

ALMA Band 2 reveals large-scale structures at high redshifts

Michał Jerzy Michałowski

Institute for Astronomy, University of Edinburgh

14.12.2011

ALMA Band 2 workshop, Manchester

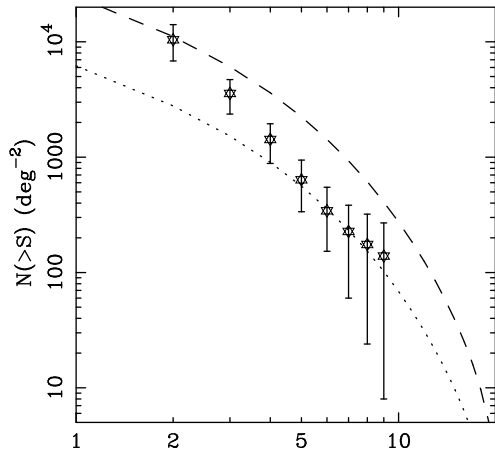
Outline

- 1 Introduction
- 2 *Herschel* programme
- 3 ALMA Band 2

Cluster of galaxies

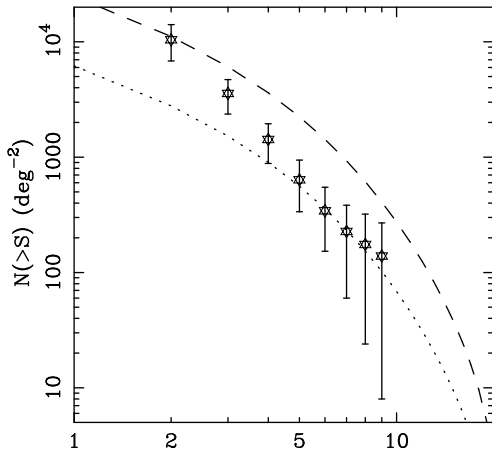
- Clusters of galaxies: largest gravitationally bound structures in the Universe
- Sensitive to cosmology
- We need to trace their origin at high redshifts
- Quasars reside in overdense regions - do they trace the formation of the first clusters?

SCUBA work



850 μm flux density (mJy)
Stevens et al., 2010, MNRAS, 405, 2623

SCUBA work



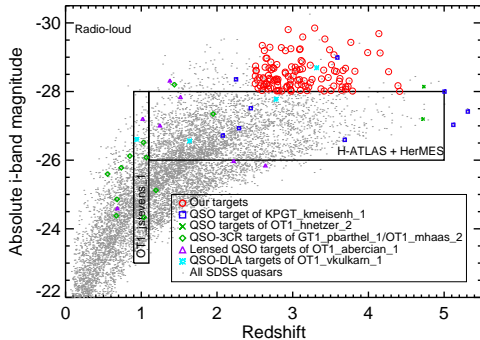
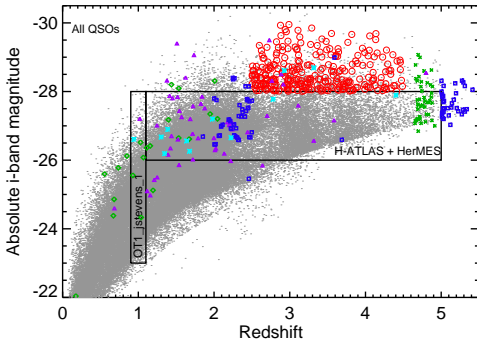
- only 5 quasars
- rest-frame 300–500 μm (cold dust)
- $1.7 < z < 2.8$

850 μm flux density (mJy)
Stevens et al., 2010, MNRAS, 405, 2623

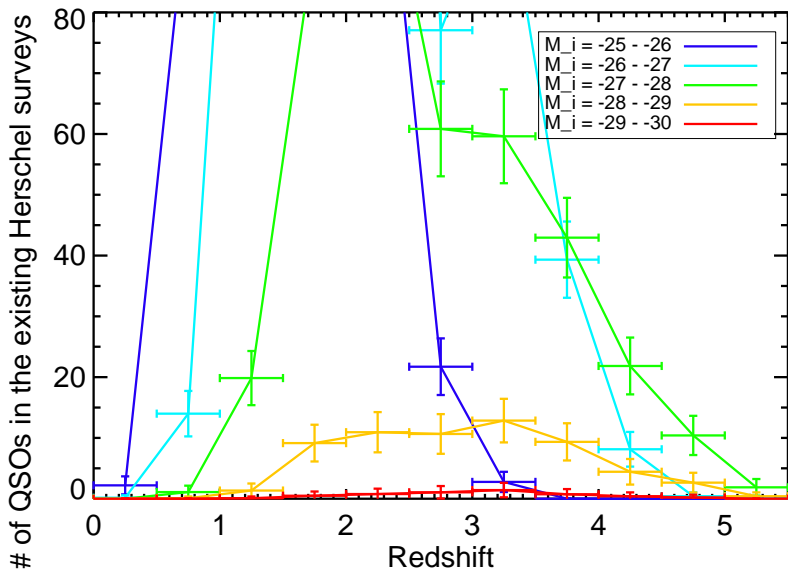
OT2_jdunlop_1 in a nutshell

- 58.3 hours awarded (priority 2)
- PI: Dunlop & Michałowski
- 275 quasars spread uniformly across $2.5 < z < 4.5$ and $-30 < M_i < -28$
- Both radio-loud and radio-quiet quasars
- Aims:
 - probe close to the rest-frame $100 \mu\text{m}$ (close to the dust peak)
 - SFR of the host as a function of M_i , z and radio power
 - identify the overdensities of SMGs: the first large-scale structures

The need of *Herschel* targetted observations



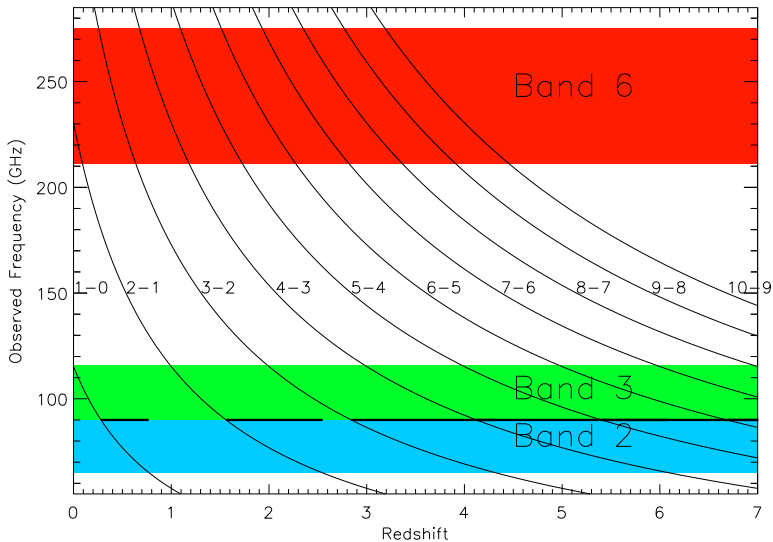
The need of *Herschel* targetted observations



Identification of large-scale structures

- 12 arcmin² FoV of SPIRE: ~ 3 SMGs in the field of each QSOs
- low-redshift ($z < 1$) rejected with shallow optical data
- foreground SMGs at $1 < z < 3$ identified via *Herschel* colours
- the rest targetted by ALMA to search for CO redshift close to the redshift of the quasar

CO redshift coverage



Conclusions

Band 2 advantages to look for high- z large-scale structures:

- lower excitation CO lines
- better redshift coverage per pointing
- larger field of view