Multiwavelength Galaxy Surveys: New Opportunities

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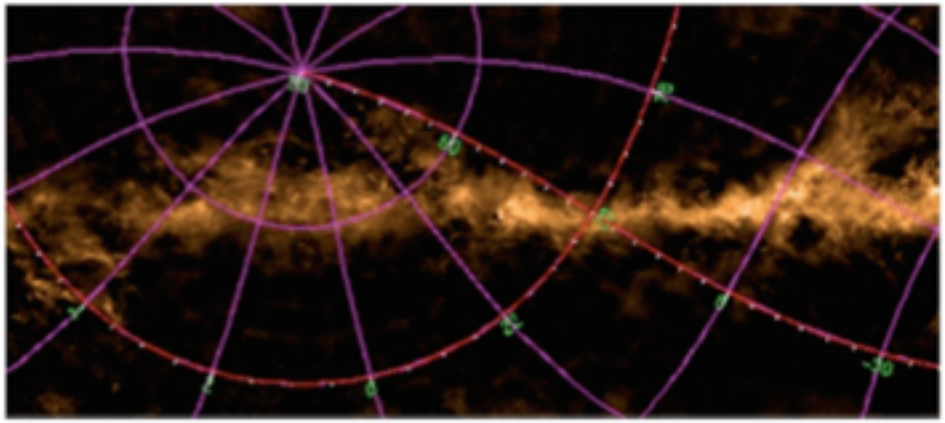
우주탐사 연구회 외부은하 다파장 연구 모임

Why are we here?

Participants at the JCMT reduction workshop, China, October 2016.



JCMT Large Programs

On this page the seven Large Programs that have been awarded time by the JCMT board are listed along with the number of hours awarded (total and per weather band), and the instrument requested.

Large Program Allocations

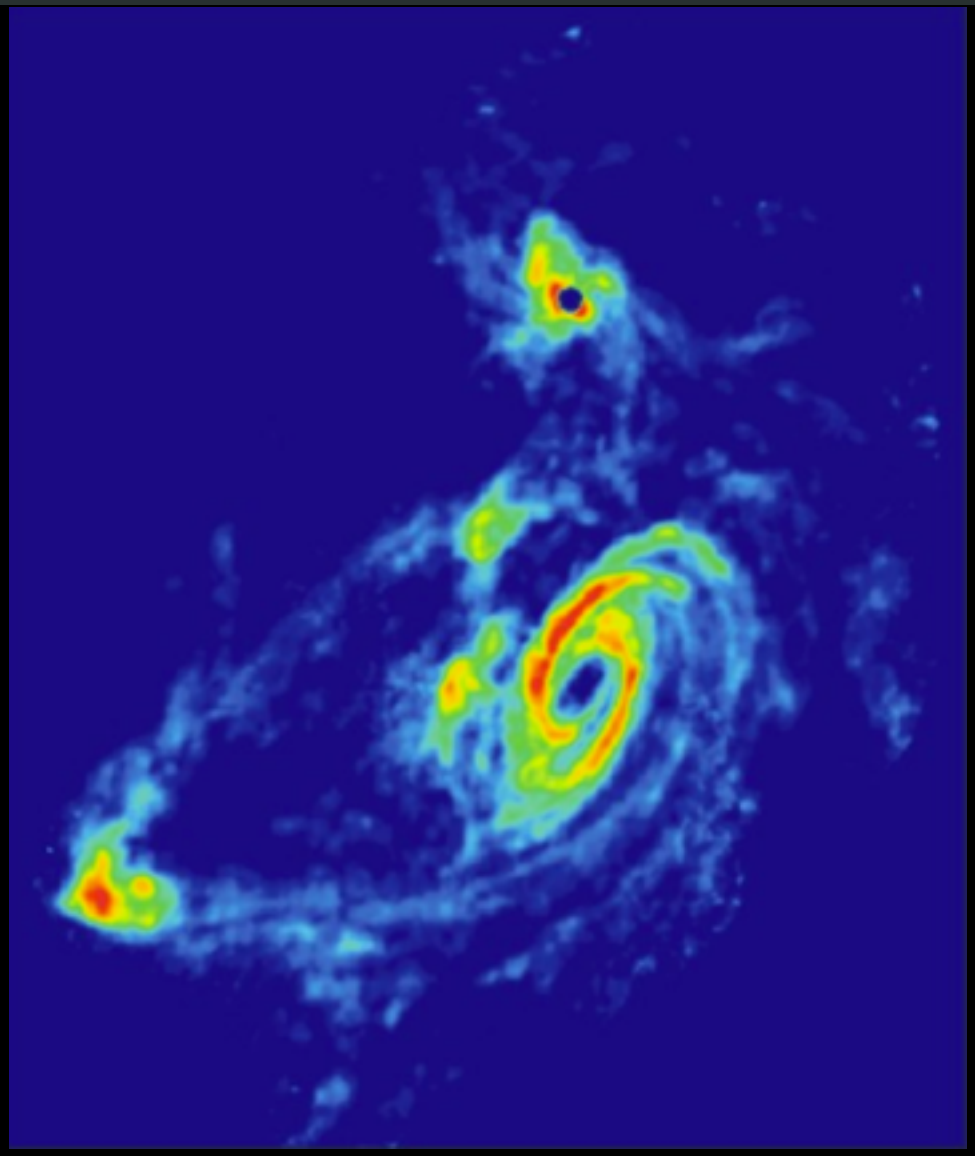
Large Program	Instrument	Hours awarded
A Transient Search for Variable Protostars	Sc-2	150
S2-COSMOS: An EAO SCUBA-2 survey of 1,000 SMGs in the COSMOS field	Sc-2	223
SCOPE: SCUBA-2 Continuum Observations of Pre-protostellar Evolution	Sc-2	300
BISTRO: B-fields In STar forming RegiOns	Pol-2	224
JINGLE: the JCMT dust and gas In Nearby Galaxies Legacy Exploration	Sc-2/RxA	780
STUDIES: SCUBA-2 Ultra Deep Imaging EAO Survey	Sc-2	330
MALATANG: Mapping the Dense Molecular Gas in the Strongest Star-forming Galaxies	HARP	390
Total		2397

Why do we need Multiwavelength Data?

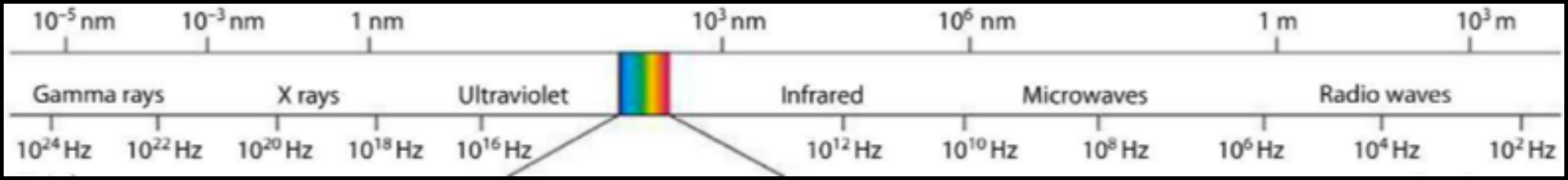
TIDAL INTERACTIONS IN M81 GROUP

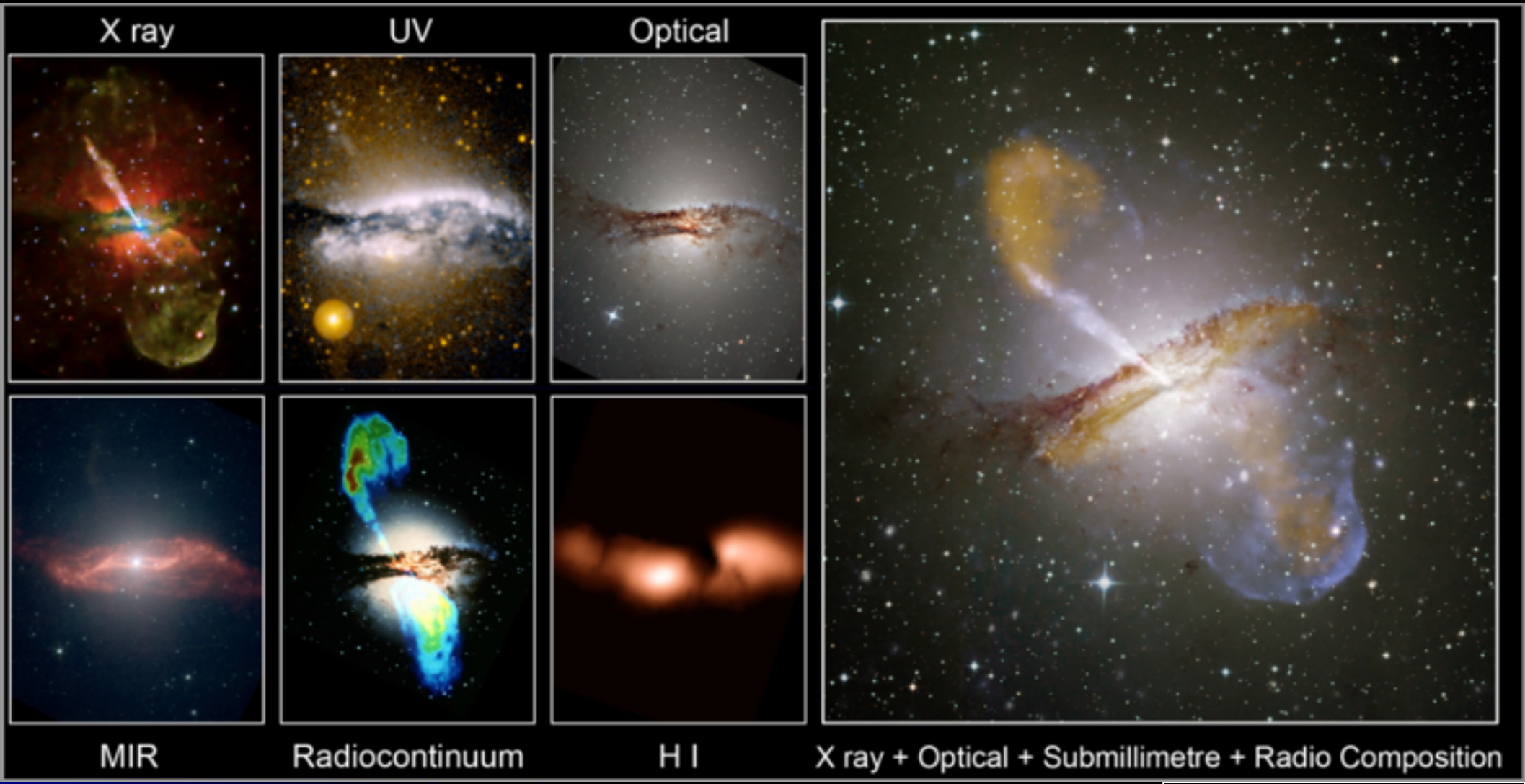
Stellar Light Distribution

21 cm HI Distribution



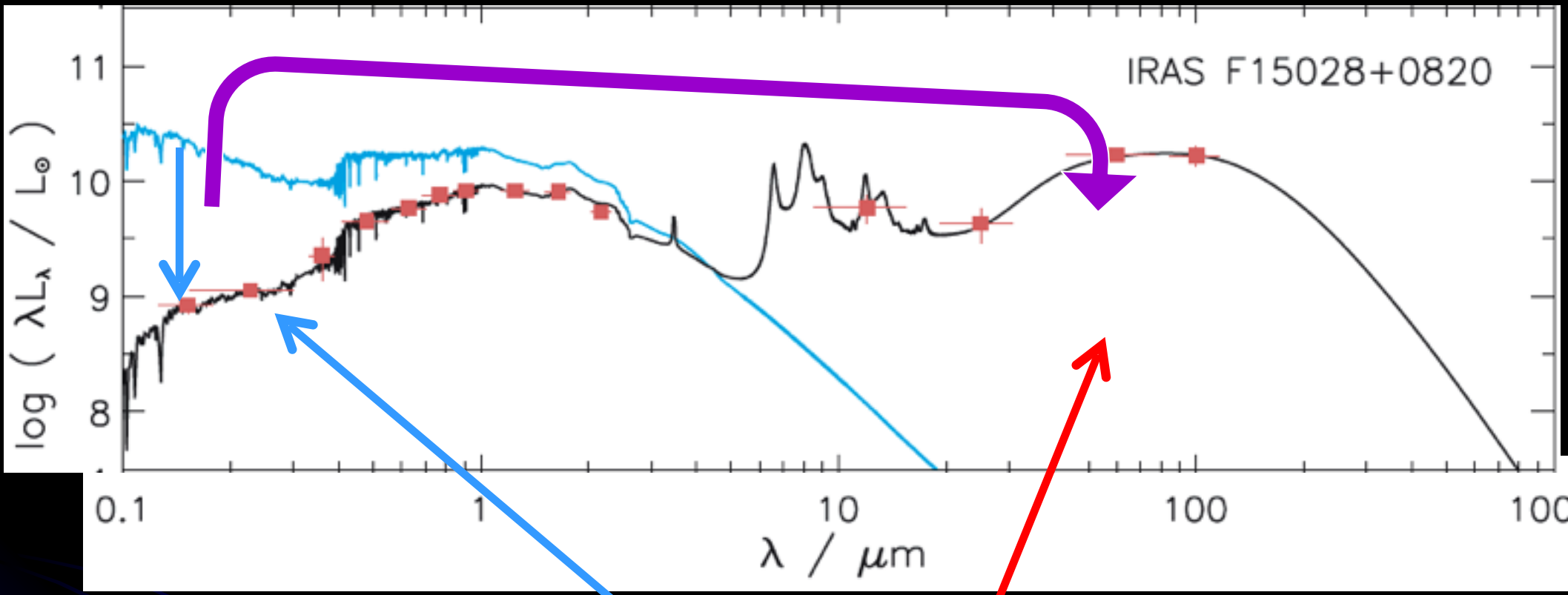
Why do we need Multiwavelength Data?





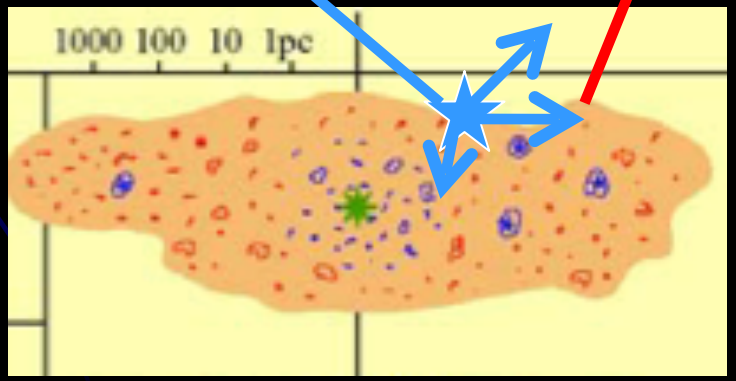
Centaurus A (Lopez-Sanchez)

Galaxy's Spectral Energy Distribution



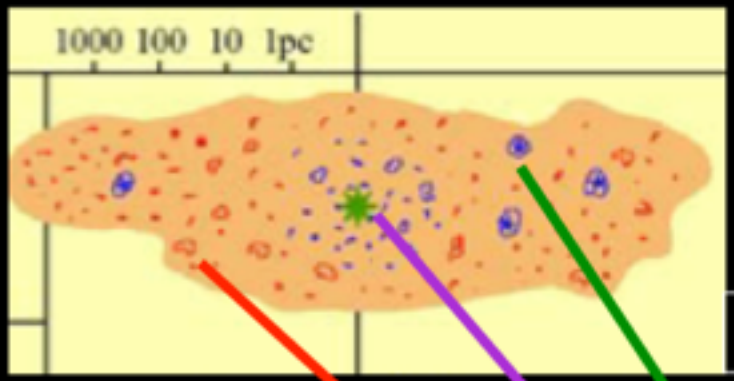
UV

IR : Dust heated by UV

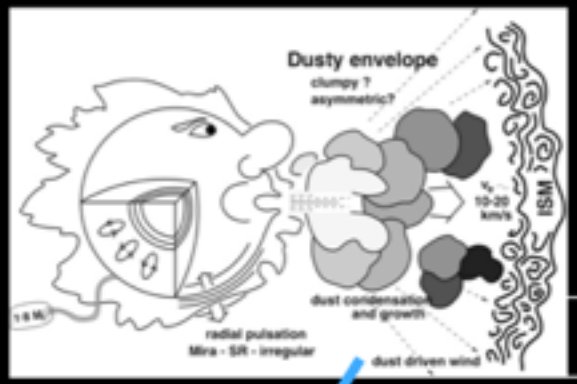


da Cunha+08

At ~12μm



Haas+03



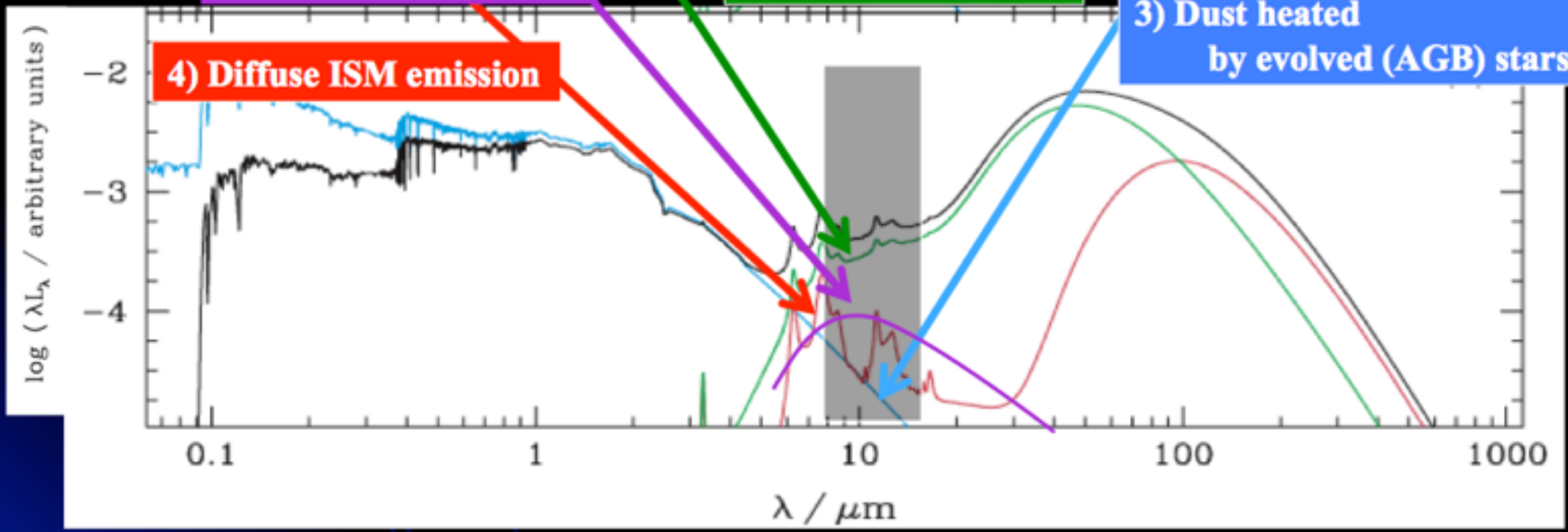
Marengo+

1) Dust heated by AGN

2) Dust heated by SF

3) Dust heated by evolved (AGB) stars

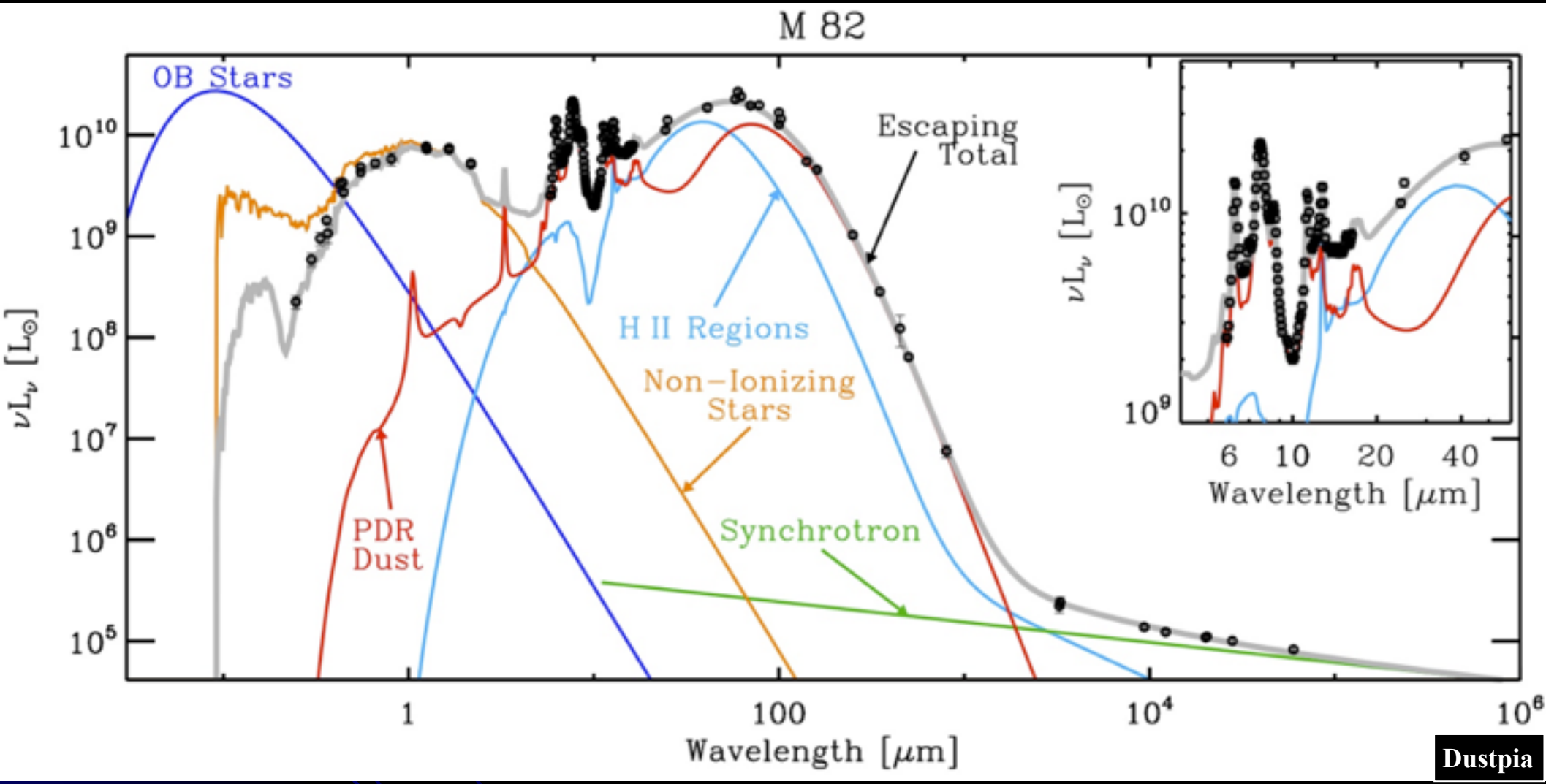
4) Diffuse ISM emission



This SED is not 100% correct, but is to show a schematic view.

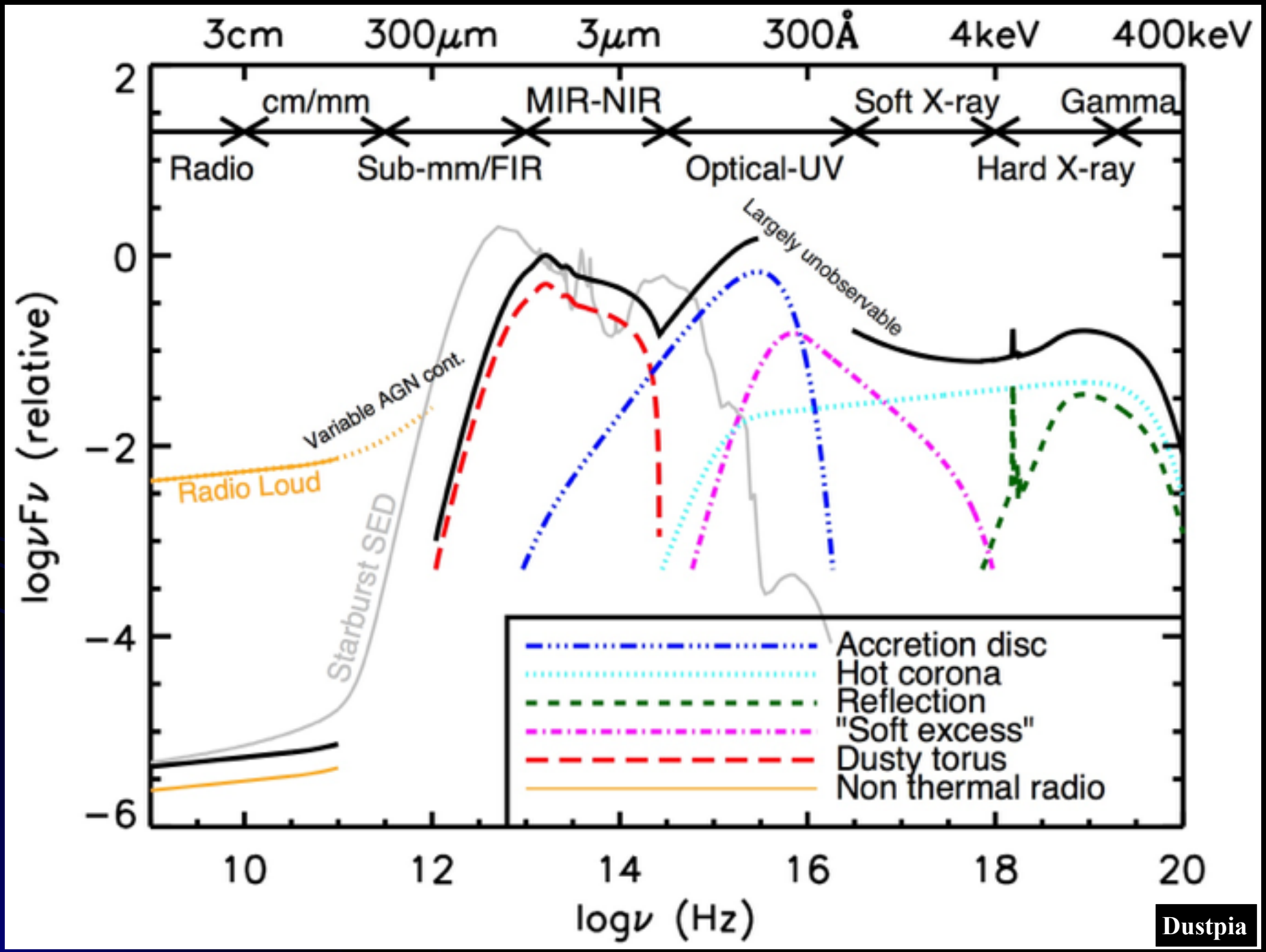
da Cunha+08

To Radio bands



Dustpia

To X-ray/Gamma-ray bands



Dustpia

What physical parameters can we obtain from Multiwavelength data?

```
Mgaldr12_flags.sav   : Several Flags including source of redshifts
Mgaldr12_stars.sav   : Spectroscopically confirmed STARs in SDSS (not included in the galaxy catalog)
Mgaldr12_garbage.sav : Problematic sources with spectra in SDSS (not included in the galaxy catalog)
Mgaldr12_id.sav      : Identifications
Mgaldr12_sdss.sav    : Photometric data
Mgaldr12_spec.sav    : Spectroscopic data
Mgaldr12_mpa.sav     : Spectroscopic data in the MPA-JHU VAGC (IN FACT, the actual data are only for galaxies in DR7)
Mgaldr12_2mass.sav   : 2MASS data
Mgaldr12_wise.sav    : WISE data from http://wise2.ipac.caltech.edu/docs/release/allwise/
Mgaldr12_wisecol.sav : AGN class using WISE data
Mgaldr12_pscakari.sav : AKARI Point Source Catalog
Mgaldr12_akari.sav   : AKARI Bright Source Catalog V2 from http://www.ir.isas.jaxa.jp/AKARI/Archive/Catalogues/FISBSCv2/
Mgaldr12_galex.sav   : GALEX data
Mgaldr12_iras.sav    : IRAS data
Mgaldr12_first.sav   : FIRST data
Mgaldr12_alfalfa.sav : ALFALFA survey data (a.70 from http://egg.astro.cornell.edu/alfalfa/data/index.php)
Mgaldr12_clines.sav  : Extinction correction emission line data from the MPA-JHU VAGC
Mgaldr12_lir.sav     : Data form the SED fit with Chary & Elbaz (01)
Mgaldr12_jrm.sav     : Data from the SED fit with DECOMPIR (Number of galaxies in this file is different from those in
Mgaldr12_s870.sav    : Predicted submillimeter data from the SED fit
Mgaldr12_cluster.sav : CIRS, HeCS & HeCS-SZ cluster data
Mgaldr12_listcluster.sav : Cluster list used for Mgaldr12_cluster.sav (number of entry is not the same as the number of g
Mgaldr12_mstarage.sav : Various Stellar Mass Estimates, Age & Metallicity
Mgaldr12_drmanga.sav : Flags for the Manga galaxies included in DR13
Mgaldr12_swift.sav   : Swift data from http://swift.gsfc.nasa.gov/results/bs70mon/
Mgaldr12_gas.sav     : H2 gas data from the literature
Mgaldr12_size.sav    : Some size information from SDSS
Mgaldr12_morfit.sav  : Galaxy Serfit Fit information from SDSS
Mgaldr12_spin.sav    : Galaxy Spin information from SDSS,SAMI,CALIFA & Literature
sdss_morph.txt       : Compilation of Visual Inspection from other surveys
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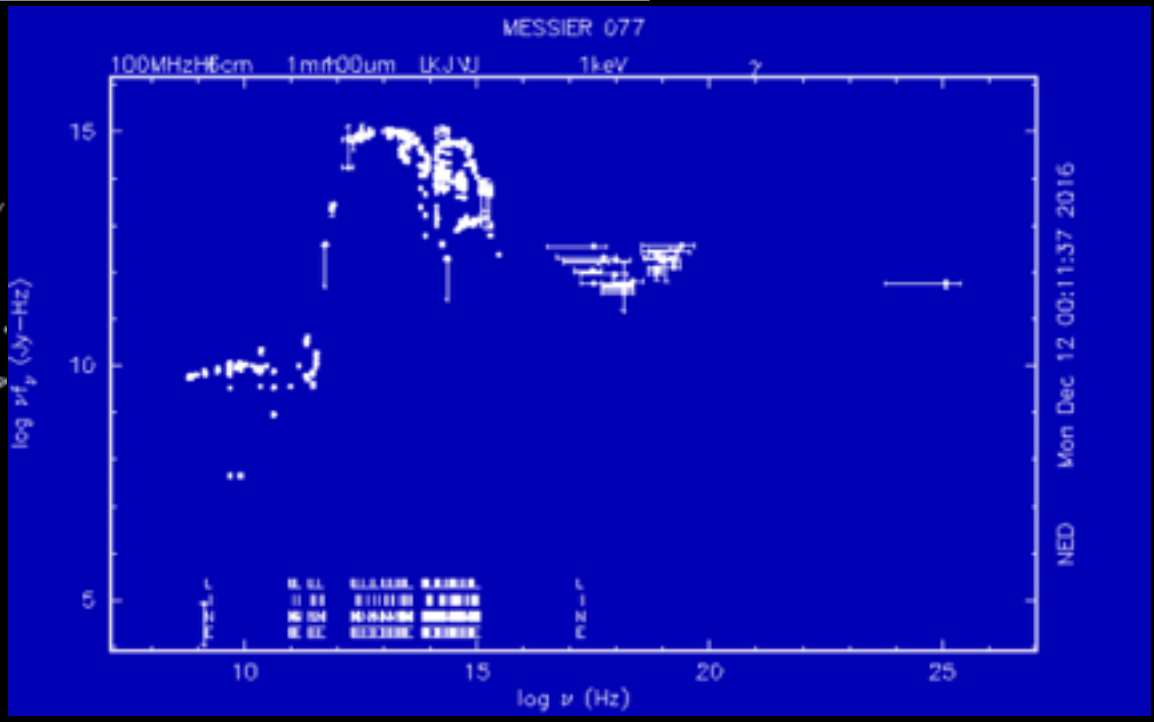
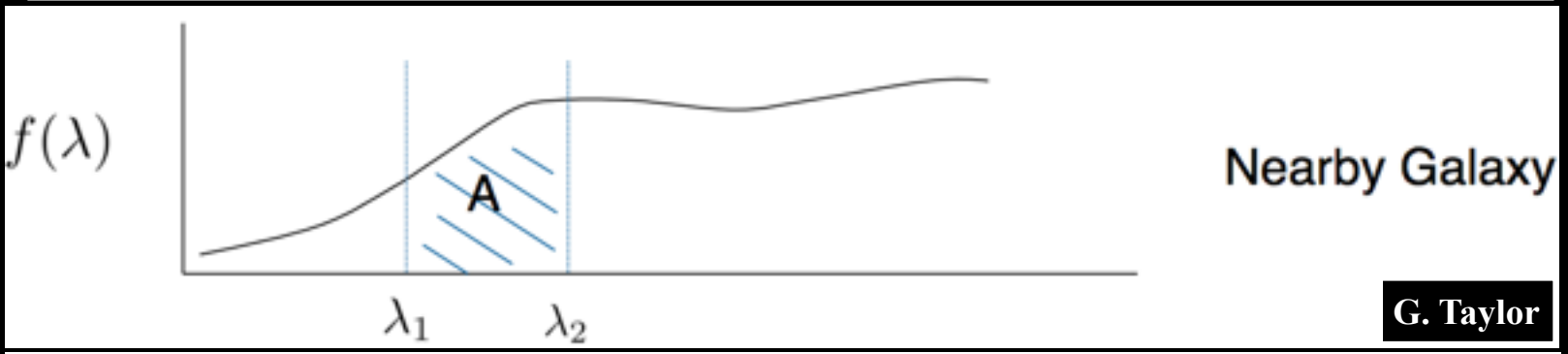


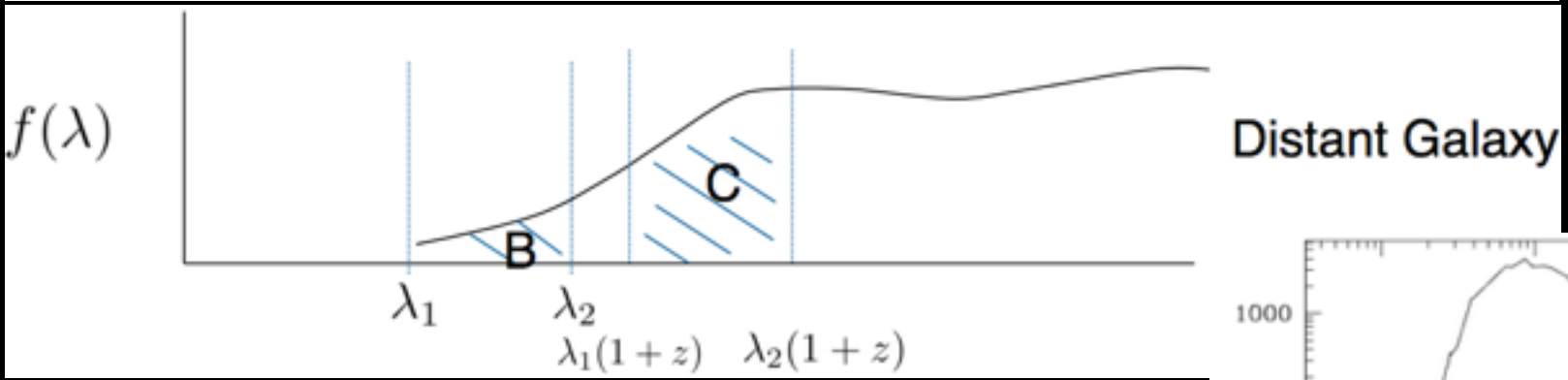
- ➢ Swift/BAT: AGN?
- ➢ GALEX: SFR
- ➢ SDSS
  - ➢ 1D spectra: SFR, AGN?, M_{star}
  - ➢ 2D spectra: Gas/Stellar kinematics
- ➢ 2MASS: M_{star}
- ➢ WISE: IR luminoisty, AGN?
- ➢ IRAS/AKARI/JCMT: IR luminosity (⇒SFR), Dust Mass/Temperature
- ➢ FIRST: SFR
- ➢ ALFALFA: $M_{HI(atomic)}$
- ➢ IRAM/COLDGASS: $M_{H2(molecular)}$
- ➢ ALMA: Dust distribution, Gas distribution/kinematics

(Negative) K-correction & High-z Galaxies



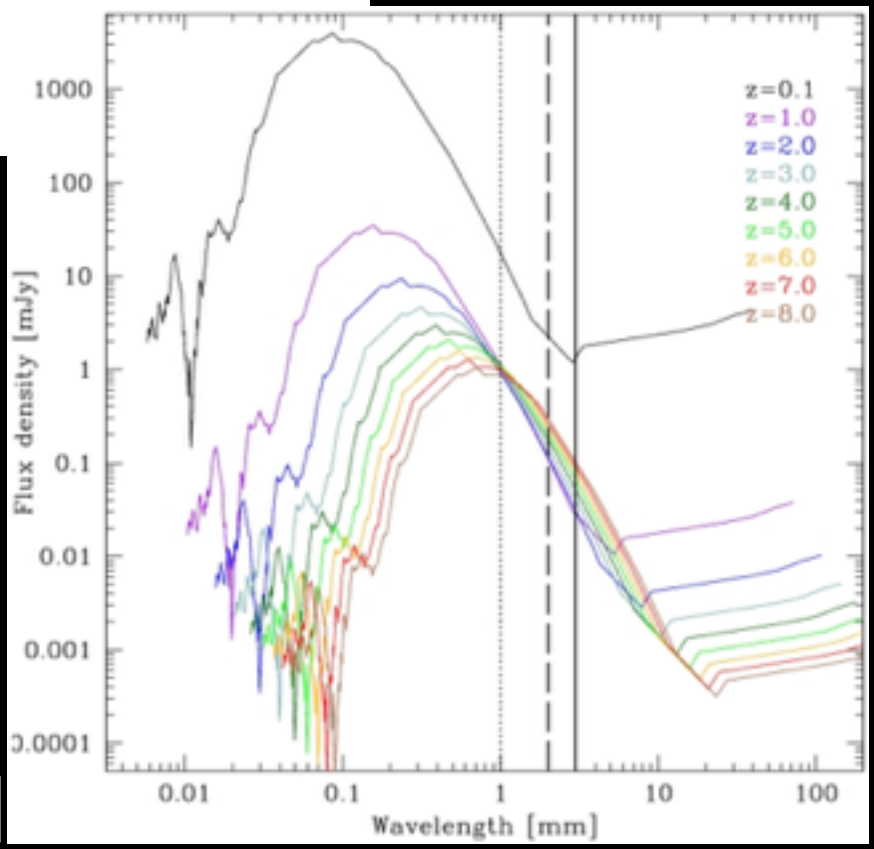
Nearby Galaxy

G. Taylor



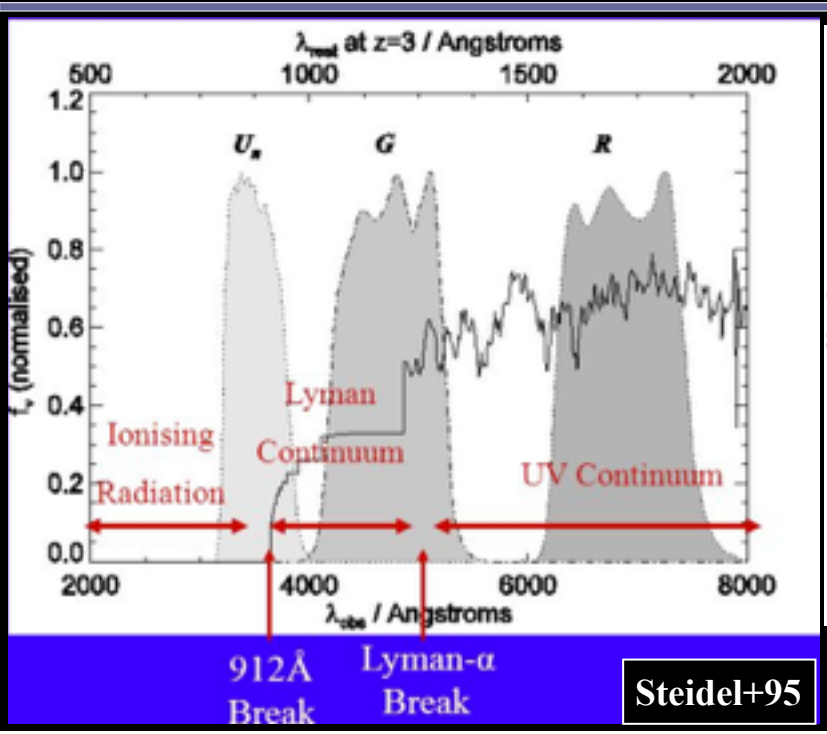
Distant Galaxy

김재우,
심현진 발표

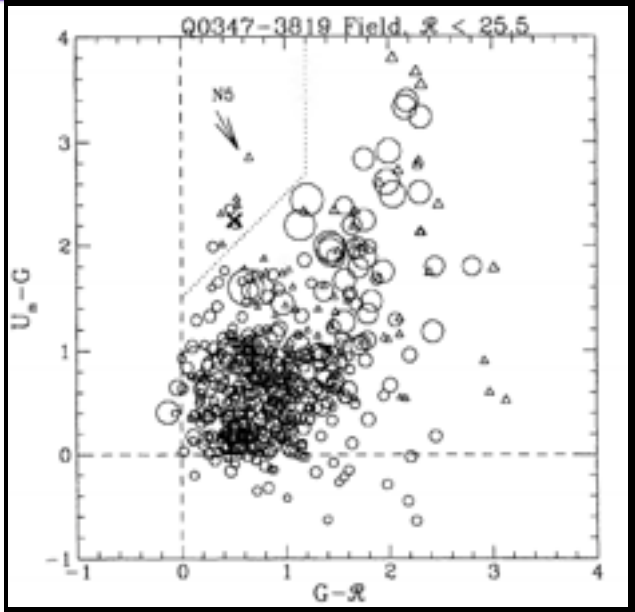


R. Decarli

Identification of High-z Galaxies: Dropout Technique

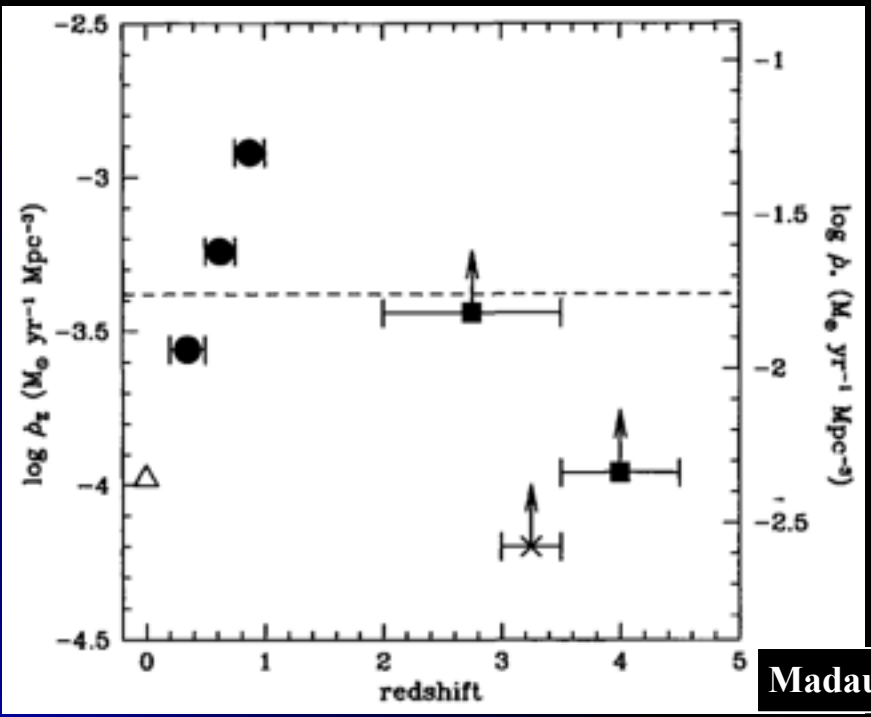


Steidel+95

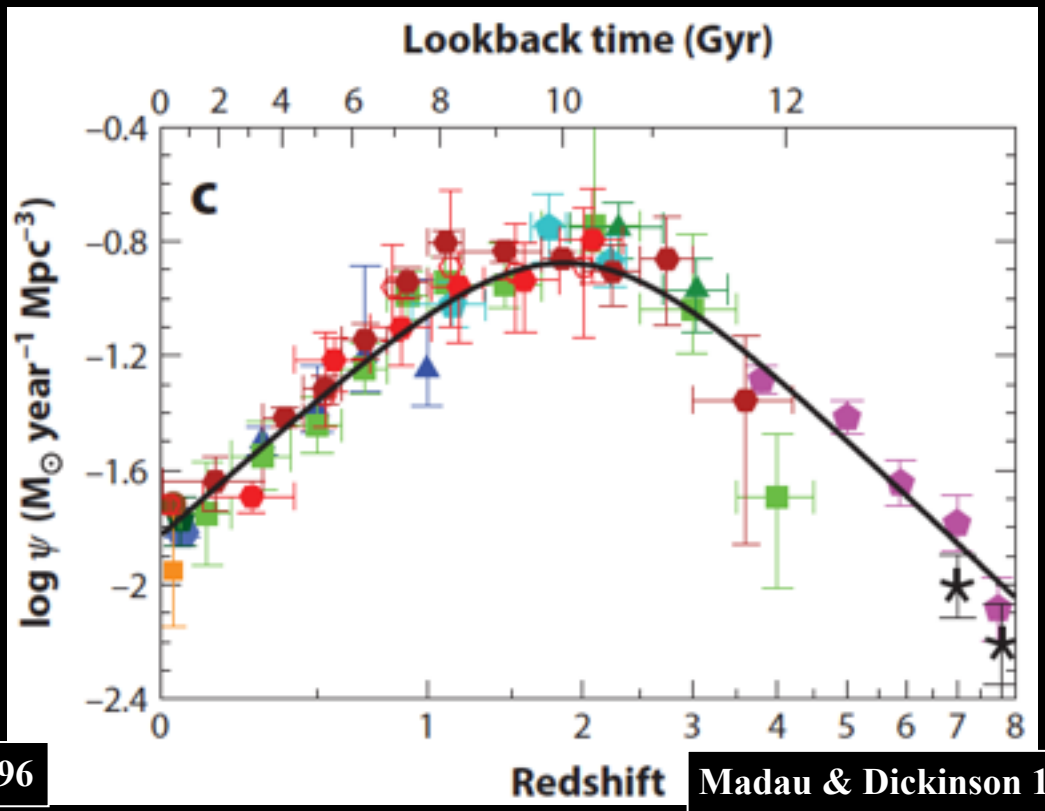


➢ Different Filters ⇒ Galaxies at different z

➢ A large sample of high-z galaxies

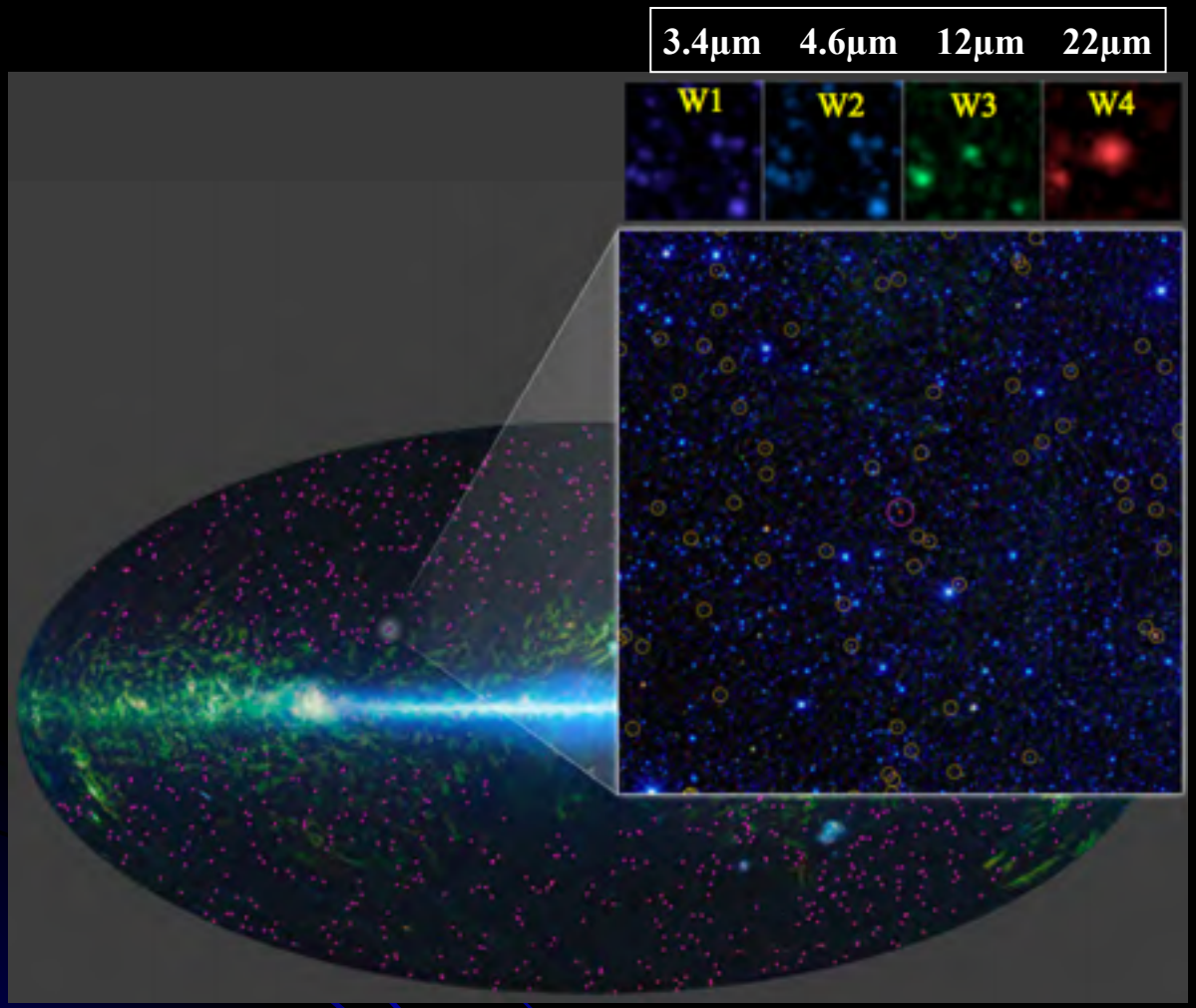


Madau+96

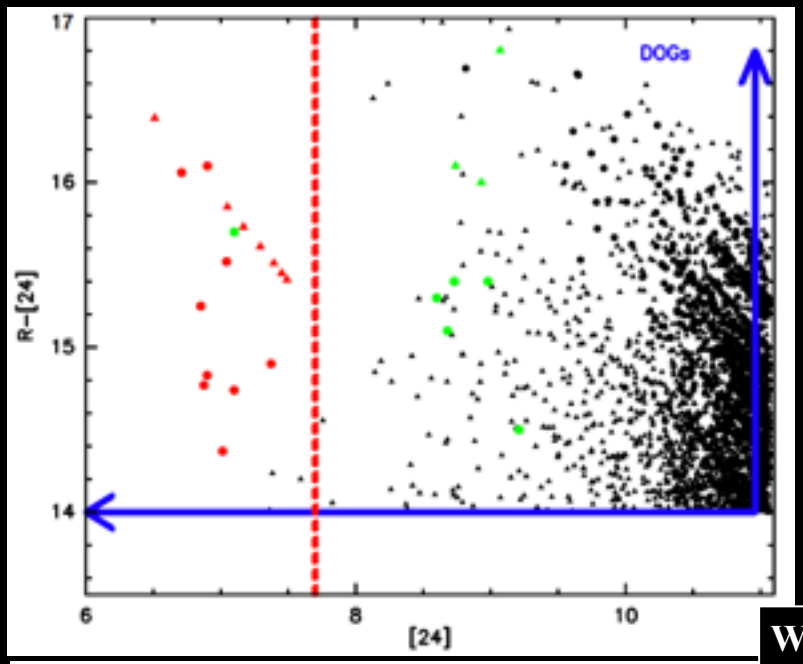


Madau & Dickinson 14

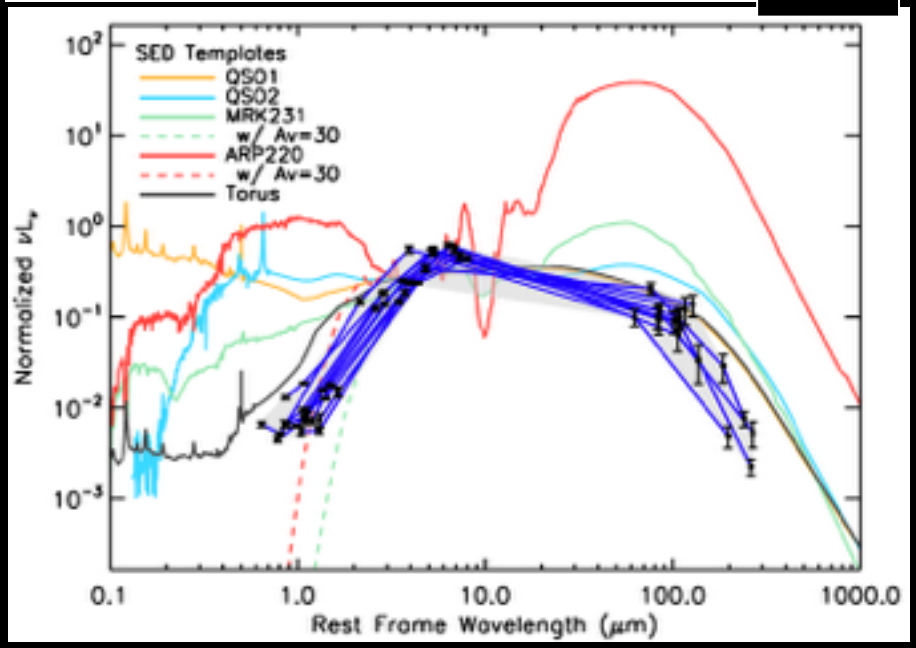
Identification of High-z Galaxies: Dropout Technique

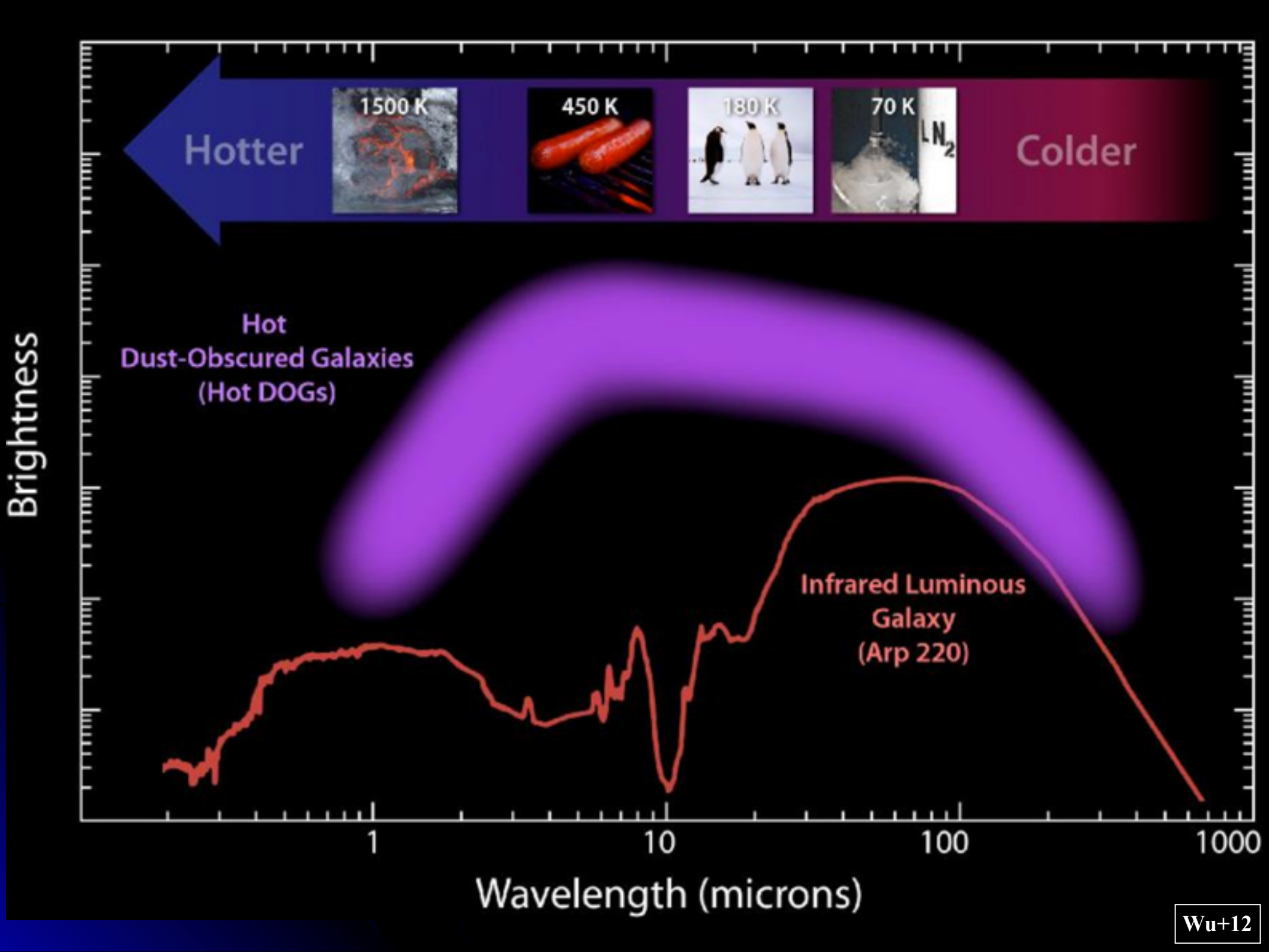


WISE W12 dropouts (Eisenhardt+12)



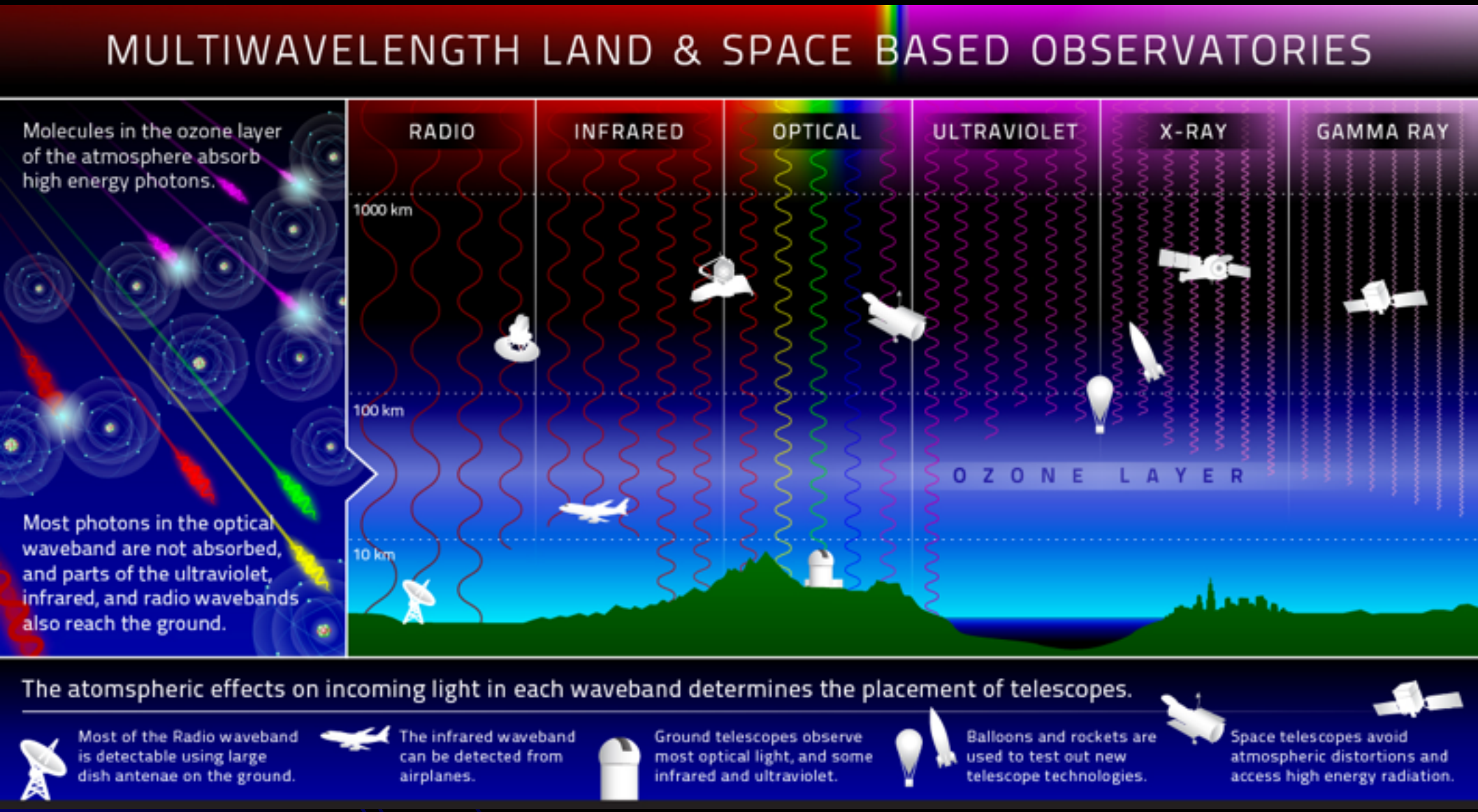
Wu+12



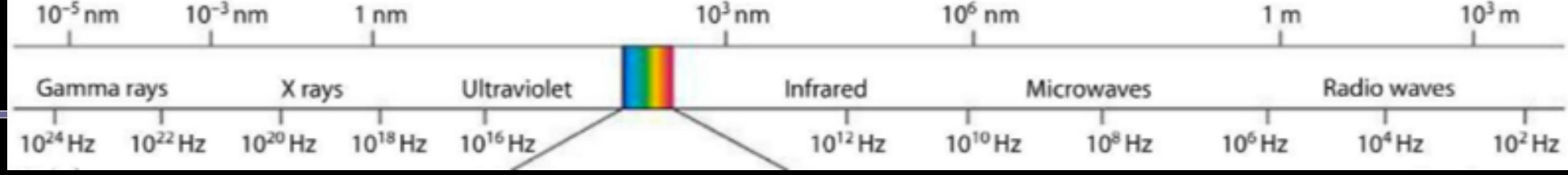

Hotter
1500 K
450 K
180 K
70 K
LN_2
Colder
Hot
Dust-Obscured Galaxies
(Hot DOGs)
Infrared Luminous
Galaxy
(Arp 220)
Brightness
1
10
100
1000
Wavelength (microns)

Wu+12

Multiwavelngth Observations



Past



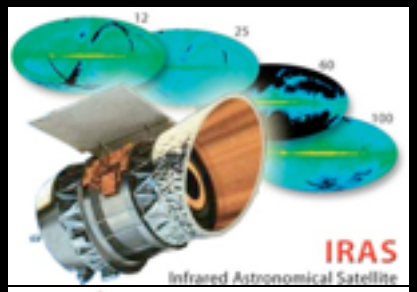
-1983

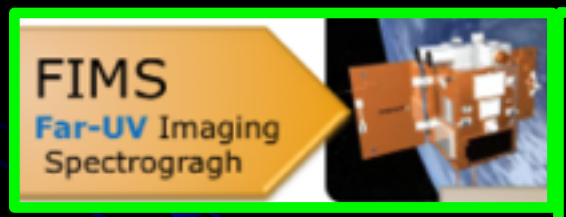
-1995

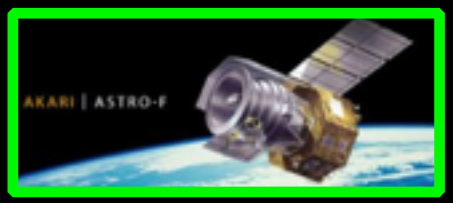
-2003

-2006

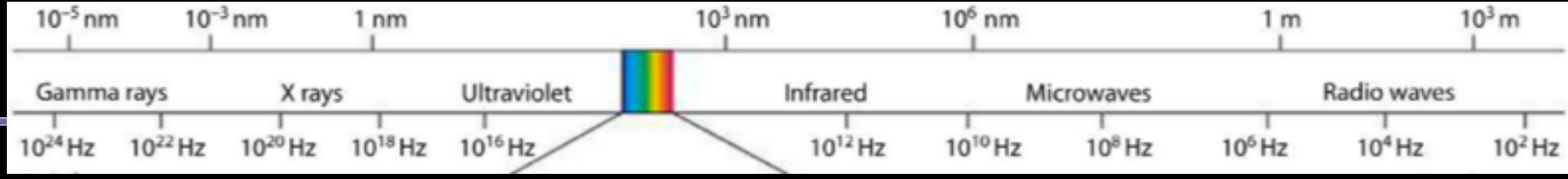
-2009







Present

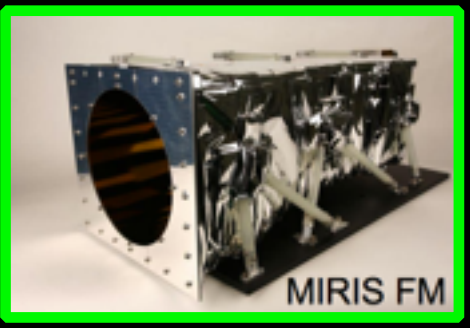


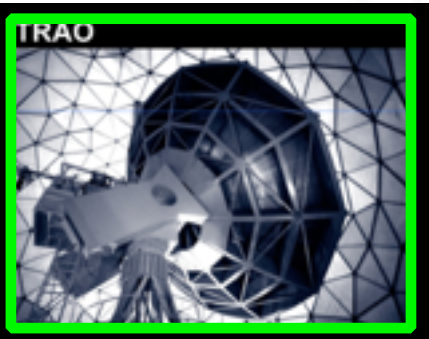
-2016

SDSS

MaNGA

신윤경 발표



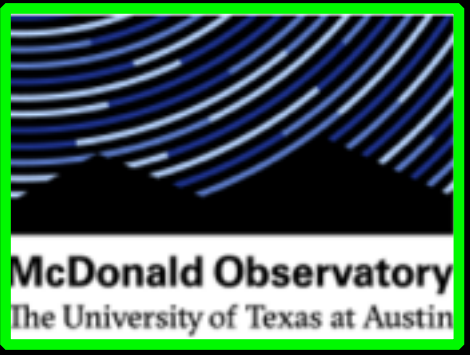


The MMT Observatory

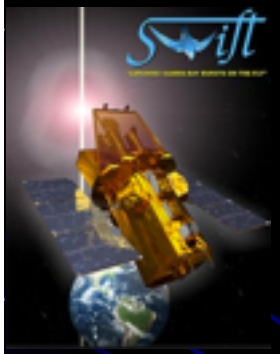
A joint facility of The Smithsonian Institution and The University of Arizona

GEMINI OBSERVATORY

Exploring the Universe, Sharing its Wonders



양유진 발표



iram

Institut de Radioastronomie Millimétrique

이종철,
심현진 발표

NASA

CXO

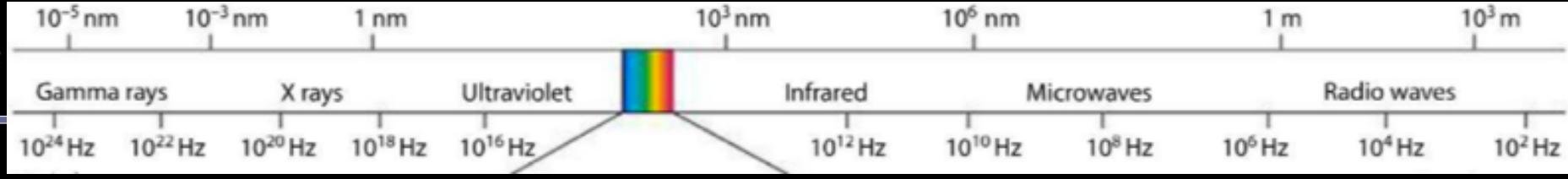
Chandra X-ray Observatory

xmm-newton

James Clerk Maxwell Telescope
East Asian Observatory

ALMA

Future

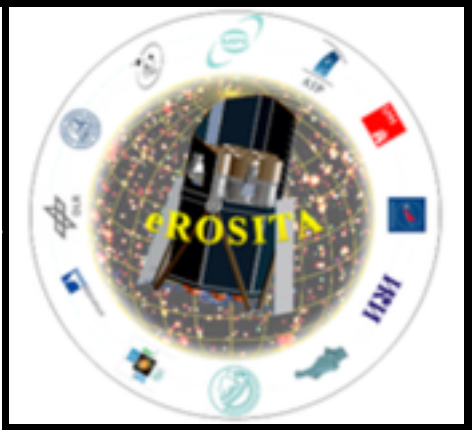


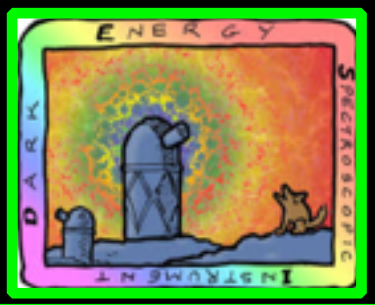
-2017

-2019

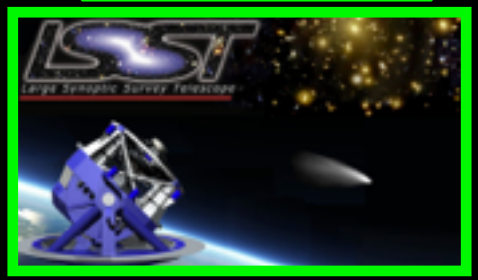
-2020

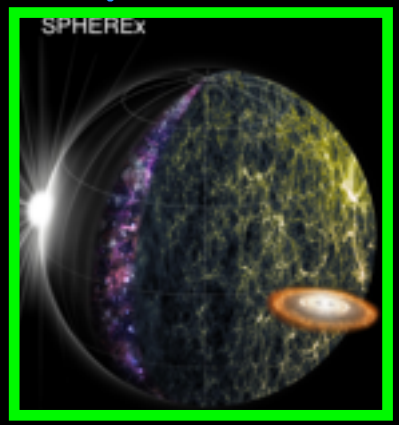
-2021





정웅섭 발표





오세헌 발표

Conclusions & Discussion

- 외부은하 다파장 연구의 중요성: Complete Understanding!
- 최근 한국 천문학계에 다파장 은하 연구 자료를 확보할 기회가 많아졌는데, 이 기회를 어떻게 잘 활용할 것인가?
- 오늘 내일 열띤 토론을 부탁드립니다!