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Author: Bonfield, DG ; Jarvis, MJ ; Hardcastle, MJ ; Cooray, A ; Hatziminaoglou, E ; Ivison, RJ ; Page, MJ ; Stevens, JA ; de Zotti, G ; Auld, R ; Baes, M ; Buttiglione, S ; Cava, A ; Dariush, A ; Dunlop, JS ; Dunne, L ; Dye, S ; Eales, S ; Fritz, J ; Hopwood, R ; Ibar, E ; Maddox, SJ ; Michalowski, MJ ; Pascale, E ; Pohlen, M ; Rigby, EE ; Rodighiero, G ; Serjeant, S ; Smith, DJB ; Temi, P ; van der Werf, P
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Abstract: We use the science demonstration field data of the Herschel Astrophysical Terahertz Large Area Survey to study how star formation, traced by the far-infrared Herschel data, is related to both the accretion luminosity and redshift of quasars selected from the Sloan Digital Sky Survey (SDSS) and the 2dF-SDSS luminous red galaxy (LRG) and Quasar Spectroscopic Catalogue survey. By developing a maximum-likelihood estimator to investigate the presence of correlations between the far-infrared and optical luminosities, we find evidence that the star formation in quasar hosts is correlated with both redshift and quasar accretion luminosity. Assuming a relationship of the form L(IR) alpha L(QSO)(theta)(1 + z)(zeta), we find theta = 0.22 +/- 0.08 and zeta = 1.6 +/- 0.4, although there is substantial additional uncertainty in zeta of the order of +/- 1, due to uncertainties in the host galaxy dust temperature. We find evidence for a large intrinsic dispersion in the redshift dependence, but no evidence for intrinsic dispersion in the correlation between L(QSO) and L(IR), suggesting that the latter may be due to a direct physical connection between star formation and black hole accretion. This is consistent with the idea that both the quasar activity and star formation are dependent on the same reservoir of cold gas, so that they are both affected by the influx of cold gas during mergers or heating of gas via feedback processes.