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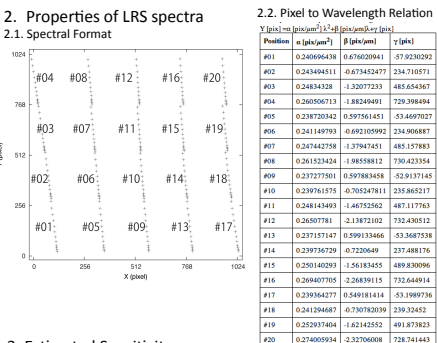
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Detailed Information is available at http://exoplanets.astron.s.u-tokyo.ac.jp/SPICA/SENSITIVITY/index_smi.html

概要: SPICA ミッションでは、新しい枠組みのもとで装置の再検討が実施された。日本の担当する中間赤外線観測装置 SMI は、低分散分光器 (LRS)、中分散分光器 (MRS)、および高分散分光器 (HRS) から構成される観測装置として定義される。LRS は、プリズムを採用して、波長帯域 17μm から 37μm を、波長分解能 R ~ 50 - 100 でカバーし、Si:Sb の 1kx1k の検出器アレイ上に、4 本のマルチ長スリット分光データ (各スリット長は 10 分角) を取得し、効率的な分光マッピング観測を実現する。MRS は、crossed echelle grating 分光器で、6 次から 11 次の回折光を用いて、波長帯域 18μm から 36μm を、波長分解能 R ~ 1000 でカバーし、Si:Sb の 1kx1k の検出器アレイ上に、約 120 秒角の長スリット分光データを取得する。HRS は、CdZnTe 製のイメージング回折格子を採用し、Si:As の 1kx1k の検出器アレイを用いて、84 次から 118 次の回折光を用いて波長帯域 12.14μm から 17.08μm を連続的に、また、77 次から 84 次の回折光を用いて 17.08μm から 18.7μm の一部の波長を断続的に、波長分解能 R ~ 27,000 でカバーする。我々は、今後サイエンス検討を行う際に必要となる装置性能を提示する目的で、得られた光学設計解を基に、現時点で入手可能な最新の検出器性能情報及び分光素子の光学特性を考慮し、点源連続光、点源ライン放射、拡散光連続光、拡散光ライン放射の各々に対する波長感度特性、及び飽和限界波長特性の計算を行った。本講演では、その計算を行う上で採用した前提条件および仮定と共に、SPICA/SMI の予測性能の計算結果を示す。

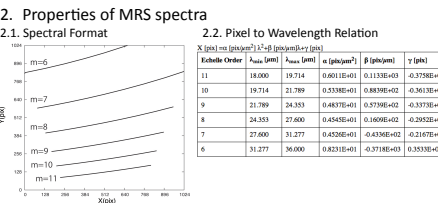
SPICA/SMI/LRS

- 1. Assumptions**
- [detectors]**
- array size: 1kx1k Si:Sb BIB detector
 - dark current: 0.8 electron/pix
 - read noise: 25.0 electrons per readout
 - saturation full well: 1.0E+5 (electrons)
 - pixel pitch: 18 (μm/pix)
 - exposure time: 600 (sec)
 - shortest exposure time: 2 (sec)
- [optics]**
- diameter of the primary mirror: 2.5m
 - secondary mirror shielding rate: 0.2
 - plate scale: 0.7 (arcsec/pix)
 - slit width: 3.7 (arcsec)
 - energy fraction within 1st null radius: 0.9
 - system efficiency (incl. mirror ref., short wave. cut filter trans., etc.): 0.3
- [others]**
- high background case: zodiacal light emission at ecliptic plane (β=0.0deg and ε=60deg)
 - black body of T=268.5 K normalized to 80 Myr/sr at 25μm
 - low background case: zodiacal light emission at ecliptic pole (β=90.0deg)
 - black body of T=274.0 K normalized to 15 Myr/sr at 25μm (Reach et al. 2003; Ootsubo et al. 2000)
 - safety factor: 0.8
 - number of pixels used to extract spectrum along cross dispersion direction; first null diameter of the airy disk



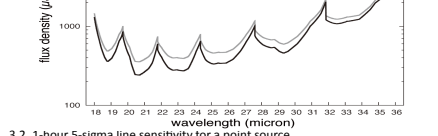
SPICA/SMI/MRS

- 1. Assumptions**
- [detectors]**
- array size: 1kx1k Si:Sb BIB detector
 - dark current: 0.8 electron/pix
 - read noise: 25.0 electrons per readout
 - saturation full well: 1.0E+5 (electrons)
 - pixel pitch: 18 (μm/pix)
 - exposure time: 500 (sec)
 - shortest exposure time: 2 (sec)
- [optics]**
- diameter of the primary mirror: 2.5m
 - secondary mirror shielding rate: 0.2
 - plate scale: 0.725 (arcsec/pix)
 - slit width: 3.7 (arcsec)
 - energy fraction within 1st null radius: 0.9
 - system efficiency (incl. mirror ref., short wave. cut filter trans., etc.): 0.3
 - peak efficiency for echelle grating and cross disperser: 0.8
- [others]**
- high background case: zodiacal light emission at ecliptic plane (β=0.0deg and ε=60deg)
 - black body of T=268.5 K normalized to 80 Myr/sr at 25μm
 - low background case: zodiacal light emission at ecliptic pole (β=90.0deg)
 - black body of T=274.0 K normalized to 15 Myr/sr at 25μm (Reach et al. 2003; Ootsubo et al. 2000)
 - safety factor: 0.8
 - number of pixels used to extract spectrum along cross dispersion direction; first null diameter of the airy disk

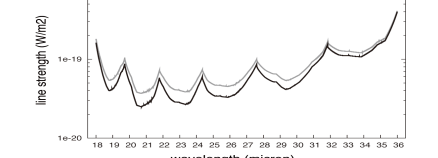


3. Estimated Sensitivity

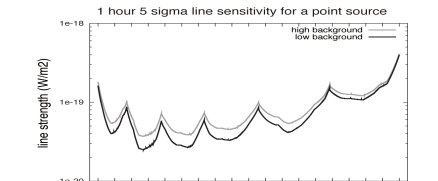
3.1. 1-hour 5-sigma continuum sensitivity for a point source (calculated for the adopted spectral resolution of R=λ/Δλ)



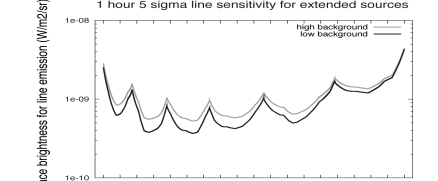
3.2. 1-hour 5-sigma line sensitivity for a point source (calculated for the adopted spectral resolution of R=λ/Δλ)



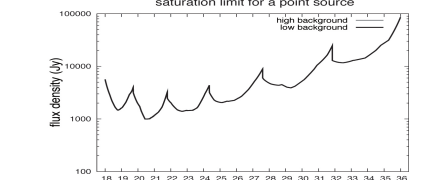
3.3. 1-hour 5-sigma continuum sensitivity for extended sources (calculated for the adopted spectral resolution of R=λ/Δλ)



3.4. 1-hour 5-sigma line sensitivity for extended sources (calculated for the adopted spectral resolution of R=λ/Δλ)

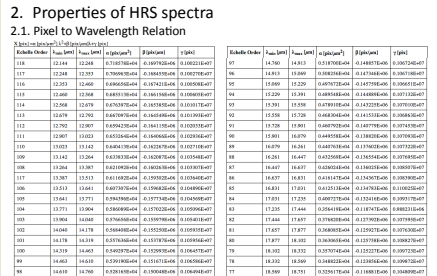


3.5. Saturation limit for a point source (calculated for the adopted spectral resolution of R=λ/Δλ)



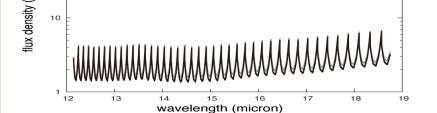
SPICA/SMI/HRS

- 1. Assumptions**
- [detectors]**
- array size: 1kx1k Si:As BIB detector
 - dark current: 0.06 electron/pix
 - read noise: 10.0 electrons per readout
 - saturation full well: 2.0E+5 (electrons)
 - pixel pitch: 25 (μm/pix)
 - exposure time: 300 (sec)
 - shortest exposure time: 2 (sec)
- [optics]**
- diameter of the primary mirror: 2.5m
 - secondary mirror shielding rate: 0.2
 - plate scale: 0.67 (arcsec/pix)
 - slit width: 1.7 (arcsec)
 - energy fraction within 1st null radius: 0.9
 - system efficiency (incl. mirror ref., short wave. cut filter trans., etc.): 0.3
 - peak efficiency for echelle grating and cross disperser: 0.8
- [others]**
- high background case: zodiacal light emission at ecliptic plane (β=0.0deg and ε=60deg)
 - black body of T=268.5 K normalized to 80 Myr/sr at 25μm
 - low background case: zodiacal light emission at ecliptic pole (β=90.0deg)
 - black body of T=274.0 K normalized to 15 Myr/sr at 25μm (Reach et al. 2003; Ootsubo et al. 2000)
 - safety factor: 0.8
 - number of pixels used to extract spectrum along cross dispersion direction; first null diameter of the airy disk



3. Estimated Sensitivity

3.1. 1-hour 5-sigma continuum sensitivity for a point source (calculated for the adopted spectral resolution of R=λ/Δλ)



3.2. 1-hour 5-sigma line sensitivity for a point source (calculated for the adopted spectral resolution of R=λ/Δλ)

