large scale galactic structure and nearby galaxies

Leslie Hunt (INAF-Osservatorio Astrophisico di Arcetri, Florence, Italy) and all those who kindly gave material

image credit: M. Galametz, KINGFISH
the Herschel legacy for nearby galaxies and galaxy structure

- **Spatial resolution in the Local Universe:** resolved dust maps and more accurate dust masses because of longer wavelengths. Use dust to trace ISM.

- **Spatially resolved energy budget in the ISM:** heating and cooling on a local scale with [CII], [OIII], [NII] dust continuum maps.

- **ISM diagnostics from molecules:** CO cooling curves, shocks and H$_2$O emission

- **AGN feedback in local ULIRGs:** P-Cygni profiles of molecular transitions with PACS.
spatial resolution
M 104

MIPS24, PACS 160, SPIRE composite (KINGFISH, image credit M. Galametz)
M81 dust at ~600 pc resolution

30x20 arcmin maps

(VNGS, Wilson et al., taken from Bendo+ 2012)
Unprecedented view of the Virgo cluster in a 64 deg$^2$ map from 100 to 500 $\mu$m

HeViCS (Davies et al.) together with HRS (Boselli, Eales et al.), enables study of early-type galaxies in an unbiased way

image credit M. Smith
Map of color temperature in M33 at \(~\)100 pc resolution

HerM33es, Cramer et al., taken from Braine+ 2012

(see also HELGA for M31, Fritz+ 2012)
HERITAGE, Meixner et al., taken from Gordon+, in prep
Dust mass and minimum radiation field $U_{\text{min}}$ with Draine & Li (2007) models

KINGFISH, Kennicutt et al., taken from Aniano+, in prep.
spatially resolved energy budget
30 Dor in LMC, PDRs on ~10 pc scales

160µm HERITAGE Meixner+ 2010
Hα MCELS Smith+

PACS maps:
[CII] 158 μm
[OI] 63 and 145 μm
[OIII] 88 μm
[NII] 122 205 μm

SPIRE FTS:
[NII] 205 μm
[CI] 370 and 609 μm

DGS, Madden et al., taken from Chevance+ 2013
Starburst-driven outflow in M82 at a resolution of 300 pc

Integrated line emission at original spatial resolution

SHINING, Sturm et al., taken from Contursi+ 2013
Spiral arms and HII regions in NGC 6946 at \(~400\) pc scales

ISO [CII] from Contursi+ (2002), resolution 5 times worse than PACS
Spiral arms and HII regions in NGC 6946 at ~400 pc scales

KINGFISH, Kennicutt et al., taken from Croxall+, in prep.
[CII] deficit revisited with SHINING

Deficit could be governed by SF efficiency, ionization parameter, optical depth? Work in progress, more galaxies will help.

SHINING, Sturm et al., taken from Gracia-Carpio+ 2011
molecular ISM diagnostics
Cooling in NGC 253, need for mechanical heating

HEXGAL, Güsten et al., taken from Rosenberg+, in prep.
HerCULES, van der Werf et al., taken from van der Werf+ (2010), Meierink+ (2013)

Local ULIRG cooling curves
XDRs vs. shocks

Mrk 231

NGC 6240
Water strongest molecule after CO in FTS spectra

NGC 1266

H$_2$O in z=2 (753 GHz from PdBI) and local ULIRGs (from FTS) taken from Yang+ 2013 and Omont+, in prep.

Shocks in NGC 1266 (FTP: JD Smith et al., taken from Pellegrini+ 2013)
Arp 220, Mrk 231 – a “FIR, molecular photosphere”, $\tau(\text{FIR}) > 1$

Taken from Fischer+, in preparation
AGN feedback in local ULIRGs
The molecular outflow in Mrk 231

(seen in various OH transitions)

Massive molecular outflows in ULIRGs

OH profiles show in some cases outflow velocities of 1000 km/s.

Thanks to all those whose hard work and dedication made Herschel the success it turned out to be!

Herschel has surpassed expectations and opened pathways to synergies with other facilities (e.g., ALMA, SOFIA, JWST, EVLA, ...)

Herschel’s treasury is safeguarded by the Herschel Science Archive and will be a valuable resource for years to come.