we make a metric for that?

The Future will need Baryons...



Summary

- The future is rich in possibilities for probes of DM (especially at the dwarf galaxy scale)
 - Is it sufficiently to rate them purely on answers to the specific current questions?
- Simulations of matched scales are critical for comparison with simulations
- The future *can* give more DM options for comparison, but *must* provide an answer to the Baryon question