Dust Obscured Star Formation Seen in the Far-Infrared

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Galaxy Evolution

- The peak era of galaxy growth took place at $z\sim 1-3$
 - Dusty star formation
- SFRD of (U)LIRGs increase dramatically towards higher redshifts.





The CANDELS project

- Cosmic Assembly Near-Infrared Deep Extragalactic Legacy Survey (PIs: S. Faber & H. Ferguson)
- HST ACS & WFC3 deep imaging for GOODS-S and N, EGS, UDS, and COSMOS
 - High resolution (galaxy structure)
 - Deep imaging (detect all Herschel counterparts)



GOODS- & CANDELS-Herschel

- Deepest 100-500µm data
 - Typical star-forming galaxies up to z~1.5
- Covering 4/5 CANDELS fields
 - Improved statistics and good control over cosmic variance
 - Increase accessible fields with ALMA
 - GOODS-S, UDS, & COSMOS









GOODS- & CANDELS-Herschel COSMOS Deepest 100-500um data **PEP-COSMOS** 10¹³ 1000 CANDELS له] (L_©) لسا 10¹² 100 ° ₩ * 10¹¹ SFR $_$ CANDELS (100 μ m, 1.4 mJy) -10 $_$ $_$ CANDELS (160 μ m, 3.5 mJy) $_$ COSMOS (100 μ m, 5 mJy) 10¹⁰ $_$ COSMOS (160 μ m, 11 mJy) 10⁹ 2 3 redshift GOODS-N GOODS-S

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Controlling cosmic variance: Number counts (160µm)



IR luminosity functions in the CANDELS fields



IR luminosity functions with stacking



IR luminosity functions in the CANDELS fields



Evolution in LFs



IR Star Formation and Galaxy Structure



Star Formation and Galaxy Structure



Kartaltepe et al. 2012





Gini-M20 for Herschel Galaxies





Summary

- The deepest 100-500µm data in 4/5 CANDELS fields
 - GOODS-S, GOODS-N, UDS, and COSMOS
 - Improved statistics and good control over cosmic variance
 - 3x more typical SF galaxies can be observed with ALMA
- Dust-obscured star formation at high redshifts
 - IR luminosity functions
 - Better constrain on IR LF < L_{IR}^*
 - Direct measurement of the faint-end slopes at $z \le 1$
- Infrared galaxies and their morphologies
 - Lie along a sequence in G-M20
 - Mostly late-type (disk) galaxies