FORMATION AND EVOLUTION OF THE MAGELLANIC SYSTEM

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Magellanic Stream is the closest example of cold gas accretion.

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Current formation scenario: Stream is gas stripped from SMC during its interaction with LMC.

Besla et al. 2012
Problems:

- Current models under-predict HI mass by factor of 5 and do not include the ionized component. (Models: Besla+2012; HI: Brüns+2005, Nidever+2010; HII: Fox+2015)

- Abundance and velocity measurements show LMC origin of some gas. (Nidever+2008,Richter+2013)
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We make two targeted changes:

1) Increase total gas mass of Clouds by 2X

2) increase size of SMC and LMC (place more gas outside tidal radius)
Follow simulation setup of Besla+12. Using Gadget NBody+SPH isolated galaxy models:

(1) LMC and SMC interact only with each other for several Gyr

(2) LMC–SMC pair falls into Milky Way

Pardy+2017 (submitted)
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Pardy+2017 (submitted)
RESULTS PART 1

Can we match the mass?

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- 4x increase in Stream gas mass $\sim 4 \times 10^8 M_\odot$ ✓
- Do not match ionized mass ✗
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- Do not match ionized mass ✗
- More mass than observed inside Clouds ✗
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- Do not match ionized mass ❌
- More mass than observed inside Clouds ❌

Takeaway:

- Increasing mass of Clouds further will cause a larger mismatch between observed and predicted HI mass

This is a problem of efficiency. Our simulations have $\sim 20\%$ of gas stripped, best estimates for Stream is that $\sim 50\%$ of all of the gas from the Clouds has been removed. (see talk by Brianna Smart)
HI data from Nidever+2010

RESULTS PART 2
Results Part 2

- Strip material from LMC
- Match Stream location
- Match density near Clouds

Predict Arm material from LMC

Pardy+2017 (submitted)
Do not match Clouds positions

LMC material not in filament

RESULTS PART 2
Current dwarf-dwarf formation model has problems reproducing the multiple filaments and the mass in the Magellanic Stream.

- Increasing the stripping efficiency from the LMC can pull material into the stream and the leading arm - but not in a long coherent filament as seen in the observations

- A tidal-only model is not efficient enough to strip enough of the material from the Clouds
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Looking Forward - other methods of stripping material:

- Local outflows (led by collaborators Chad Bustard and Ellen Zweibel at UW Madison)

- Ram pressure stripping (ongoing with collaborator Romeel Davé)
BONUS SLIDES

![Graph showing the relationship between LMC-SMC Mass Ratio and Gas Stripped (%) for different ISM ionization states. The graph includes data points for simulation cases (Not Merged and Merged) and observed LMC+SMC with ISM 90% ionized.](image-url)