TRACING HOT DUST SINCE z=1—2

EVOLUTION OF IR LUMINOSITY FUNCTIONS AND LUMINOSITY DENSITIES

wanna-be-Dr Hugo Messias

Multiwavelength Views of the ISM in High-Redshift Galaxies

Santiago, 30th June 2011

Supervisor

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Bahram Mobasher

Collaborators

Andrew M. Hopkins
Mara Salvato

OUTLINE

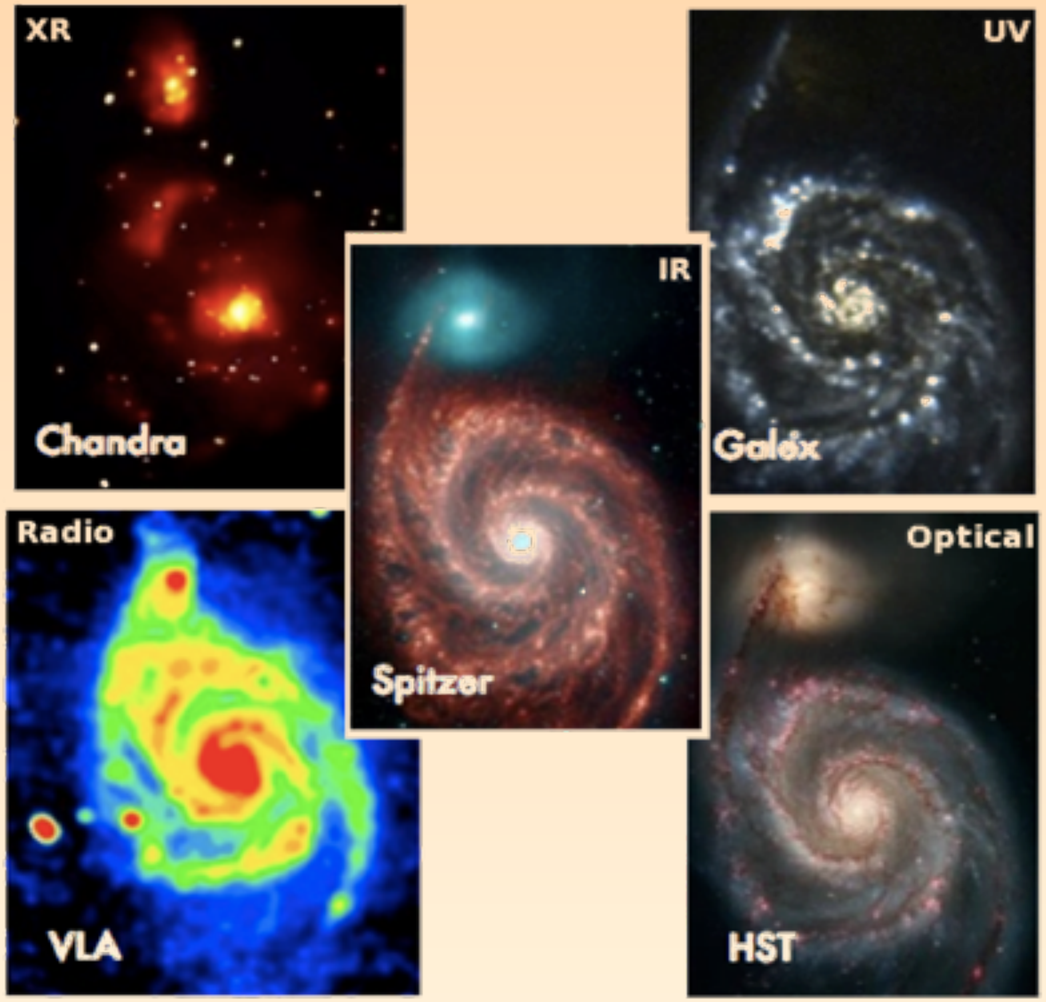


Image credits: Chandra: NASA/CXC/SAO; Galex: NASA/JPL-Caltech; HST: NASA/AURA/STScI/Hubble Heritage Team; Spitzer: NASA/JPL-Caltech, VLA: MPIfR Bonn

INTRO

.WHY INFRARED?

.WHY DUST?

STRATEGY

.TRACING HOT DUST

.SAMPLE

.AGN: THE KI CRITERION

IR

.LUMINOSITY FUNCTIONS

.THE AGN BOOST

DUST

.LUMINOSITY DENSITY FUNCTIONS

.EVOLUTION

FUTURE

INTRO WHY INFRARED? DUST?

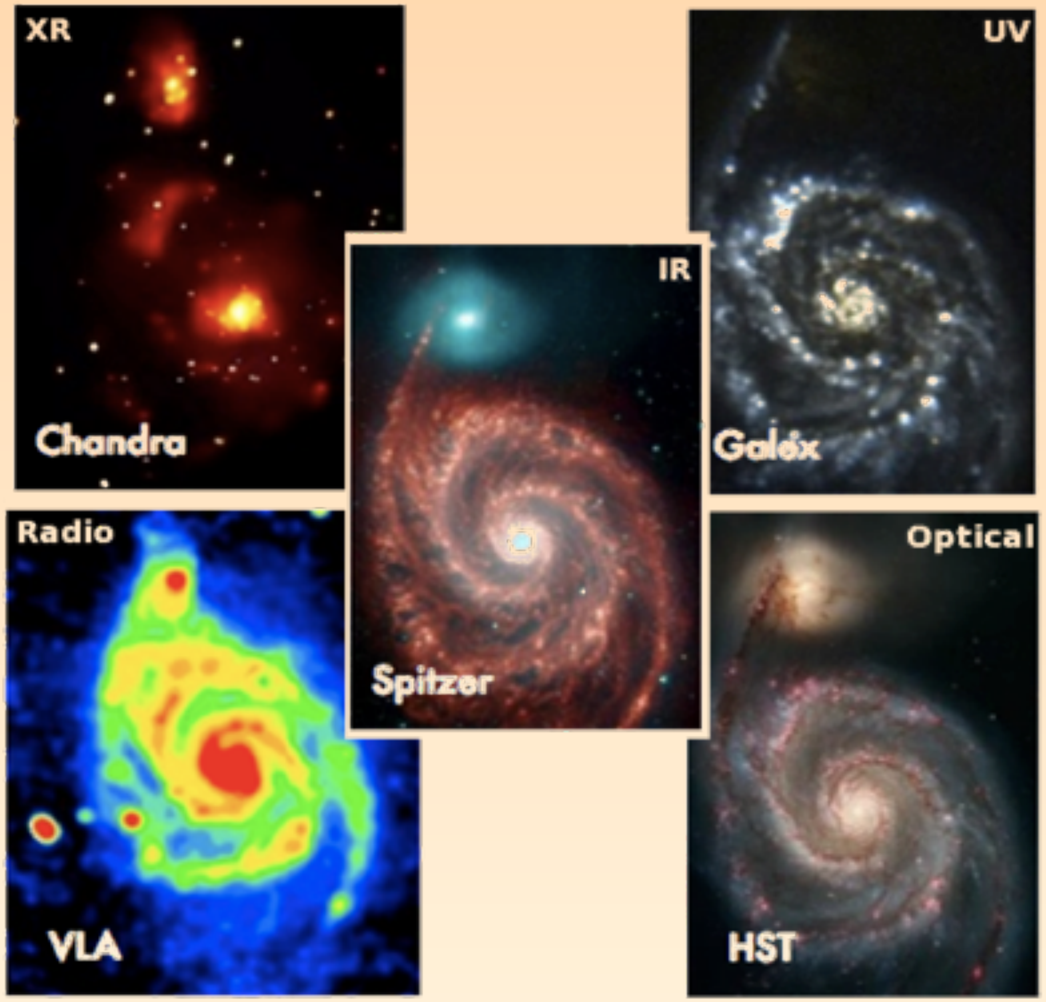


IMAGE CREDITS: CHANDRA: NASA/CXC/SAO; GALEX: NASA/JPL-CALTECH; HST: NASA/AURA/STSCI/HUBBLE HERITAGE TEAM; SPITZER: NASA/JPL-CALTECH, VLA: MPIFR BONN

WHAT...

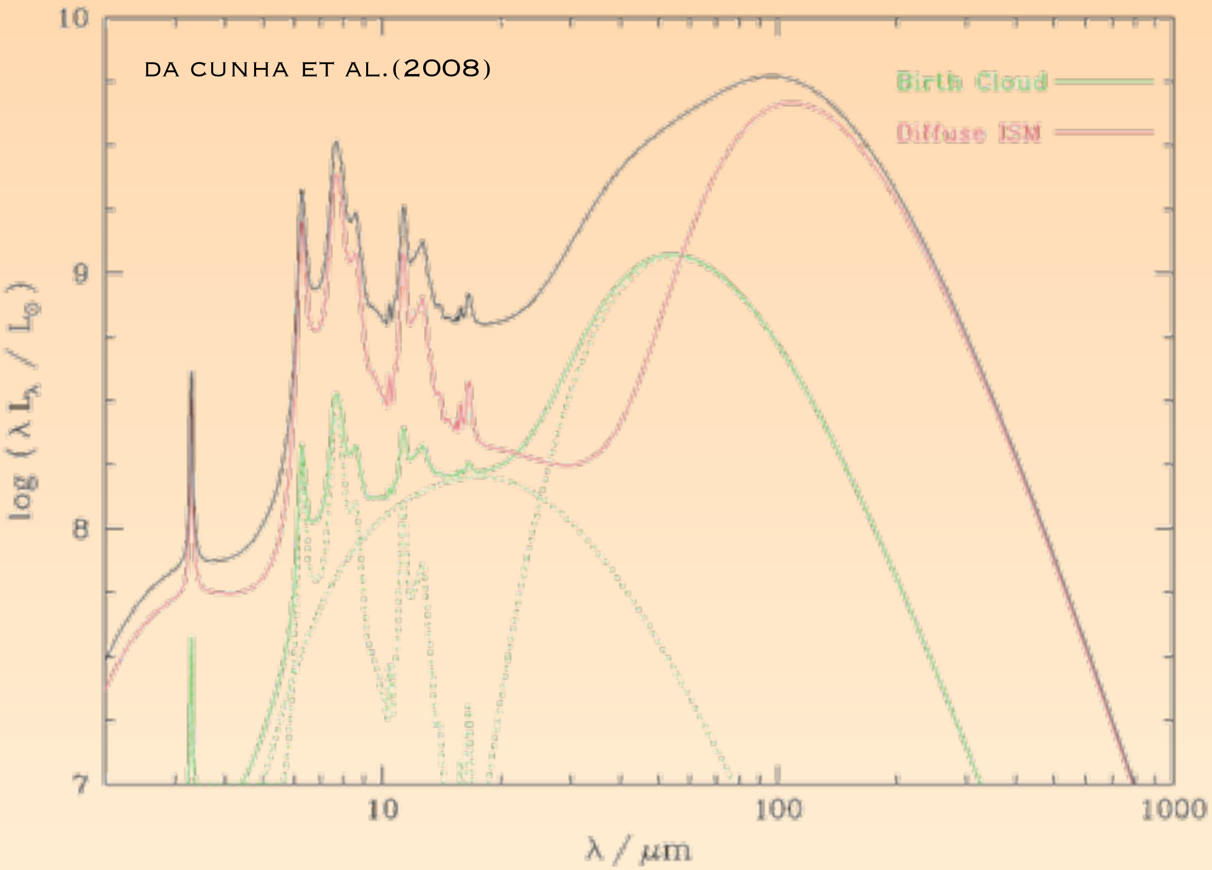
...DOES IR SHOW?

.COLD LONG-LIVED STARS
.EVOLVED STARS
.DUST

...DOES DUST HIDE?

.STAR FORMATION (SF)
.ACTIVE GALACTIC NUCLEI (AGN)

DUST

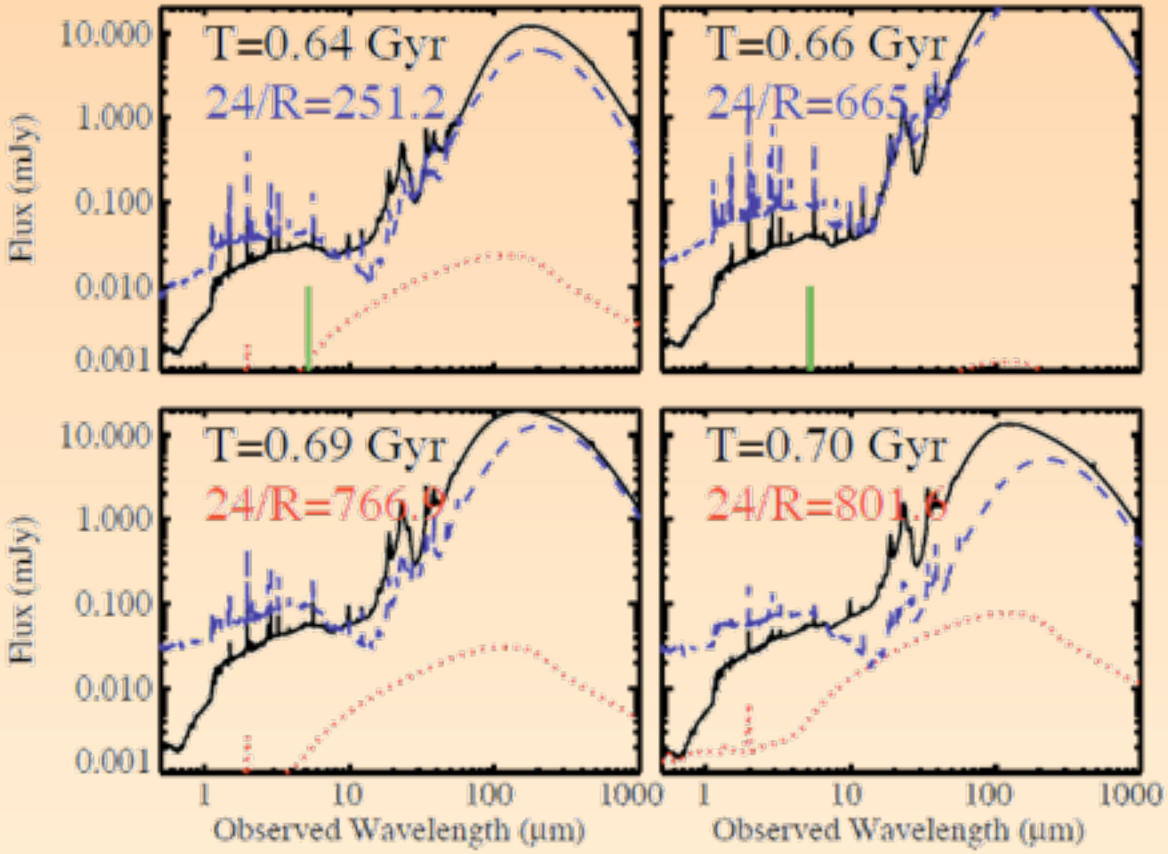


FACTS

.MOSTLY EMITTING AT MIR/FIR/SUB-MM WAVELENGTHS

.HIDES INTENSE SF/AGN ACTIVITY

DUST



NARAYANAN ET AL.(2010)

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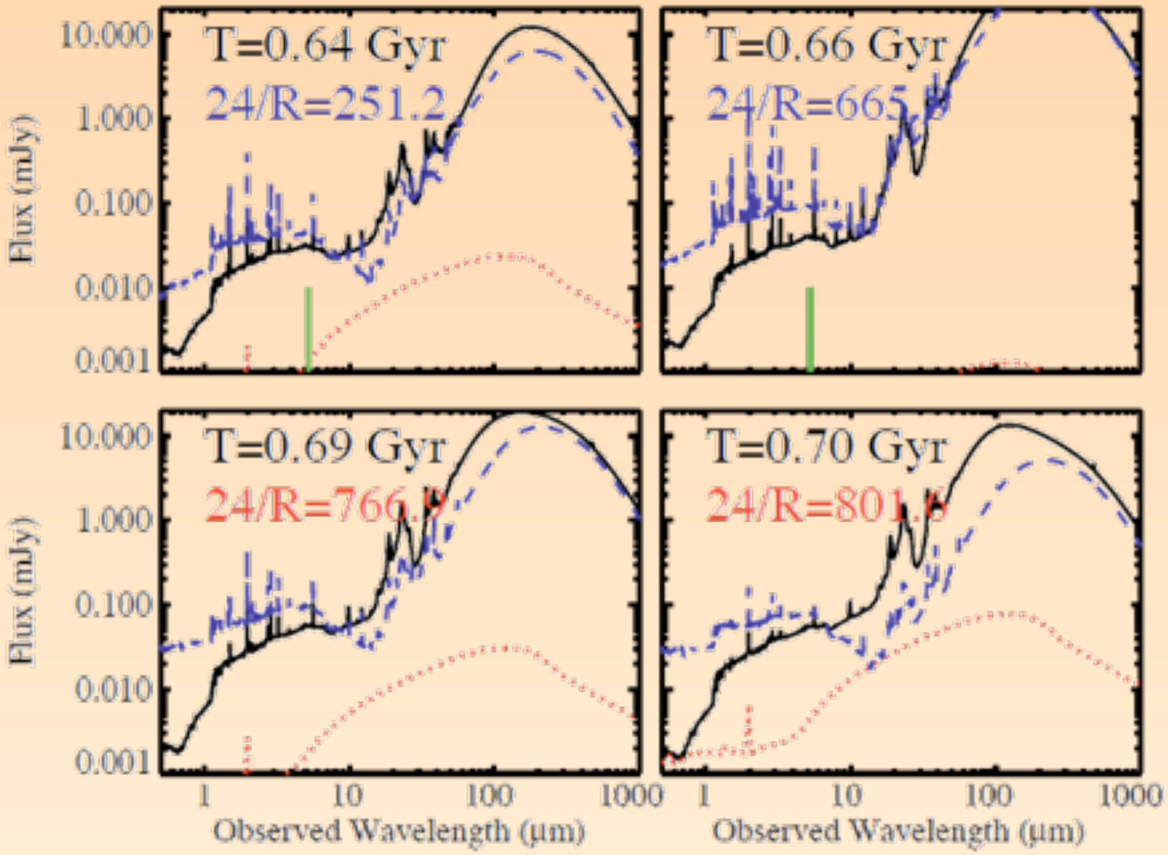

narayanan et al.(2010)

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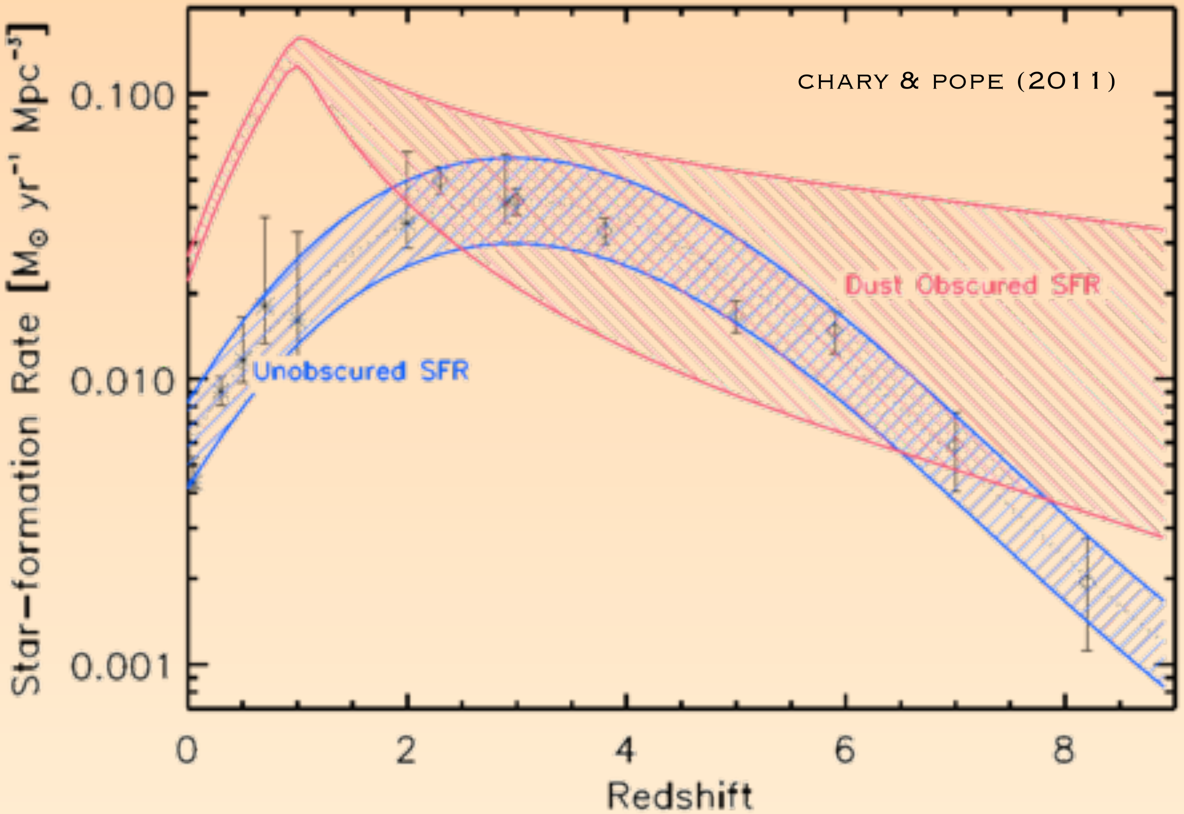
QUESTIONS

.do we really understand it?

Monday, September 12, 2011

DUST



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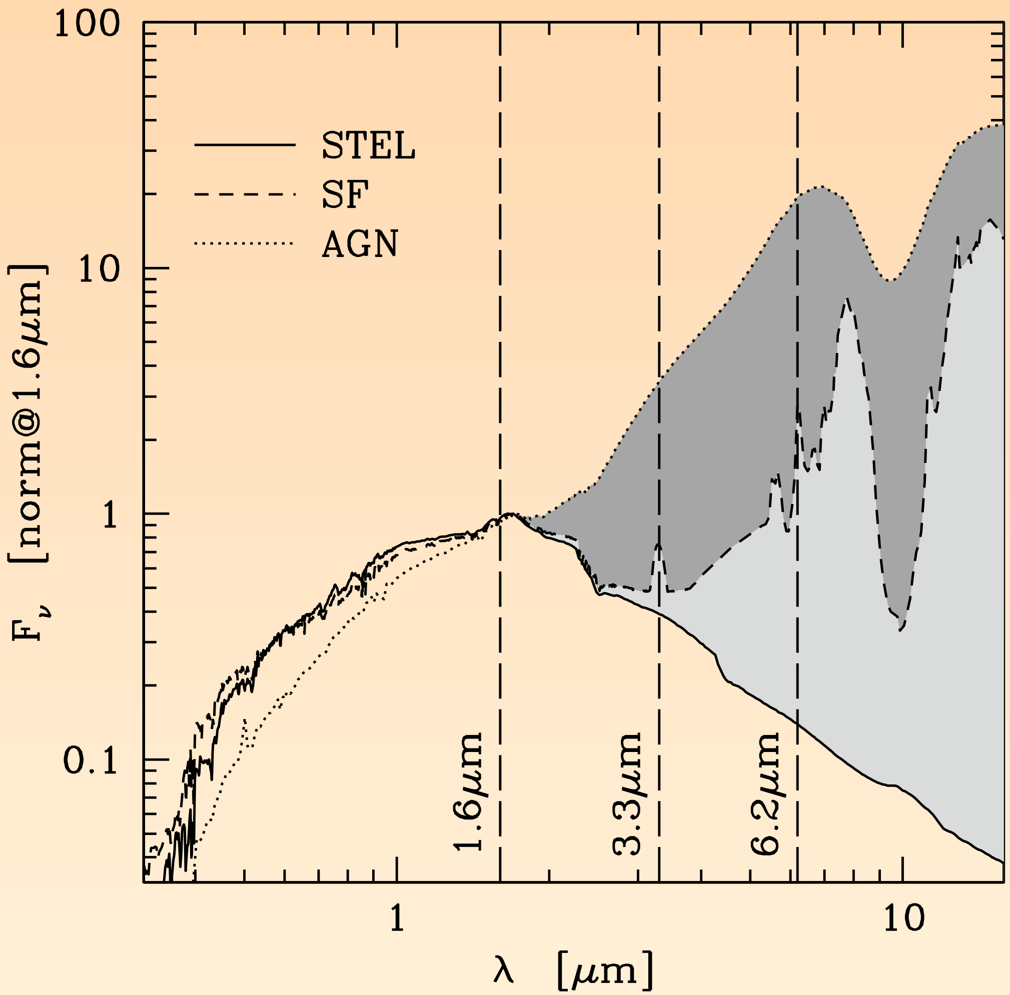
.HOW ABOUT EVOLUTION?

STRATEGY tracing hot dust



hot dust contribution at IR wavelengths. Dashed line refers to Arp220, while the dotted line to IRAS 19254-7245.

FACTS

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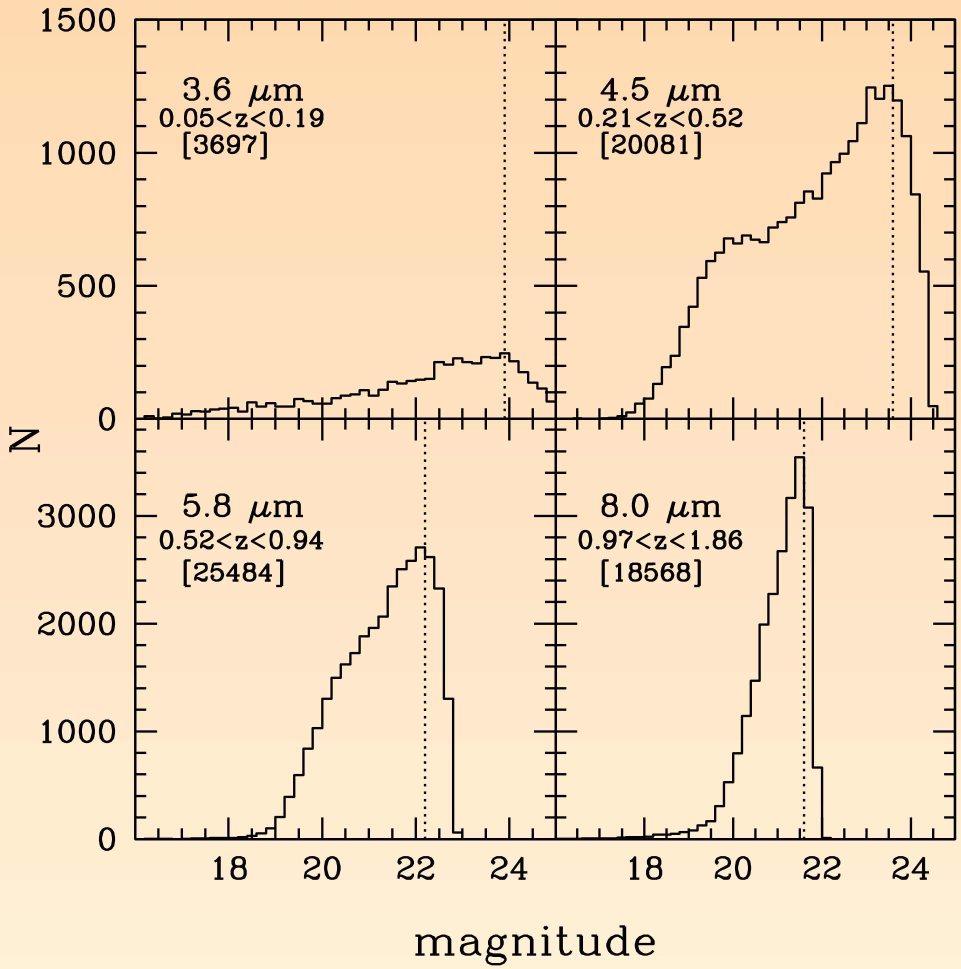
QUESTIONS

.do we really understand it?
.how about evolution?
.how about hot dust?

ESTIMATE LUMINOSITIES

.1.6μm - interpolation
.3.3μm - observed band

STRATEGY sample



SAMPLE SELECTION

.COSMOS (Ilbert et al.2009)

.EARLY/LATE/STARB. - SED FITTING

.AGN - K-[4.5]<0 or KI

AGN IR SELECTION: KI

PROS:

.SIMPLE

.MORE COMPLETE

.ALLOW DEEPER FLUX LEVELS

.STATISTICALLY LARGER SAMPLES

CONS:

.RESTRICTED TO IRAC BANDS

.CONTAMINATION BY SF GALAXIES

.BIAS TOWARD LUMINOUS AGN

.BIAS TOWARD UNOBSCURED AGN

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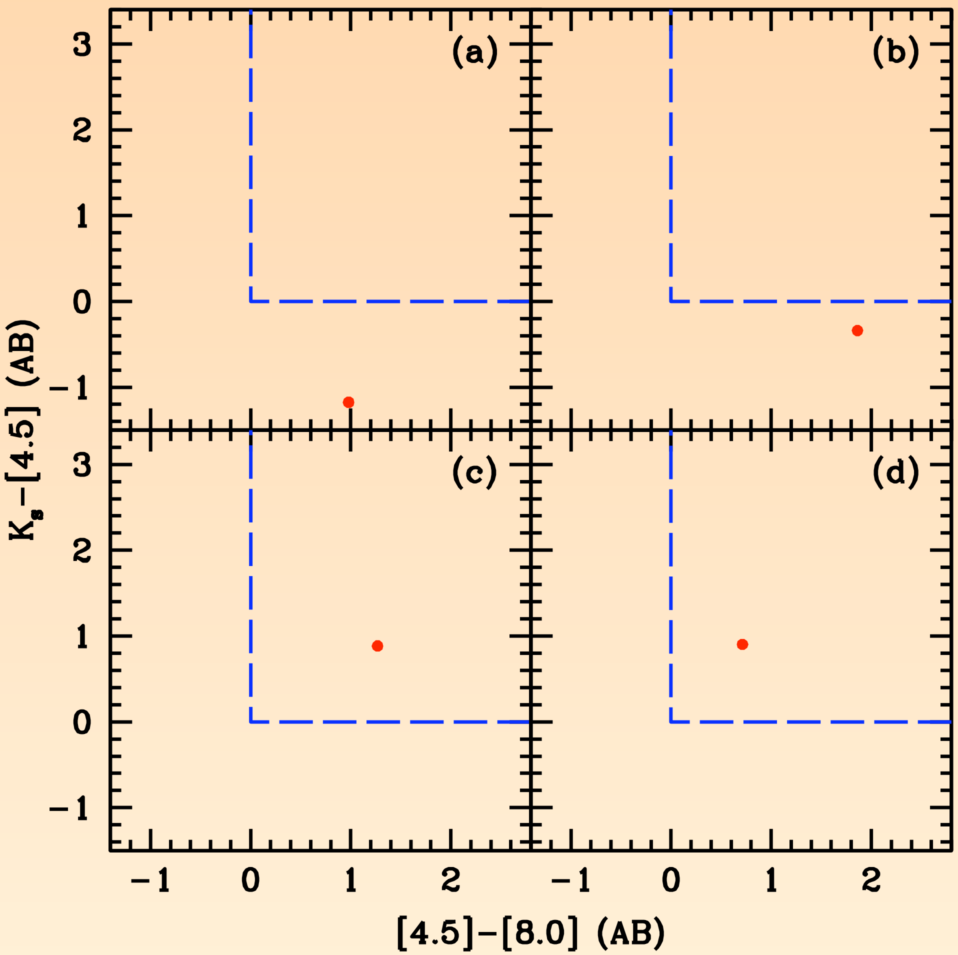

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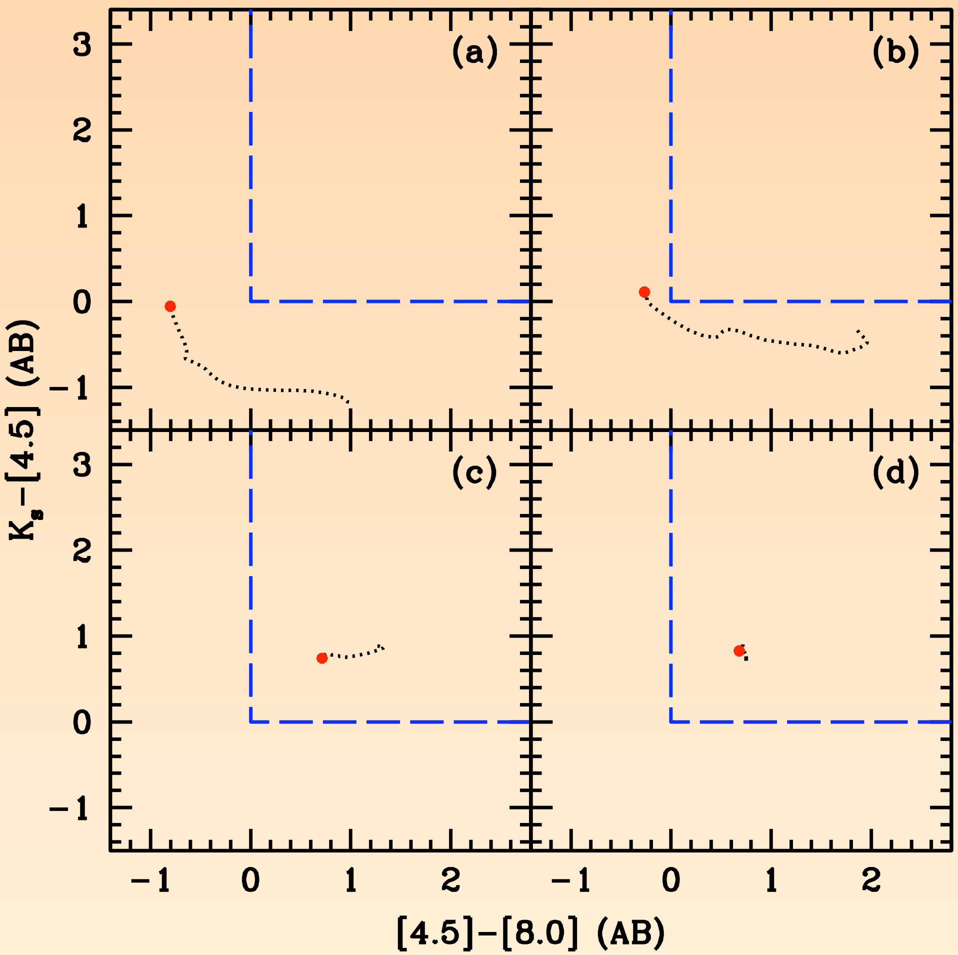

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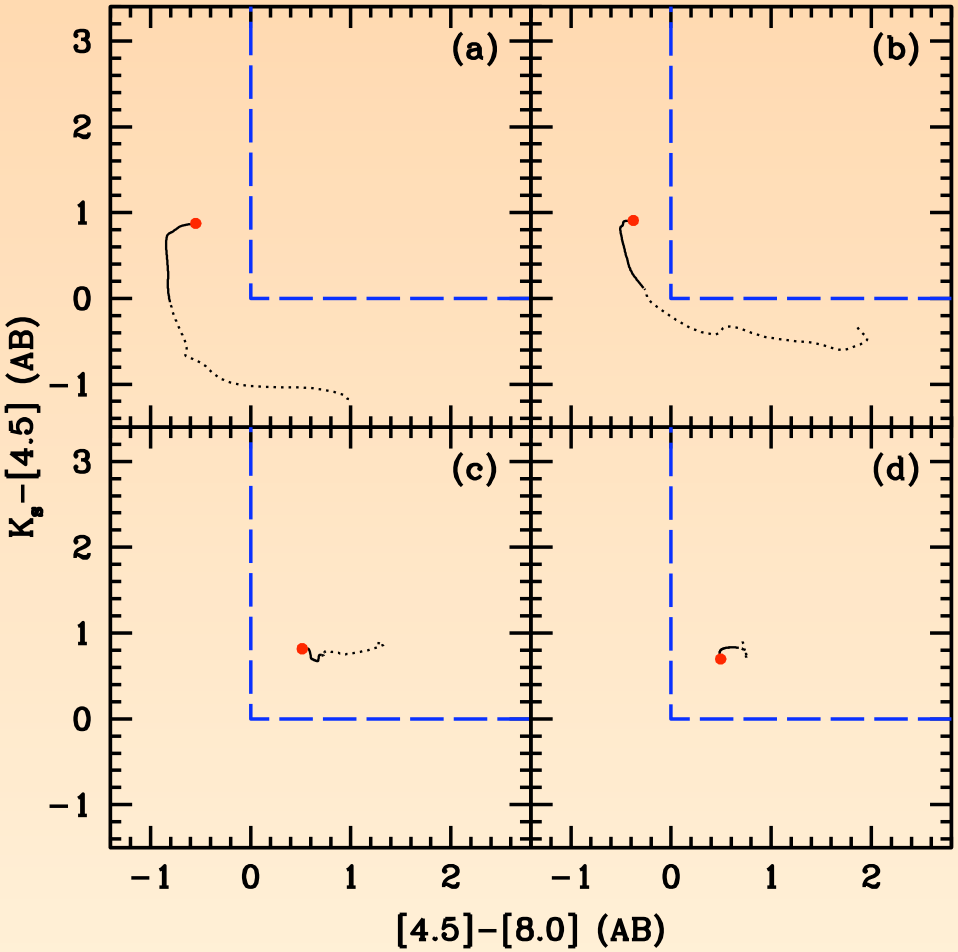

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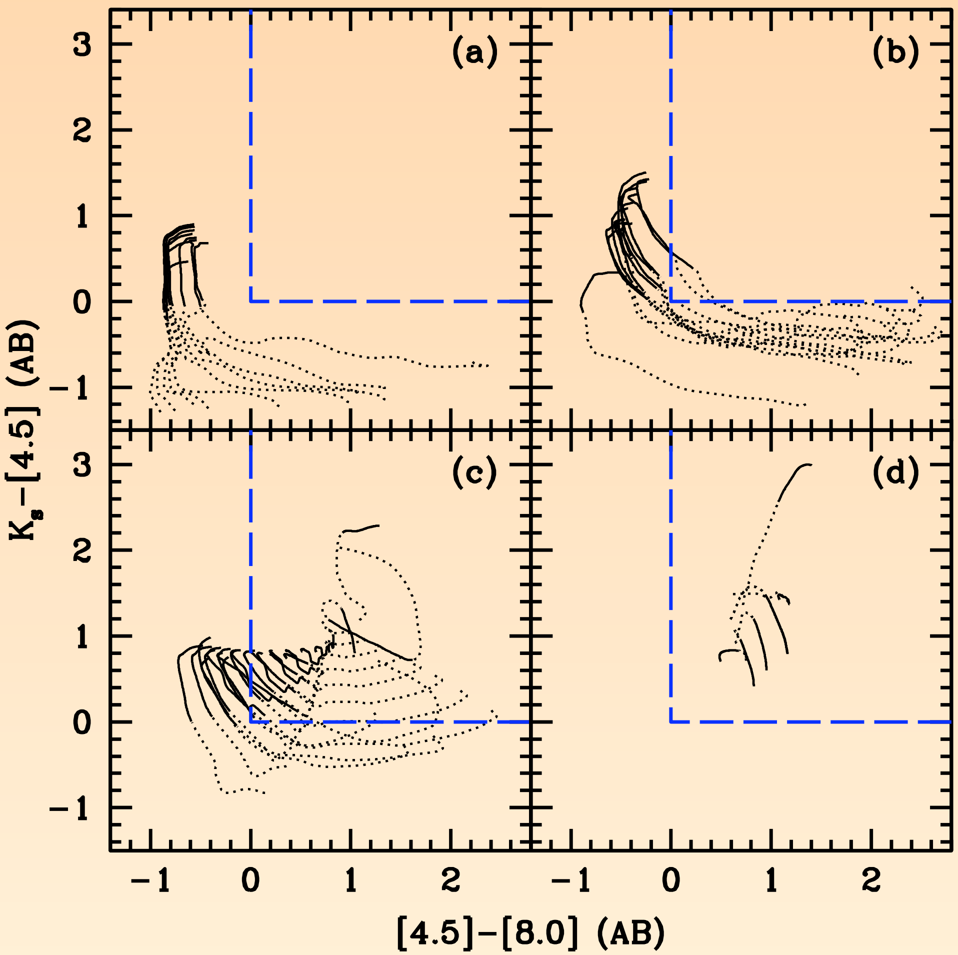

KI. The dashed blue frontiers delimit the AGN loci. The colour tracks are divided into (a) early/late, (b) starbursts, (c) hybrids, and (d) AGN. The dotted portion of the tracks indicate 0<z<1, solid otherwise. Red dots mark z=2.5.

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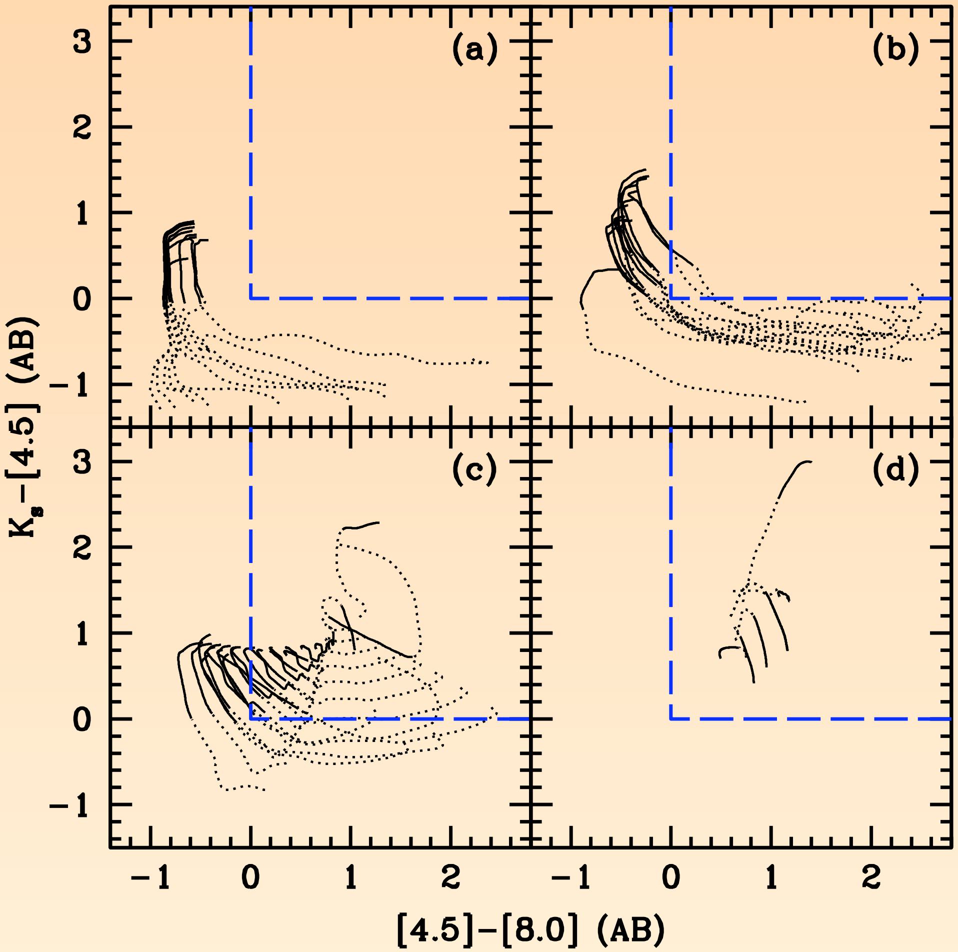

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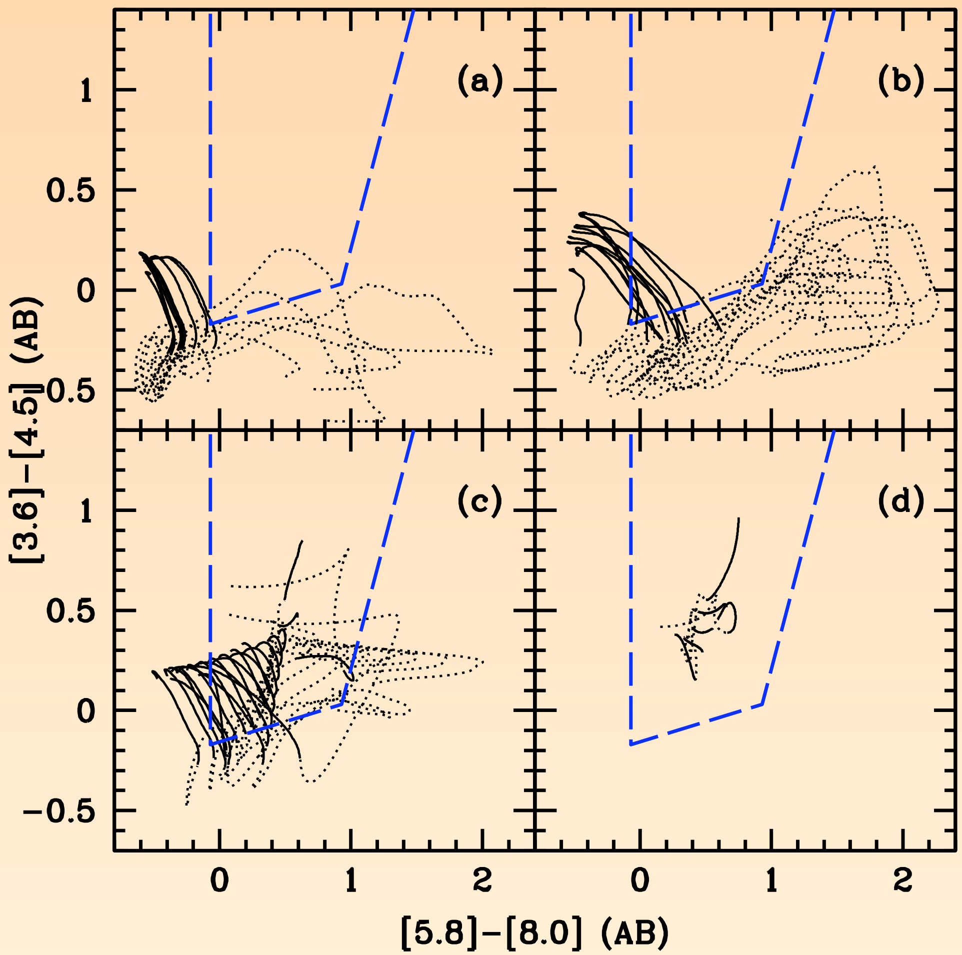

STERNETDALS (2005) 'WEDGE'. THE DASHED BLUE REGION. THE AGN ROLE. THE ...

THE AGN TRACKS. THE COLOURED TRACKS ARE EARLY/LATED (B) STARBURSTS/

(A) ETHYBRIDS, STARBURSTS, AGN (N) HYBRIDS, T AND PORTION OF THE TRACKS

PORTION OF Z<1, TRACKS INDICATE 0<Z<1, DOTS MARK Z=2.5E.

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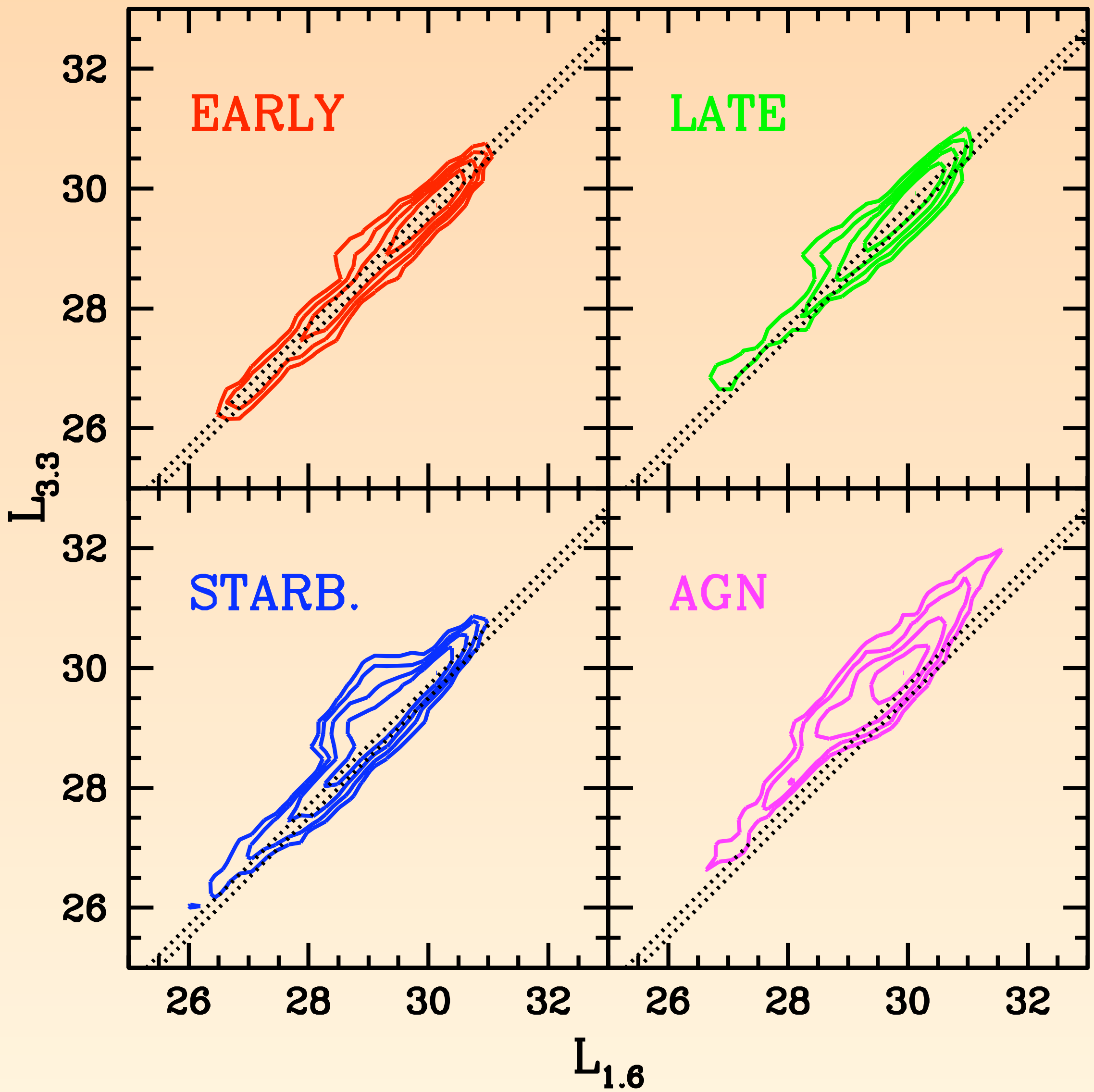

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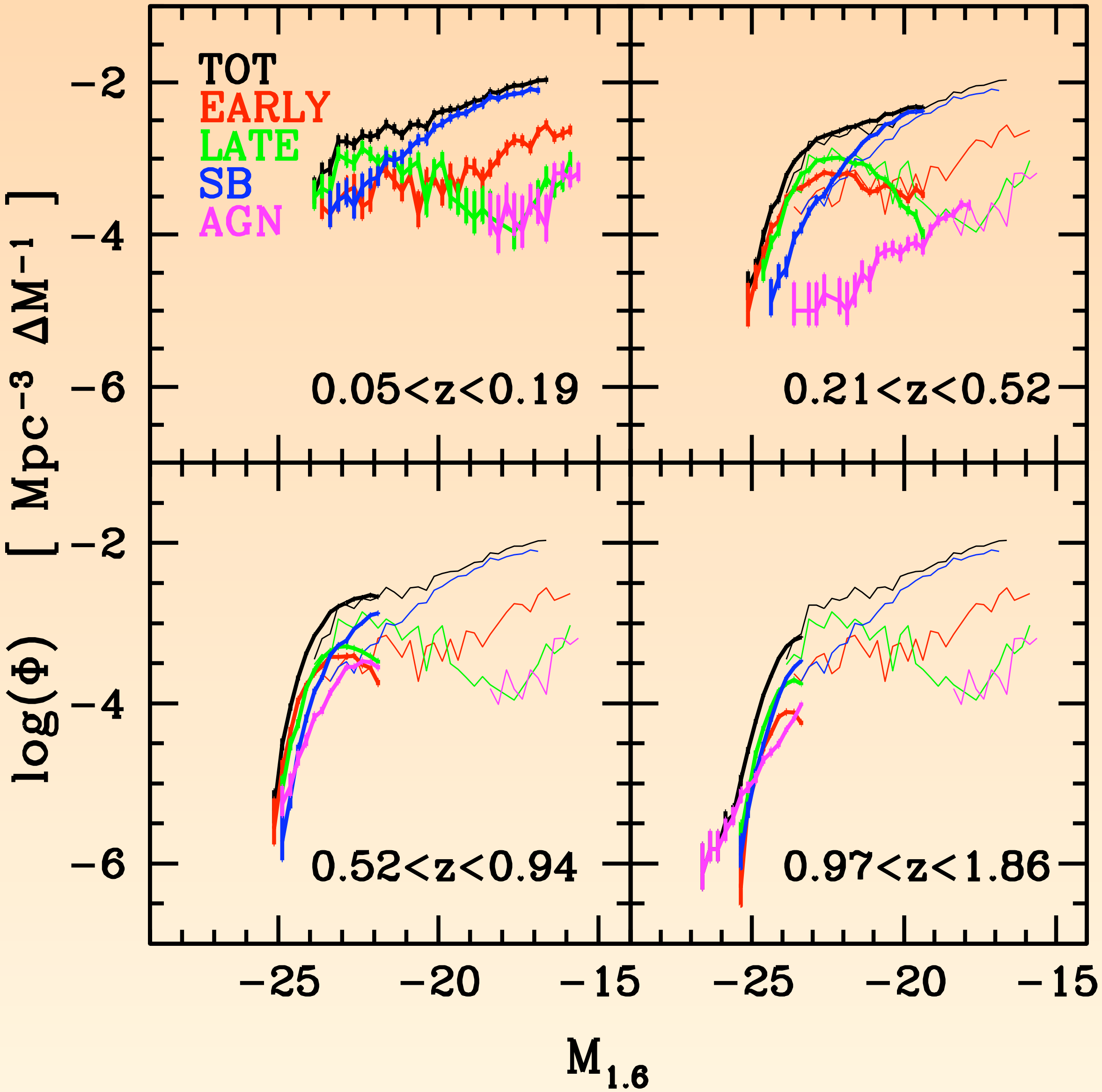

Worth of note

.bimodality (Drory et al.2009 and refs)

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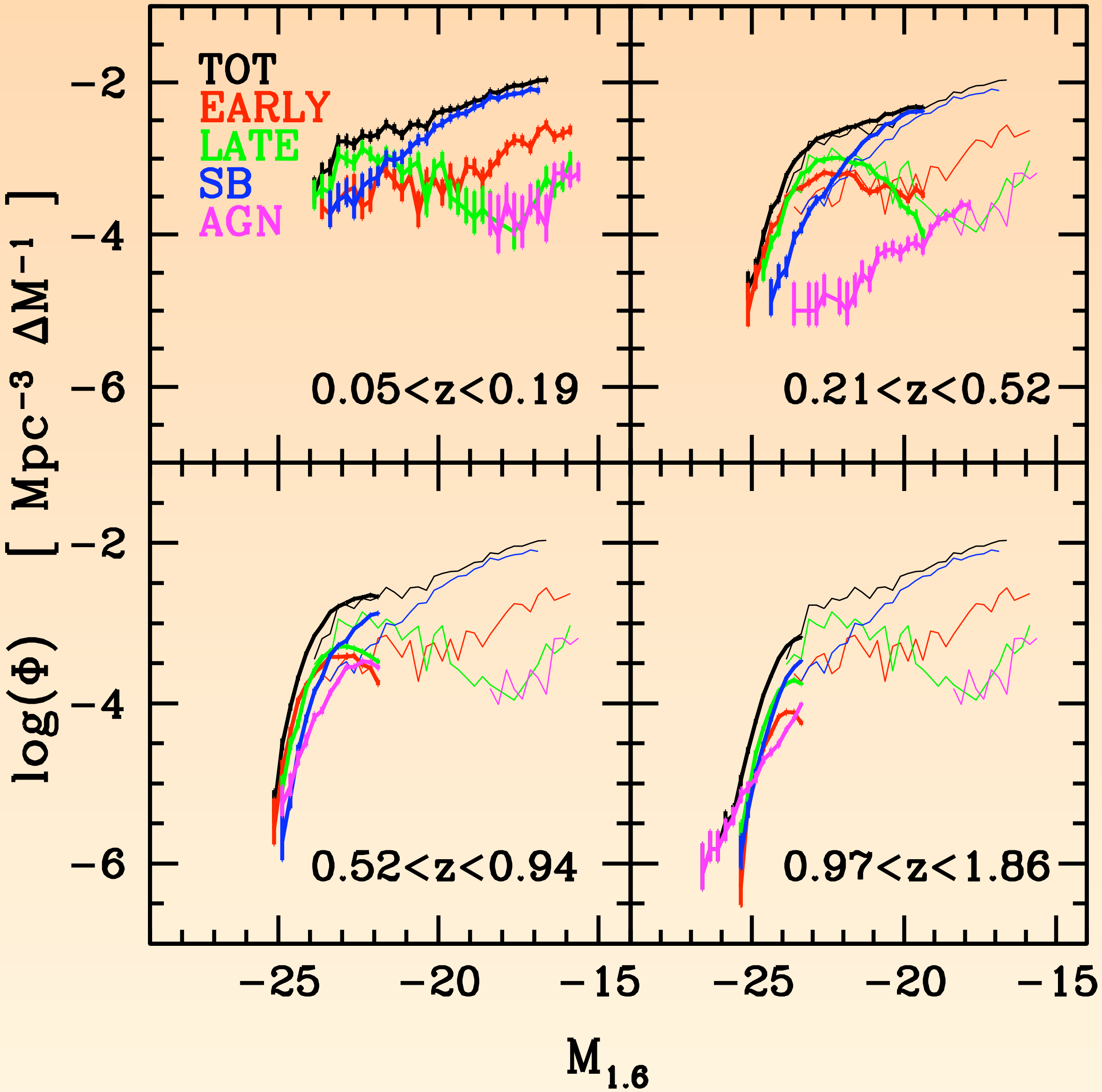

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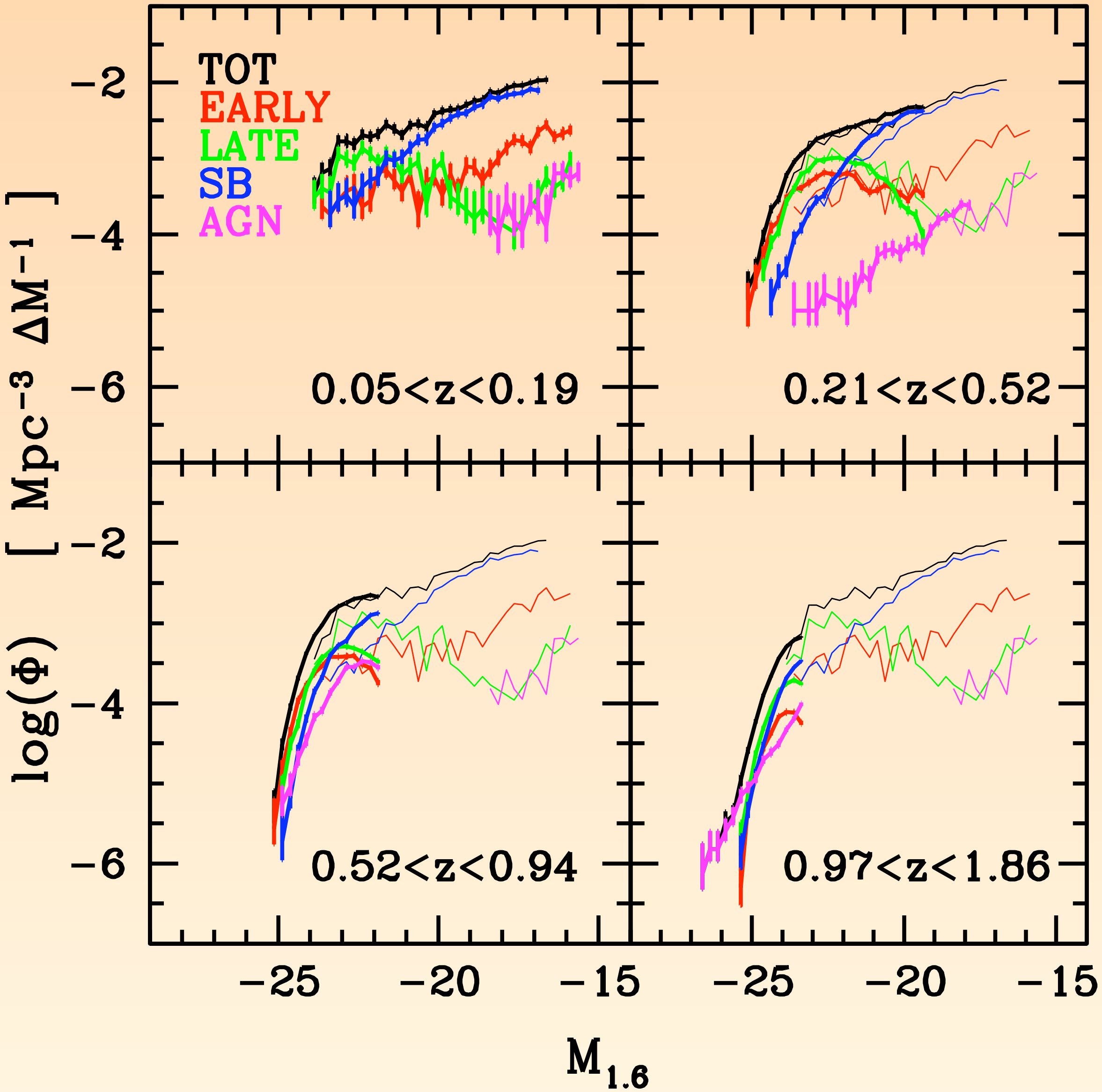

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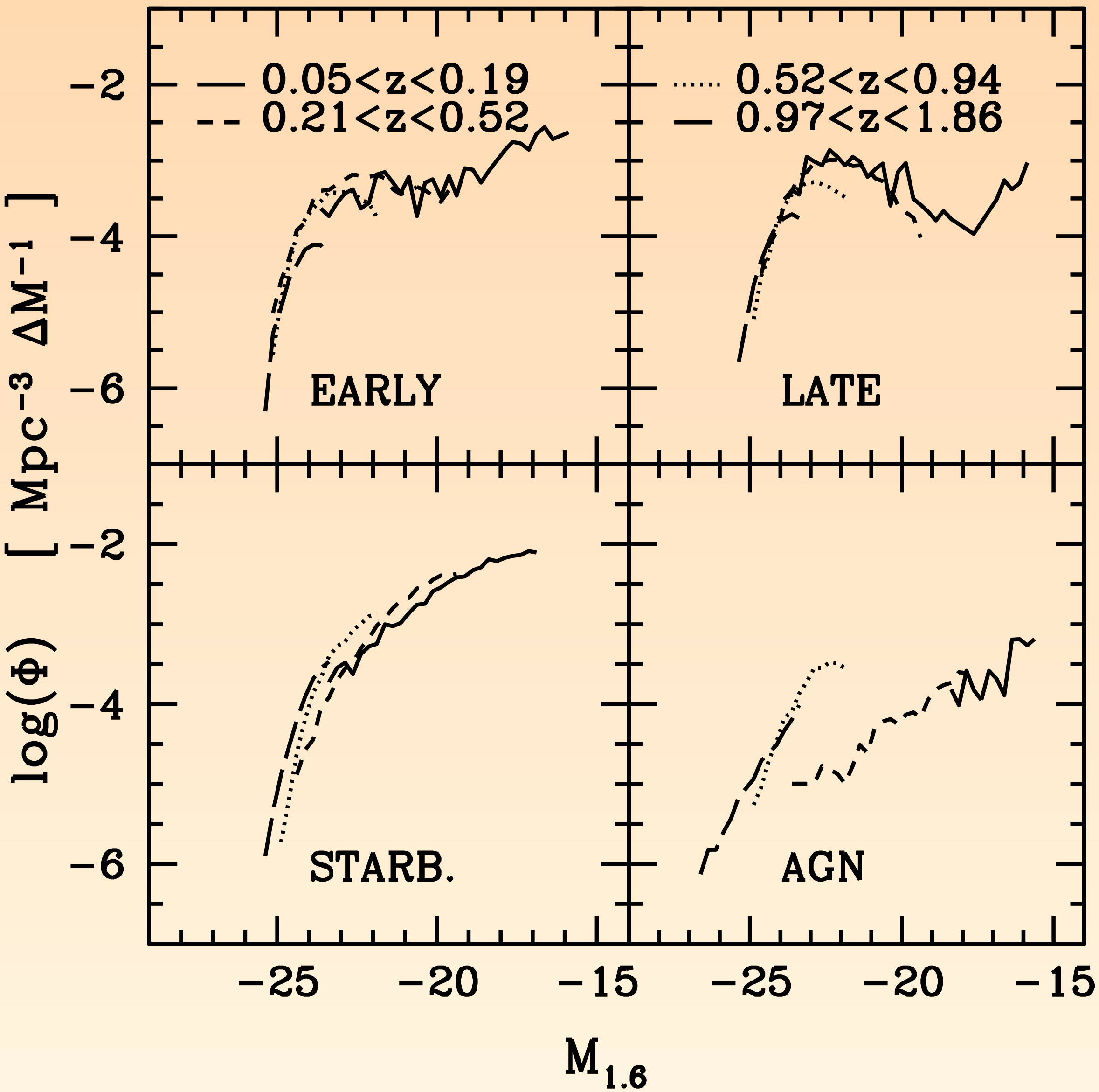

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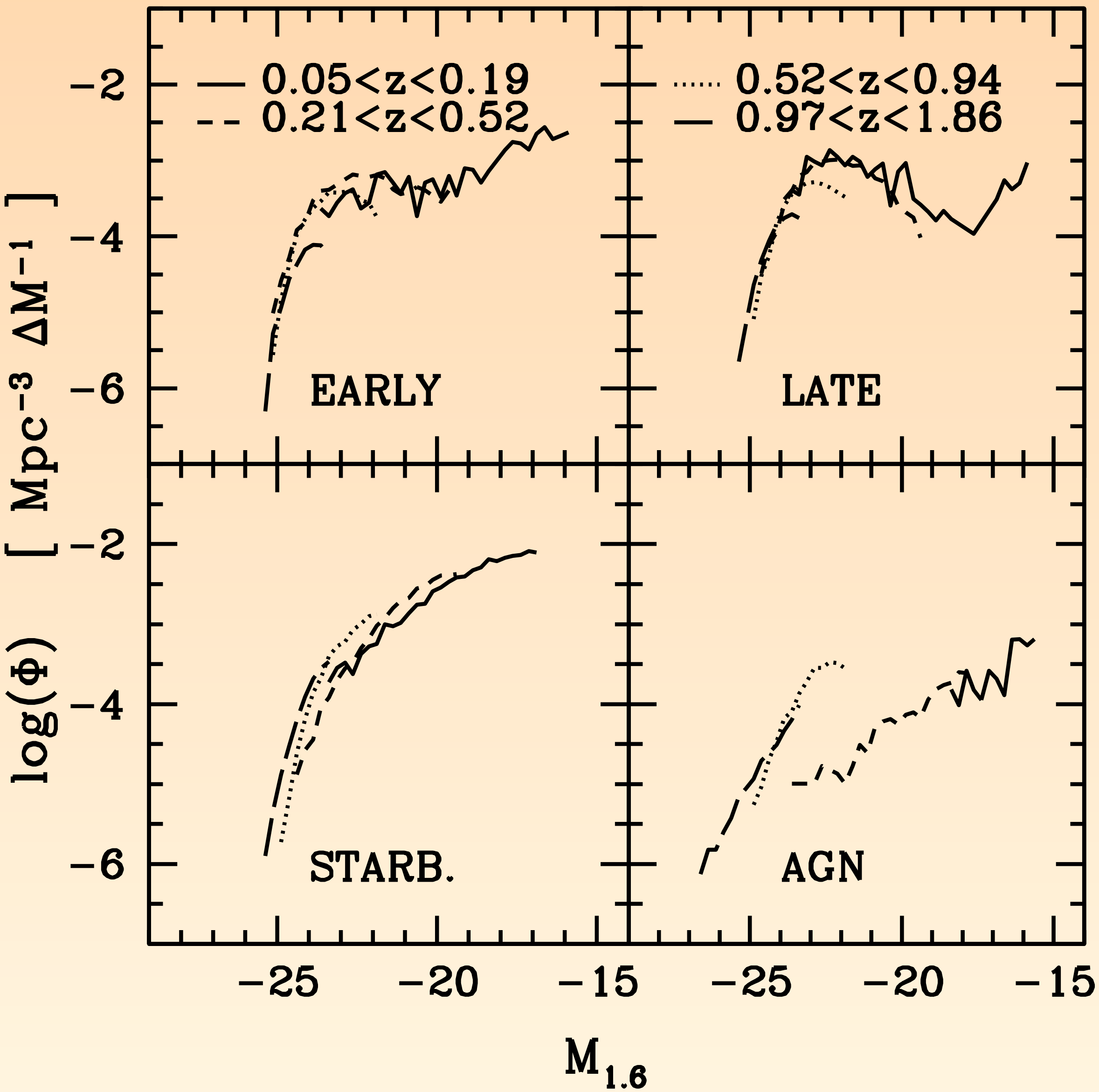

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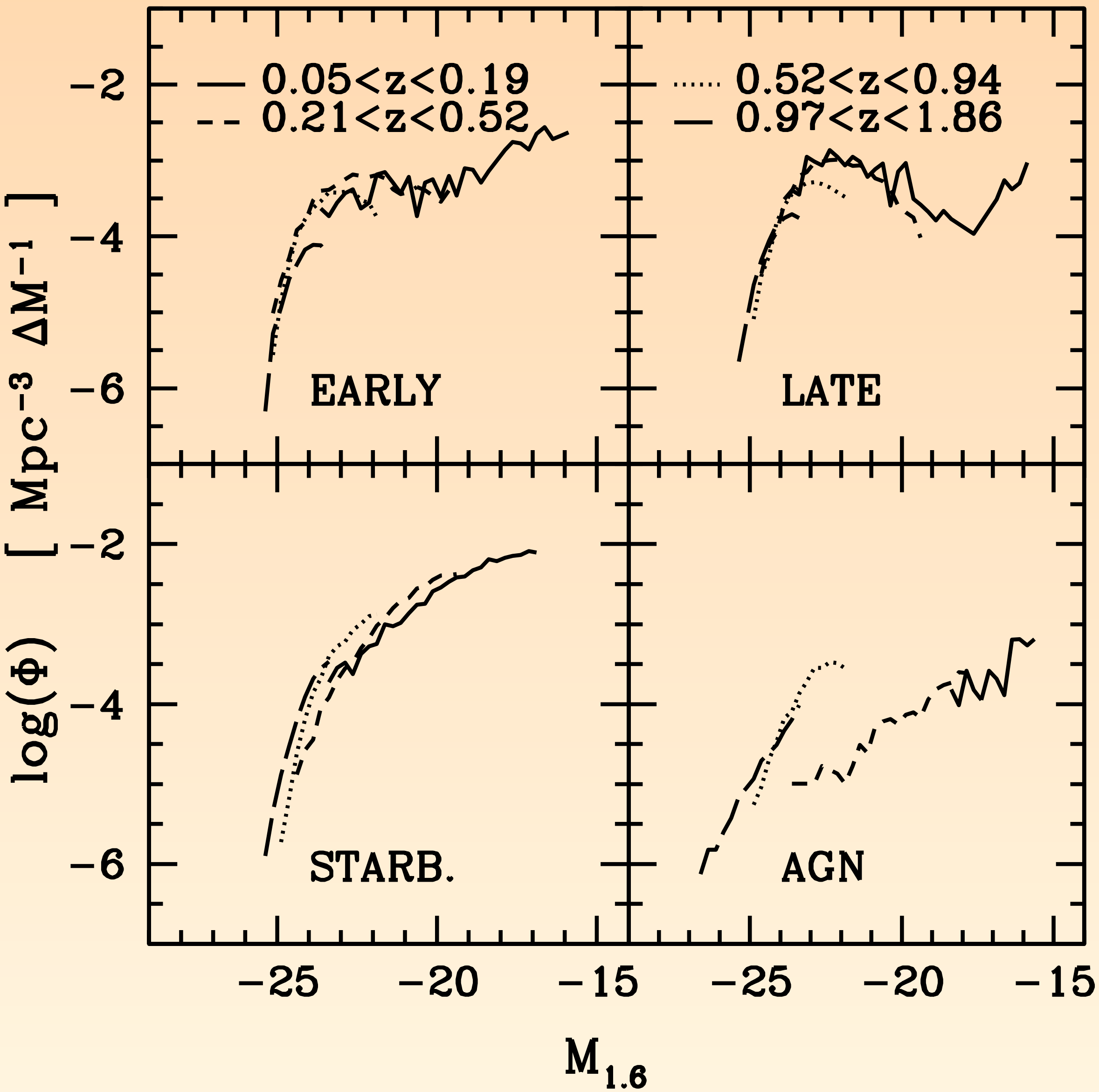

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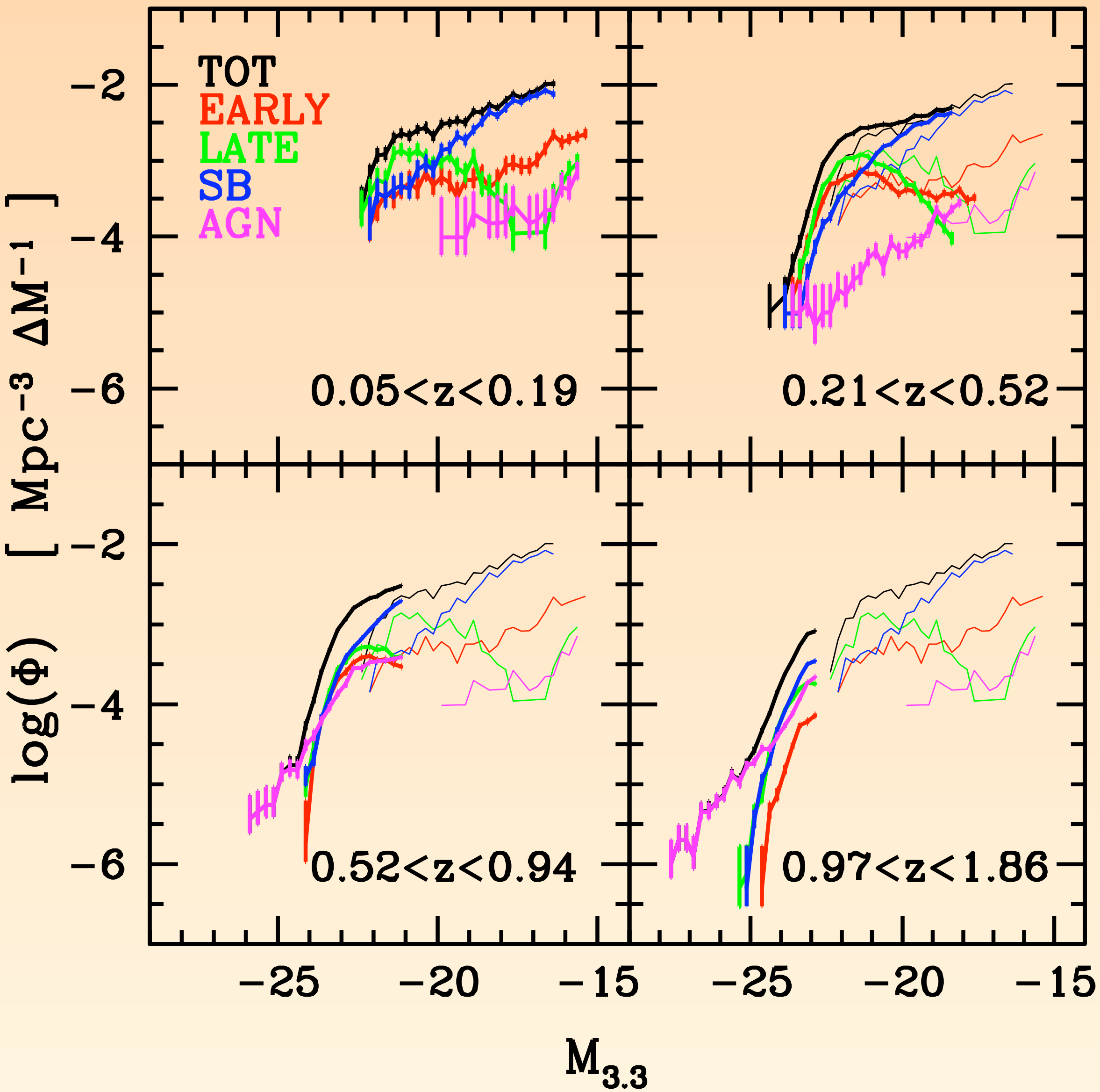

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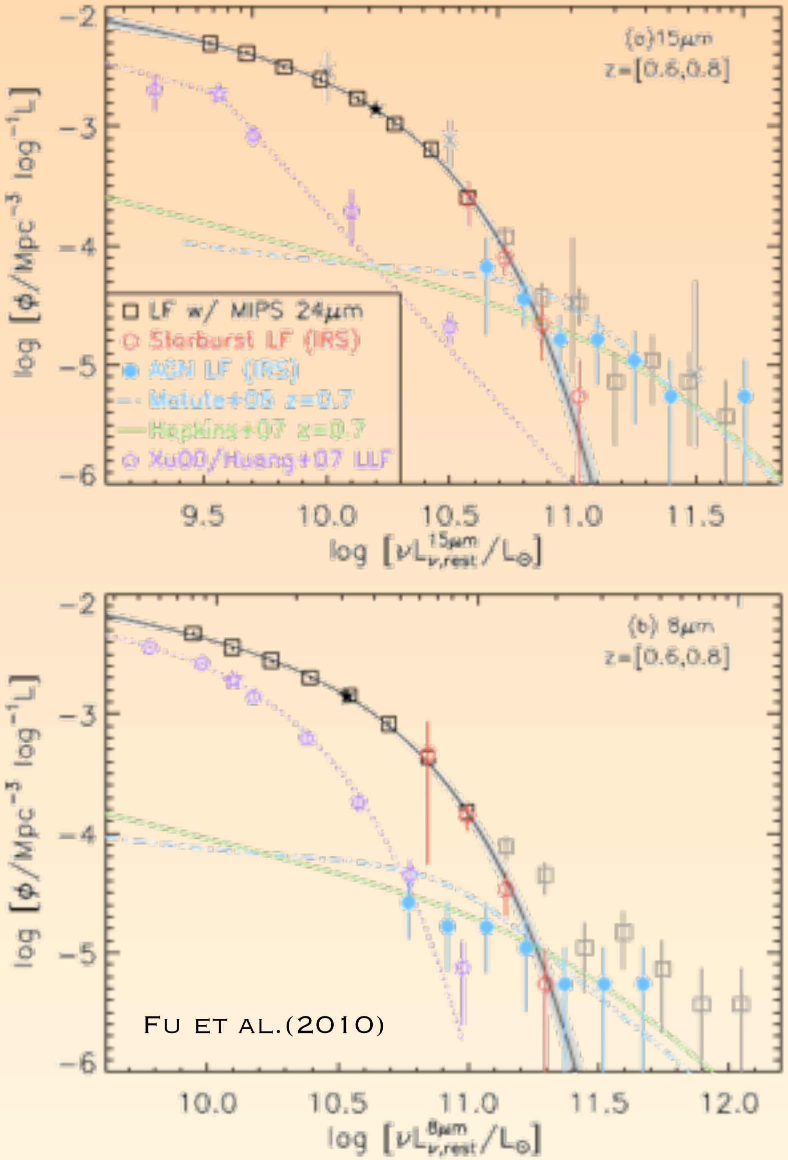

Fu et al.(2010)

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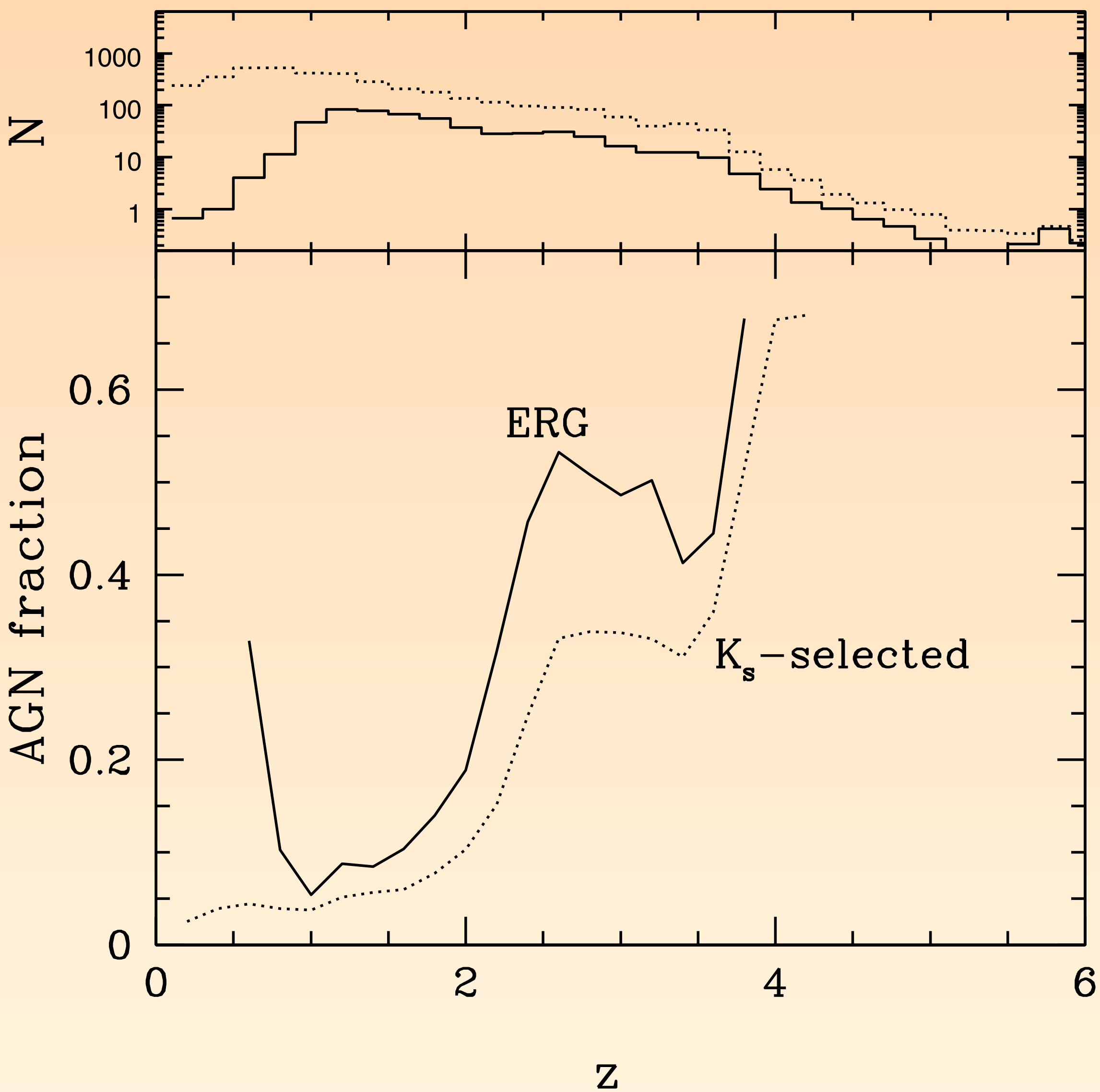
IR the AGN boost



THE ERG CASE

EXTREMELY RED GALAXIES

COLOUR SELECTION

.EROs - I_{775}-K_s>2.5

.IEROs - z_{850}-[3.6]>3.25

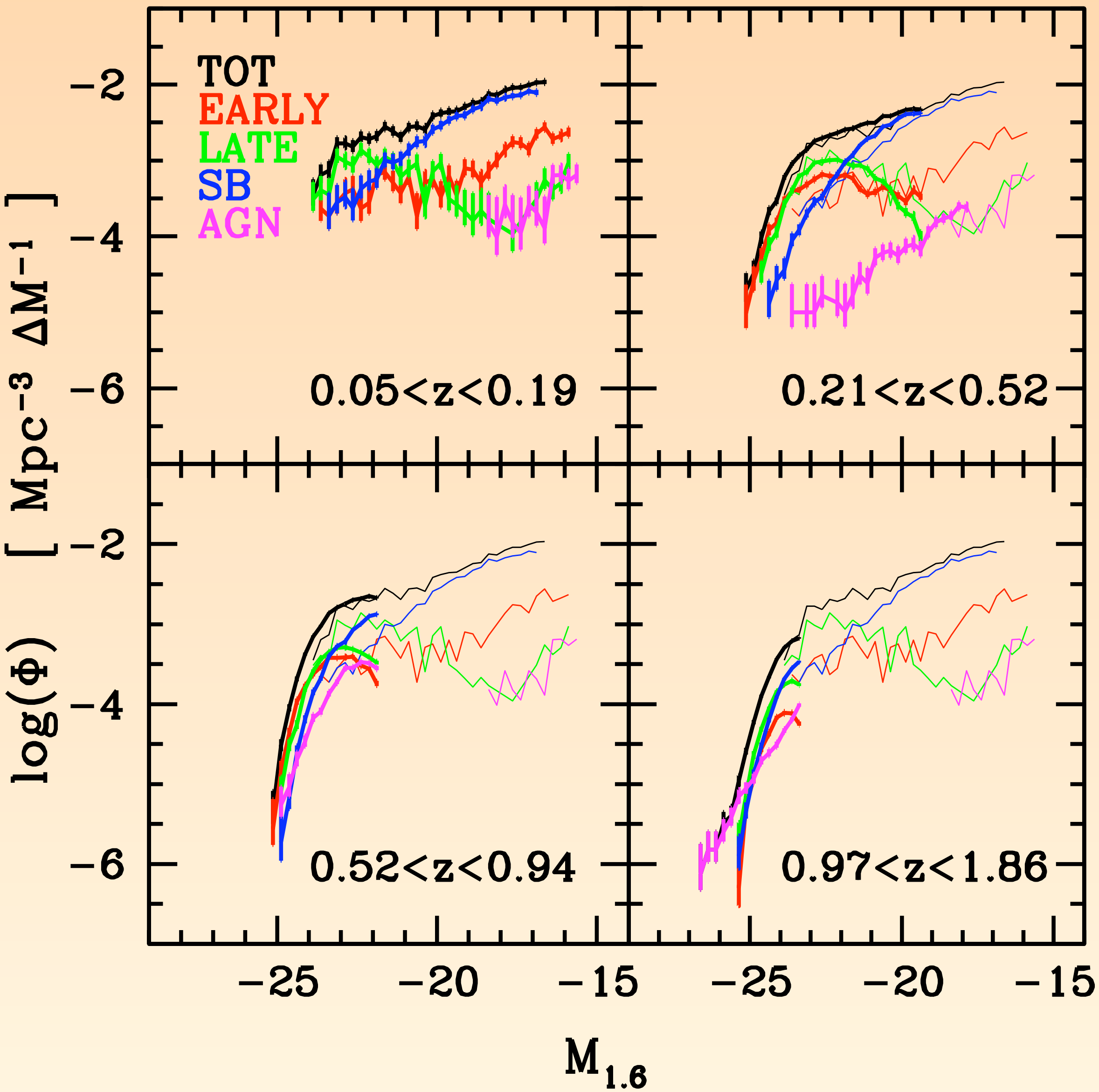
.DRGs - J-K_s>1.35

TWO KNOWN PROPERTIES

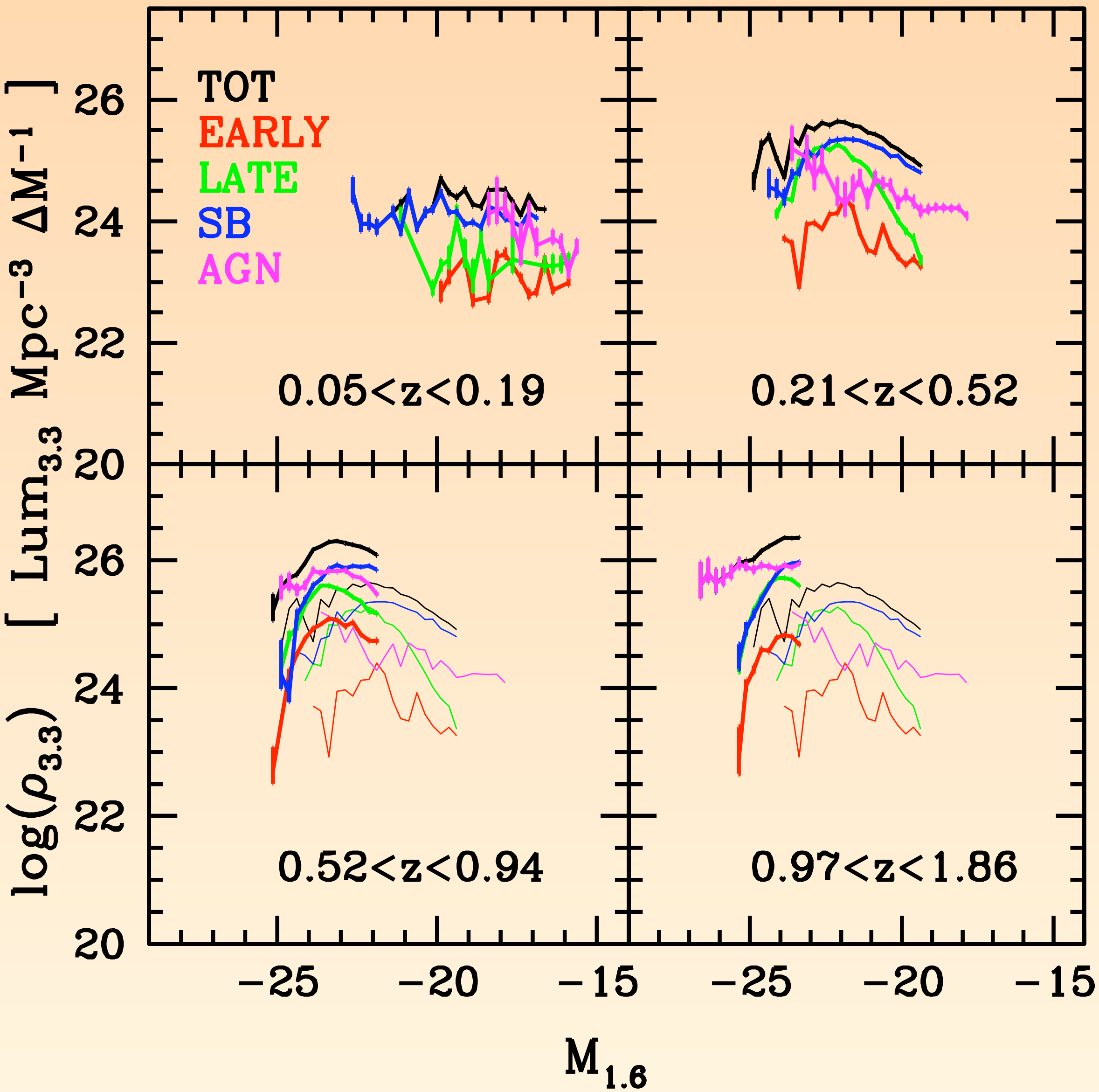
.MASSIVE

.HIGH AGN FRACTION

DUST LUMINOSITY DENSITY FUNC.



DUST luminosity density func.



EARLY

.contribute the least

LATE

.as much as starburst at the bright-end

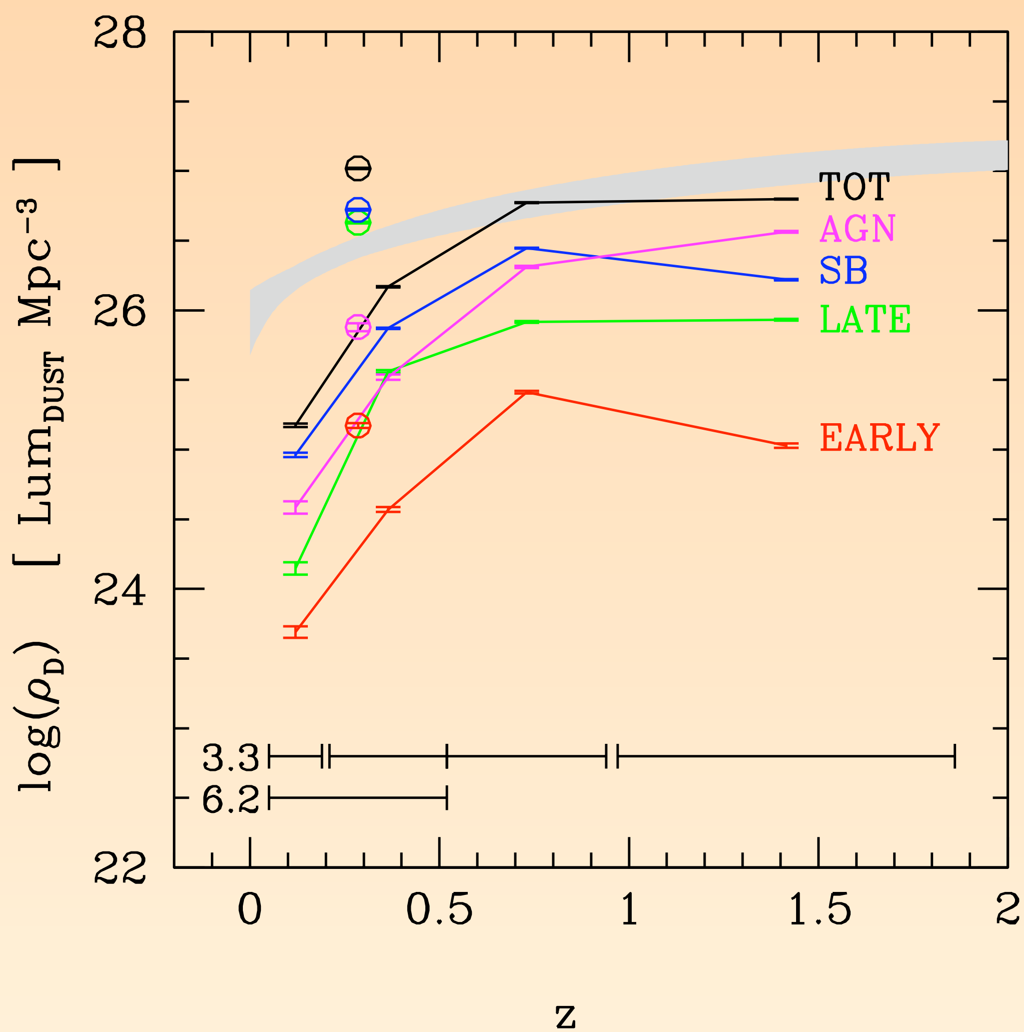
STARBURST

.highest contributor to the faint-end

AGN

.number vs contribution

DUST EVOLUTION



SOLID LINES CONNECT 3.3μM ESTIMATES PROBED BY IRAC BANDS. CIRCLES REFER TO LOCAL 6.2μM ESTIMATES. THE SHADED REGIONS SHOW THE 3σ TREND OF THE SFH OF THE UNIVERSE (HOPKINS&BEACOM 2006, DARKER REGION REFERS TO OBSCURED SF, CHARRY&POPE 2011) SCALED TO THE DUST ESTIMATE AT 0.52<Z<0.94.

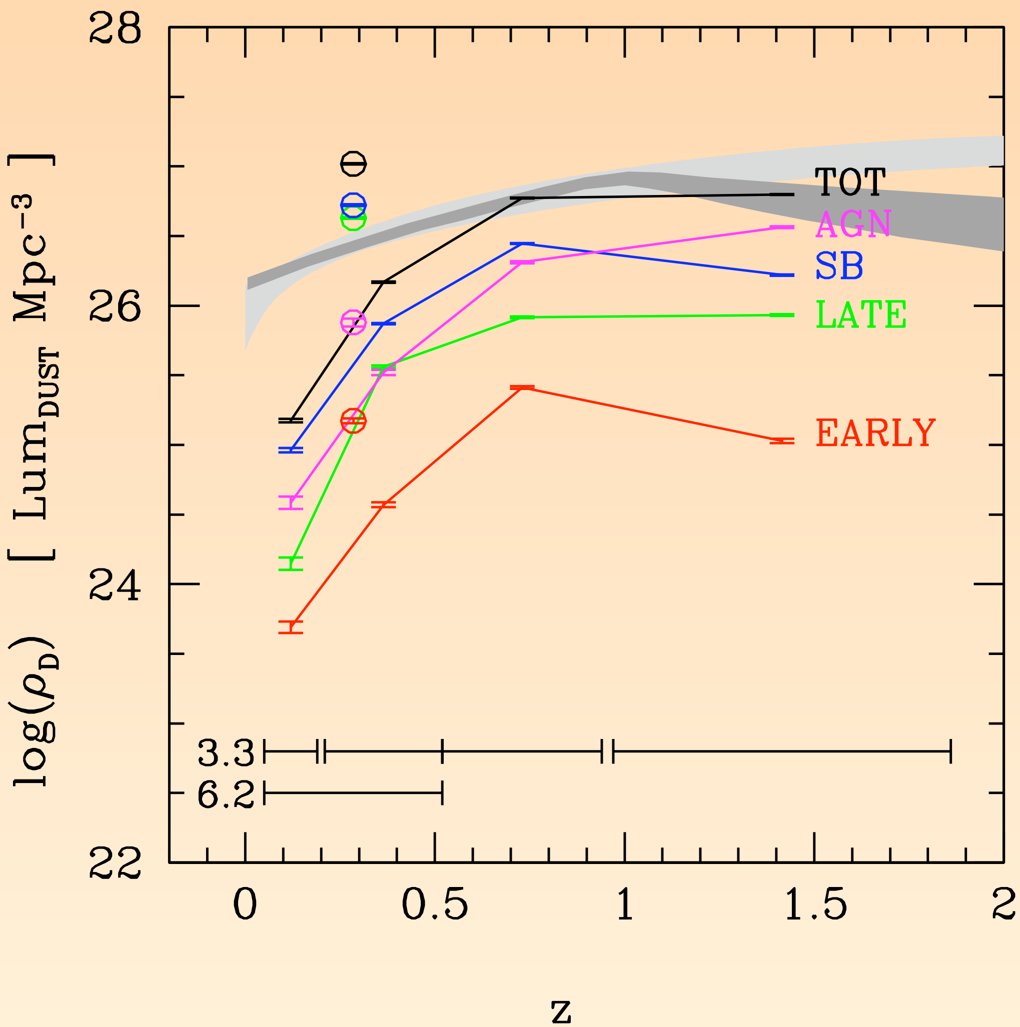
TOTAL

.DECAYS 1DEX MORE THAN SFH
.FAILURE TO EXTRACT DUST EMISSION?
.DUST DEPLETION? (DUNNE ET AL.2011)
.DUST AT LARGER DISTANCES?
. ...?

AGN VS STARBURST

3.3μM VS 6.2μM

DUST evolution



solid lines connect 3.3μm estimates probed by IRAC bands. circles refer to local 6.2μm estimates. the shaded regions show the 3σ trend of the SFH of the universe (Hopkins&Beacom 2006, darker region refers to obscured SF, Charry&Pope 2011) scaled to the dust estimate at 0.52<z<0.94.

TOTAL

.decays 1dex more than SFH
.failure to extract dust emission?
.dust depletion? (Dunne et al.2011)
.dust at larger distances?
. ...?

AGN vs STARBURST

3.3μm vs 6.2μm