活動的銀河核の進化の観測
（ひとつのコメント）

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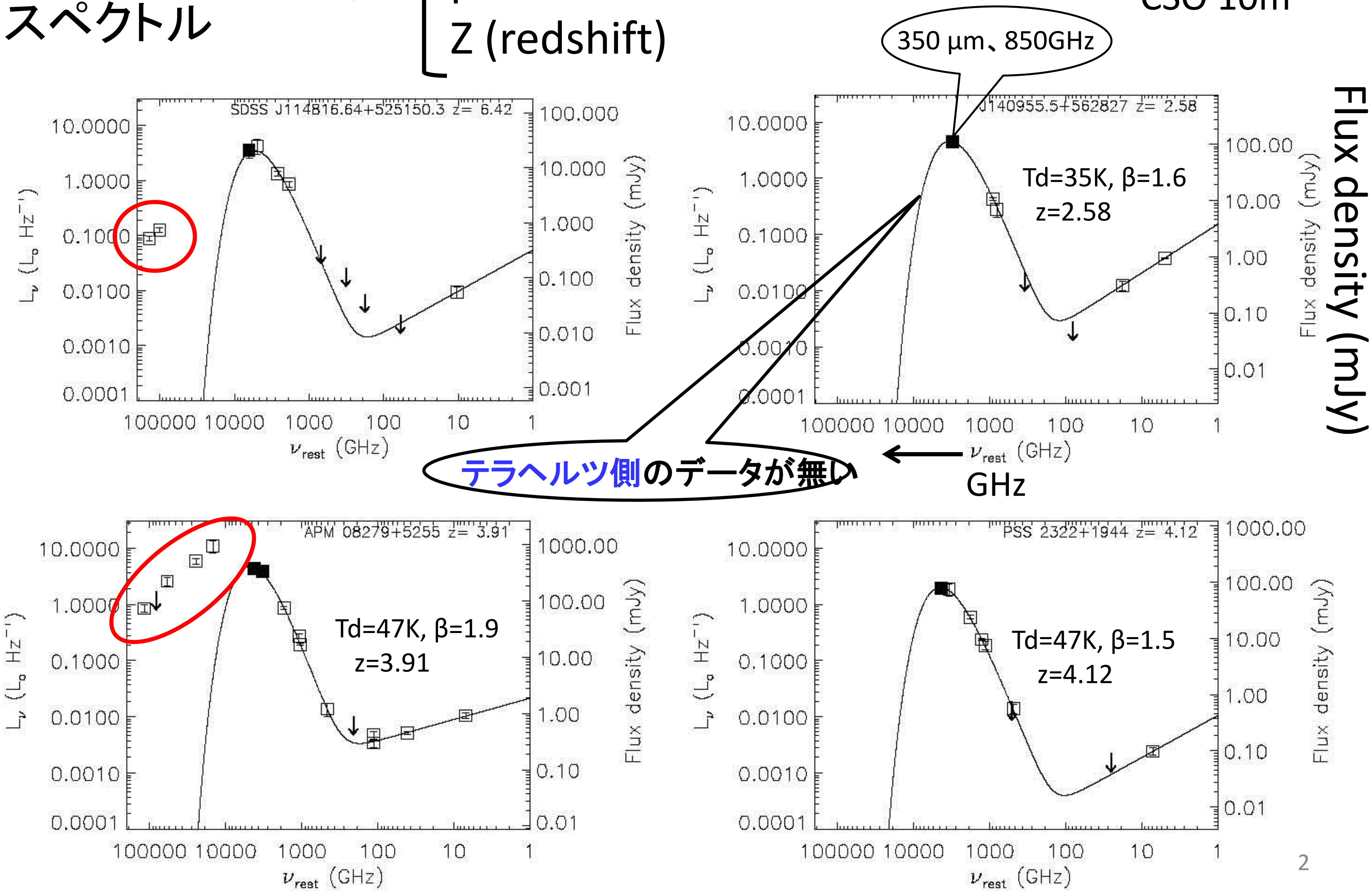
サブミリ波銀河

ダスト放射のスペクトル ⇨
- Td ~ 30 – 50 K → Star burst
- β
- Z (redshift)

Beelen etc 2006
CSO 10m

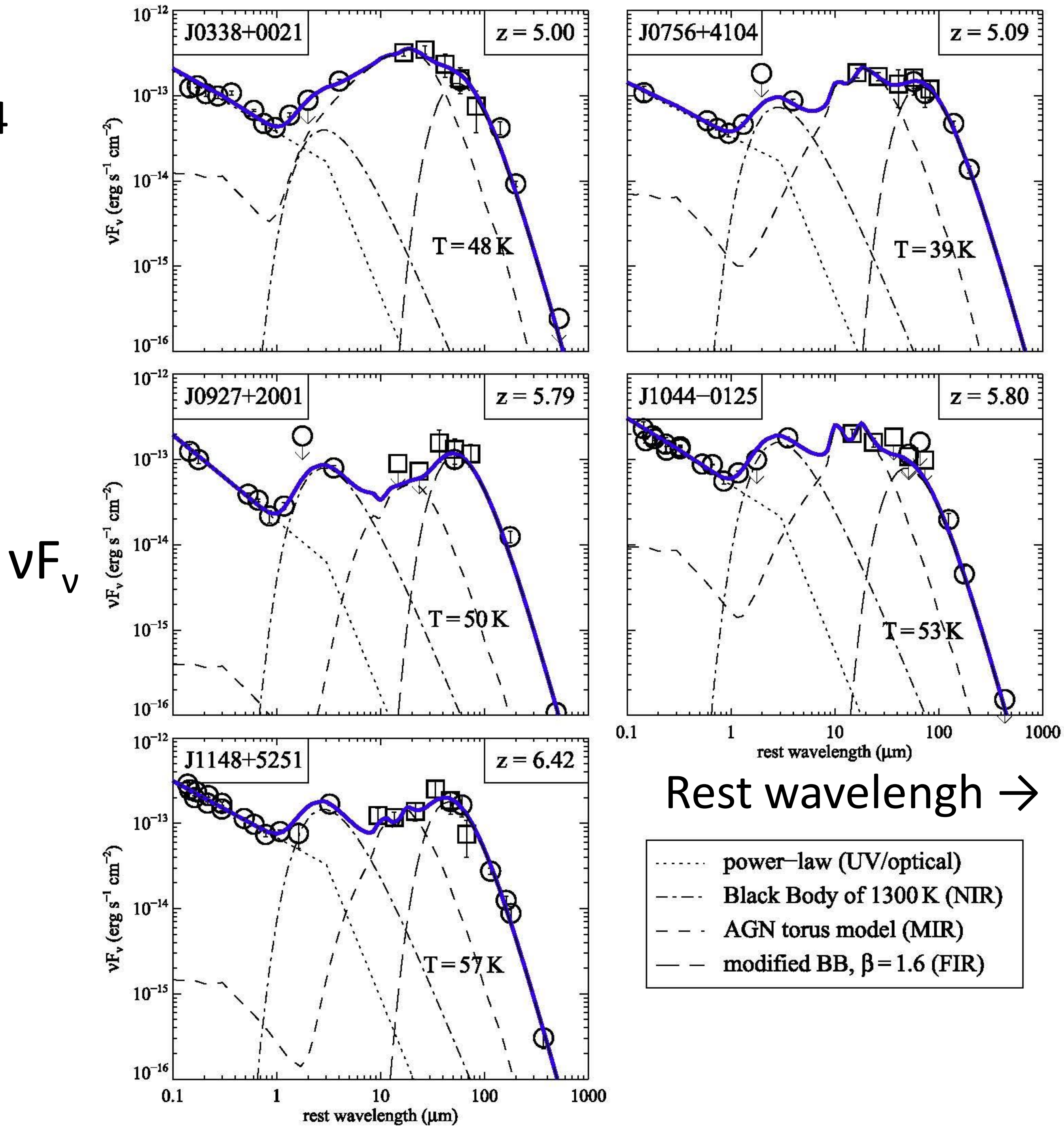


Leipski+2013, 2014

QSO at z>5

Herschel

SDSS検出済



(Leipski+2014)

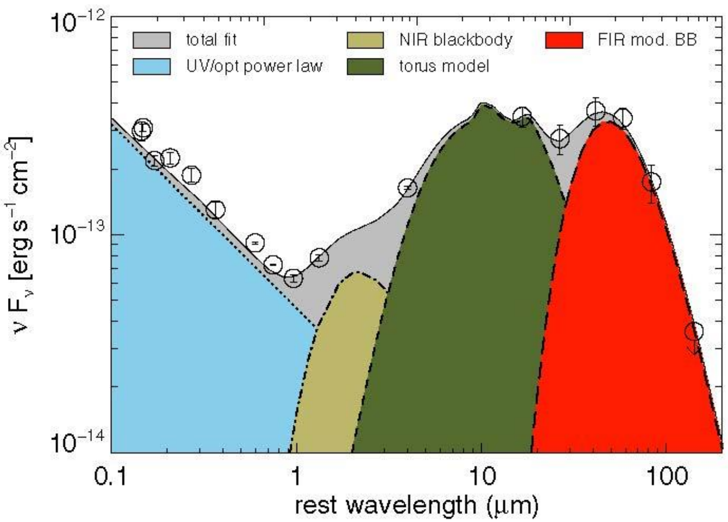
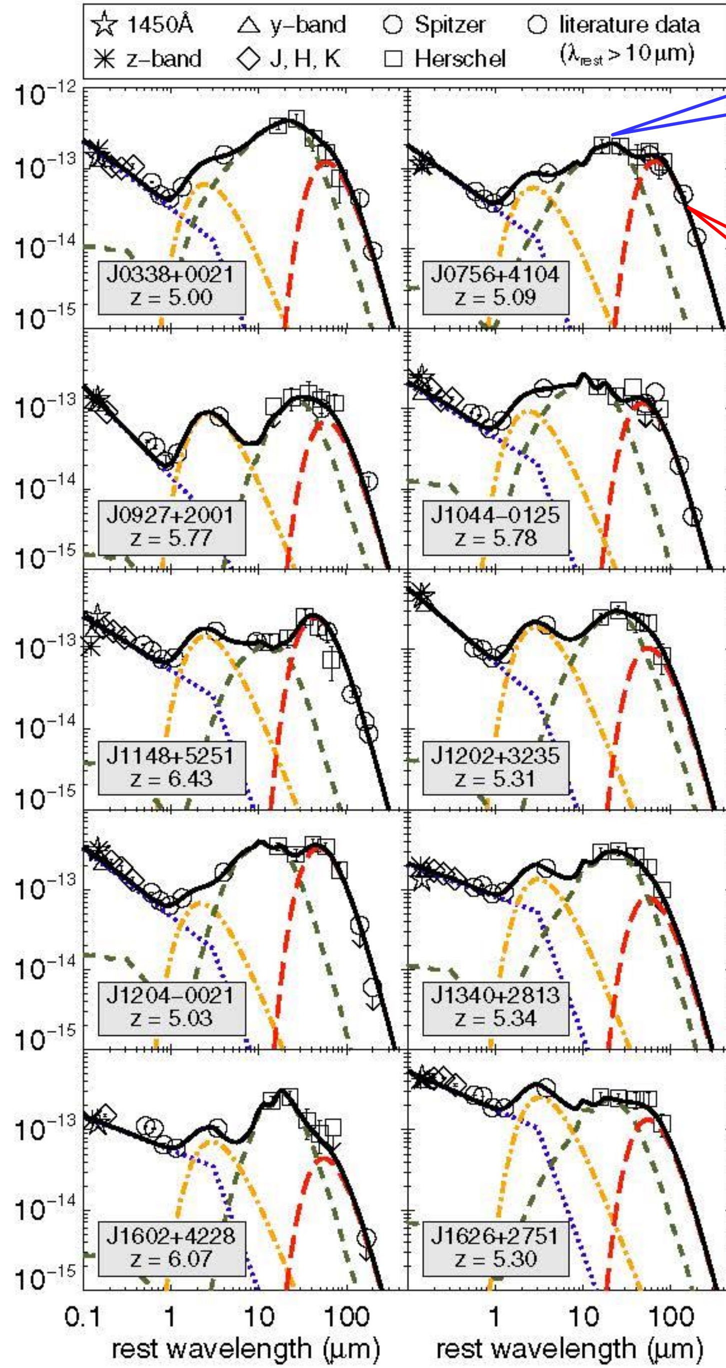


Figure 2. Schematic representation of the components used for SED fitting. As an example, we use the observed photometry of the $z = 5.03$ QSO J1204−0021. (A color version of this figure is available in the online journal.)



高温ダスト

Td>150 K

AGN-torus

低温ダスト

Td~30-50 K

Star burst

Figure 3. SEDs of the 10 quasars detected in at least four *Herschel* bands. The

(Leipski+2014)

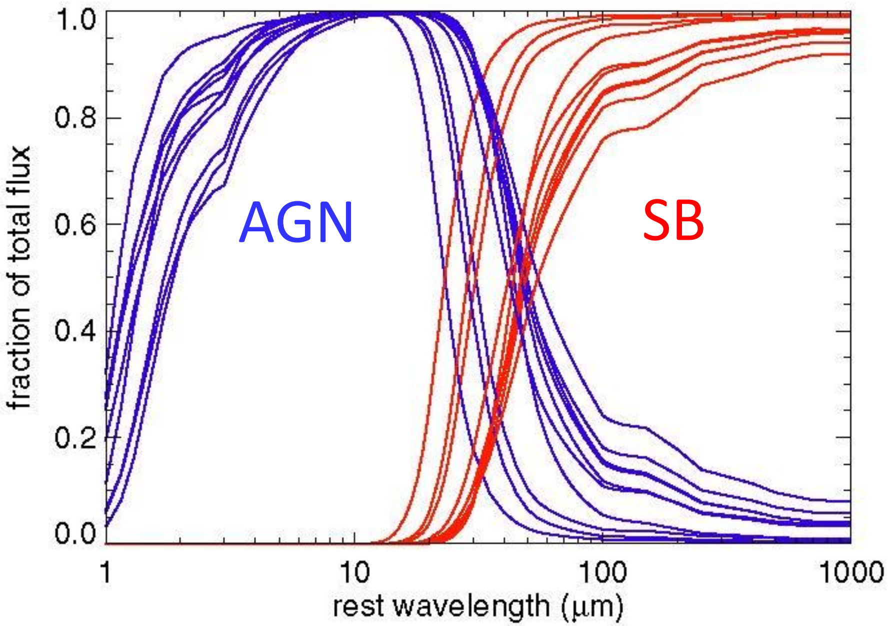


Figure 4. For the 10 objects where the FIR component could be well constrained due to additional millimeter data (see Figure 3) we here show its relative contributions (red) compared to the presumably AGN-heated dust (NIR blackbody plus torus model; blue) as a function of wavelength. For these FIR-bright sources, the FIR component dominates the total infrared emission at $\lambda_{rest} \gtrsim 50\ \mu m$.

F(AGN)～F(SB)

rest λ～20-60μm

⇩

z	obs λ
1	40-120 μm
2	60-180
5	120-360
7	160-480
10	220-660
15	320-960

AGNとSBの輻射成分の分離

↓

テラヘルツ～サブミリ波が必要

（z<~5では、TAO(東大)、SPICAと協力

Mrk231

ハーシェル衛星(van der Werf+ 2010)

P. P. van der Werf et al.: Seperation of AGN and starburst in Mrk 231

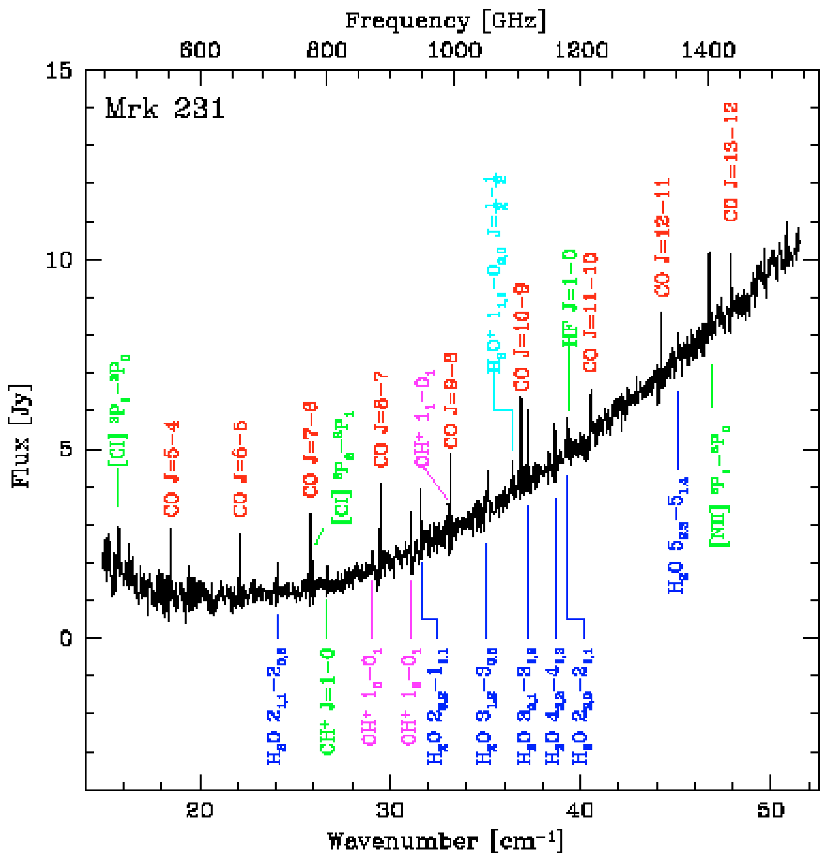
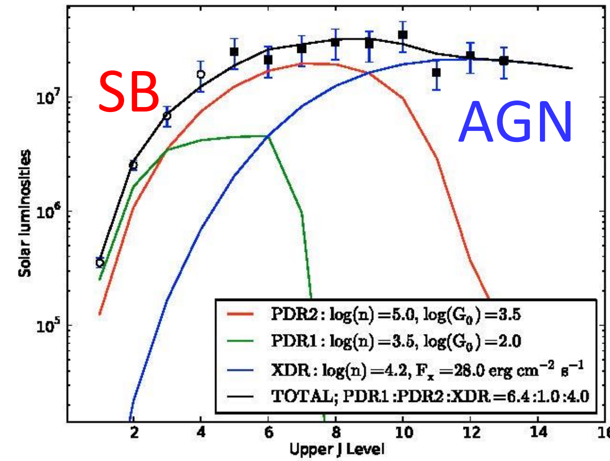


Fig. 1. SPIRE FTS spectrum of Mrk 231. Line identifications are given in red for CO lines, in blue for H_2O, in magenta for OH^+, in cyan for H_2O^+, and in green for the remaining lines.



upper J

Fig. 2. Luminosities of CO lines from Mrk 231. Filled symbols represent measurements from the SPIRE FTS spectrum, while ground-based measurements are denoted with open symbols. Coloured lines indicate two model PDR components (red and green lines) and an XDR component (blue line). The sum of these three components is indicated by the black line and fits the CO measurements. In the legend, n denotes the number density of hydrogen nuclei ($n = n_H + 2n_{H_2}$) in cm^{-3}, G_0 denotes the incident UV flux in units of 1.6×10^{-3} erg s^{-1} cm^{-2} for the PDRs, and F_X the incident X-ray flux for the XDR. The legend also indicates the relative emitting areas of the three components.

CO
- up to J=8
  - by UV radiation from star formation
- J>8
  - X-ray heating by the accreting SMBH

テラヘルツのスペクトル：科学意義（の例）

(1) SF起源のダスト放射の正確なSEDの決定

・SF由来の輻射とAGN由来の輻射の分離

・ SF由来の成分（Td~40-50K）

→星形成率、（gas-to-dust ratioを仮定できるならば）ガス量の推定

(2) AGN成分の有無

(3) AGN成分のSEDの決定

＠z>7~10（テラヘルツ波のみ）

＠z=1~7 （テラヘルツ波＋赤外線=SPICA,TAO）

・AGN由来の成分（Td~>150K）

→質量降着率の推定

・z（宇宙年齢）依存性の決定

→銀河（SB）とSMBH（AGN）の共進化(z)

AGNの始まりと進化（z）