PEP: FIRST *HERSCHEL* PROBE OF DUSTY GALAXY EVOLUTION UP TO z~3

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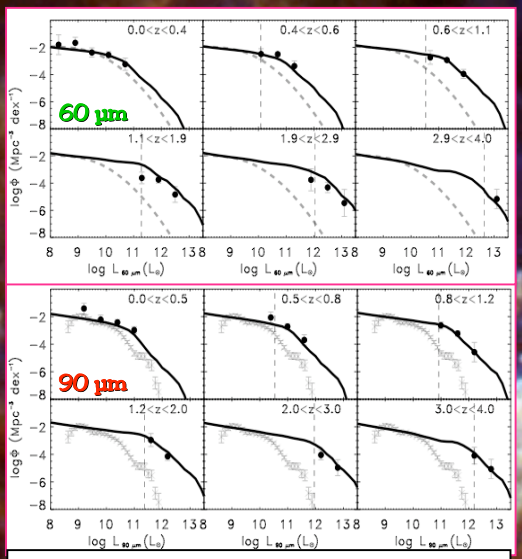
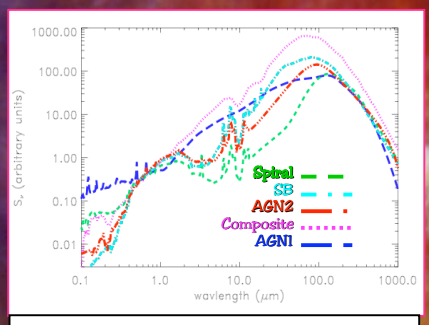
ABSTRACT: We exploit the deepest existing 100- and 160-μm data obtained by PEP in the GOODS-N to derive for the first time the evolution of the rest-frame 60-μm, 90-μm and total IR Luminosity Function (LF) up to unprecedented high redshifts (z~3).



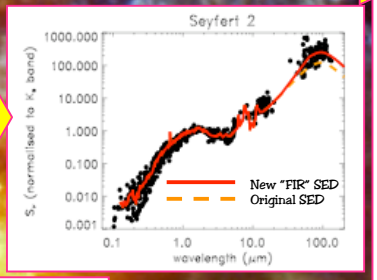
Rest-frame LF at 60 μm (top) and 90 μm (bottom). Black solid line: GP2010 model; grey dashed line: Saunders+'90 60-μm LLF; diagonal crosses: Serjeant+'04 90-μm LLF.

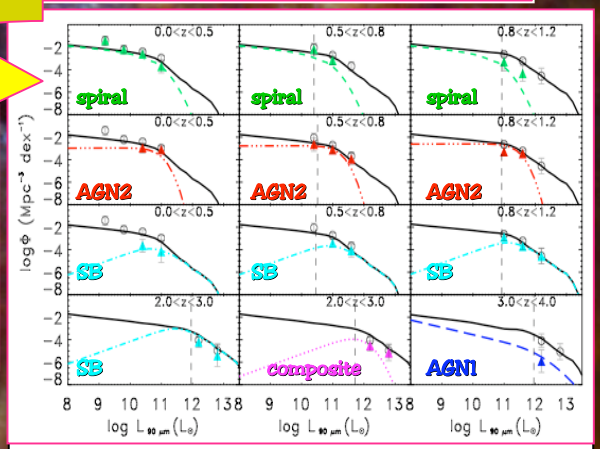


Prototypical template SEDs (from the library of Polletta+'07) for the five populations.

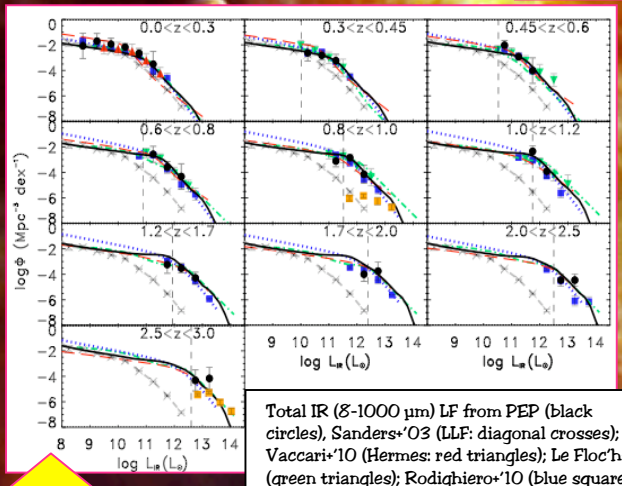
The PEP sources (216 and 237 to S(3σ)~3 and 5.7 mJy at 100 and 160 μm respectively) have been fully characterised through a SED-fitting analysis and divided into five main classes: spiral galaxies, starbursts (SB), composite AGN+SB, AGN2, AGN1 (several templates for each class). Their LFs have been computed separately and compared to the Gruppioni & Pozzi (2010, in preparation: GP2010) backward evolution model predictions.

In some cases (10-12%, mainly for the AGN2) the considered local templates underestimate the PEP data points: it is therefore necessary to construct ``more FIR" templates to fit our observed SEDs.



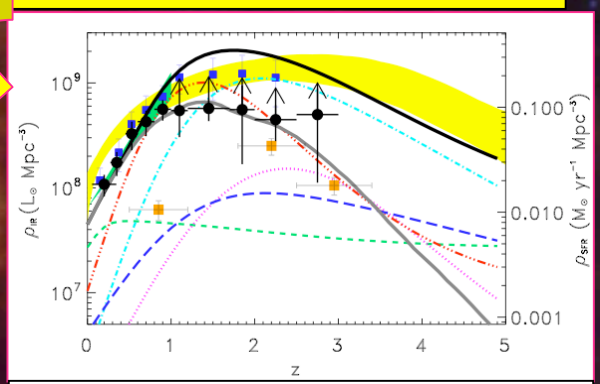


Rest-frame LF at 90 μm from PEP (coloured triangles) and from GP2010 model at the most representative z-bins for the different populations (green: spirals; red: AGN2; cyan: SB; magenta: composite; blue: AGN1).



Total IR (8-1000 μm) LF from PEP (black circles), Sanders+'03 (LLF: diagonal crosses); Vaccari+'10 (Hermes: red triangles); Le Floc'h+'05 (green triangles); Rodighiero+'10 (blue squares); Chapman+'05 (orange squares). Models are from GP2010 (black solid), Lagache+'04 (green dot-dashed), Le Borgne+'09 (red dashed) and Valiante+'09 (blue dotted).

Spiral galaxies dominate the LF and the Star-formation Density (SFD) only at low redshifts (z≤0.3), when moderate SF galaxies with AGN2 SEDs start to prevail up to z~1.5. Then SB galaxies, dominating the bright end of the LF at any z, become the prevalent population up to the highest redshifts.



Total IR LD (or SFD) versus z from PEP (black circles) and GP2010 model (black line: total SFD, grey line: SFD integrating to the PEP completeness limit only, coloured lines; different populations, as above). SFD measurements from different optical/UV surveys (Hopkins&Beacom'06: yellow area), 24-μm surveys (Le Floc'h+'05: green area; Rodighiero+'10: blue squares) and sub-mm surveys (Chapman+'05: orange squares) are also reported.

Our PEP total IR LF agrees well with previous determinations (from either data or models). We find luminosity evolution as $\sim(1+z)^{4.1\pm0.3}$ up to $z=1.5\pm0.3$ (though degeneracy is found between luminosity evolution and both density and luminosity). At $1.5\leq z\leq 2.5$-3 the evolution rate appears to keep ~constant.

CONCLUSIONS: We make use of the deepest *Herschel* PEP 100- and 160-μm data in the GOODS-N to characterise the evolution of the galaxy and AGN FIR LF and SFD at $0\leq z\leq 3$, finding that strong evolution is required at least up to z~2, with the different IR populations showing different evolutionary behaviours.