Zooming into the ISM of the SMC

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Preamble:

- The Turbulent ISM
- A description of turbulence: its role and importance
- Observations of the SMC & technique
- Caveats & future work



Time: 832.35 Seconds



The turbulent Interstellar Medium

- The ISM is best traced with Neutral hydrogen (HI)
- Energy injection/distribution – reshapes ISM at all scales.
- Mixing of the ISM
 - distribution/enrichment of metals
- Influences SFE
 - Turbulent support against core collapse





Characterising Turbulence

The ISM is almost ALWAYS turbulent

- Large scales, low viscosity
- Reynolds numbers are typically ~1000
- Incompressible fluid flow: $P(k) = k k \sim -11/3$ (3-D kolmogorov index)



Characterising Turbulence



- Fractal nature of the ISM:
 - Outer scale: The largest scale at which energy transfer occurs:
 - Spiral arms, Colliding systems
 - Inner scale: The smallest scale at which damping is significant
 - Reynolds number becomes ~1
 - ~molecular level (dept. on T, P etc.).
- Energetic processes re-organise the ISM – eg. SNe





The effects of Starformation/SNe

- Early stages: core clumping of the ISM.
- Stellar winds sweeping/heating the ISM
- PNe, SNe, shells and shell fragmentation





Why the SMC?

- Far enough ~Parallel lines of sight
- Close enough high spatial resolution
- Active starforming region in the SW SMC
- Among largest known HI column densities $\sim 10^{22} \text{ cm}^{-2}$.
- Augment with existing HI data:
 Stanimirovic: ATCA+Parkes
- Accessible resolution: ~2-3 pc
- Problems
 - Possible large line of sight depth.
 - Optical depth.



Stanimirovic: http://www.atnf.csiro.au/research/smc_h1/



The Energetic Southwest SMC.



Muller & Jones, In prep

Courtesy: Karl Gordon





Total power





SMC Spatial power spectrum



Calculating the SPS





Early, Hi-resolution Power Spectrum





Coping with optical depth.

Optical depth presents a significant challenge: 0.6 Peak HI Absorption appears to be more 0.5 200 🖌 important at small scales. (e.g. Gibson et al, 2000). 0.4 Eractional error Artificial steepening of the ____ 0.3 300 K SPS at small scales. 0.2 500 K 0.1 0 80 100 120 140 20 40 60 160 n TB [K]





The extended SMC





Summary

• Highest-yet resolution observations of the SMC.

• Powerspectrum index of (~-3) appears to extend into high frequencies

• Not possible to exclude excess power at <10pc

• Refinement of process still underway.

