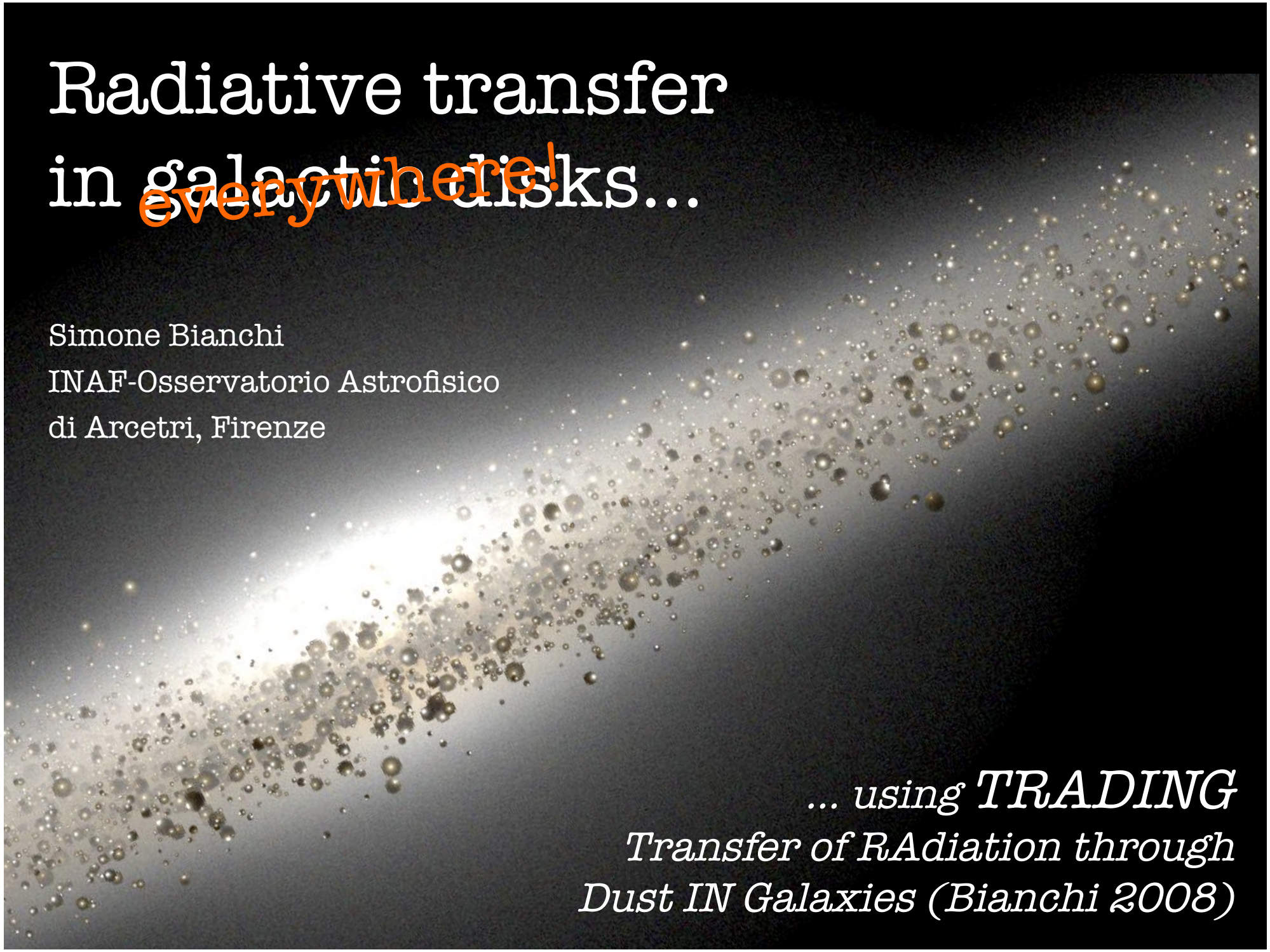
Radiative transfer in galactic disks...

everywhere!

Simone Bianchi
INAF-Osservatorio Astrofisico
di Arcetri, Firenze



... using TRADING
Transfer of RAdiation through Dust IN Galaxies (Bianchi 2008)

TRADING features

Continuum RT in a dusty medium

Monte Carlo code

An adaptive grid for dust

Stellar emission from diffuse/point-like sources
of different spectra

Thermal & stochastic dust emission
from a distribution of grain sizes and material
(Now Draine & Li 2007)

Dust self-absorption.

RT and the Monte Carlo Method

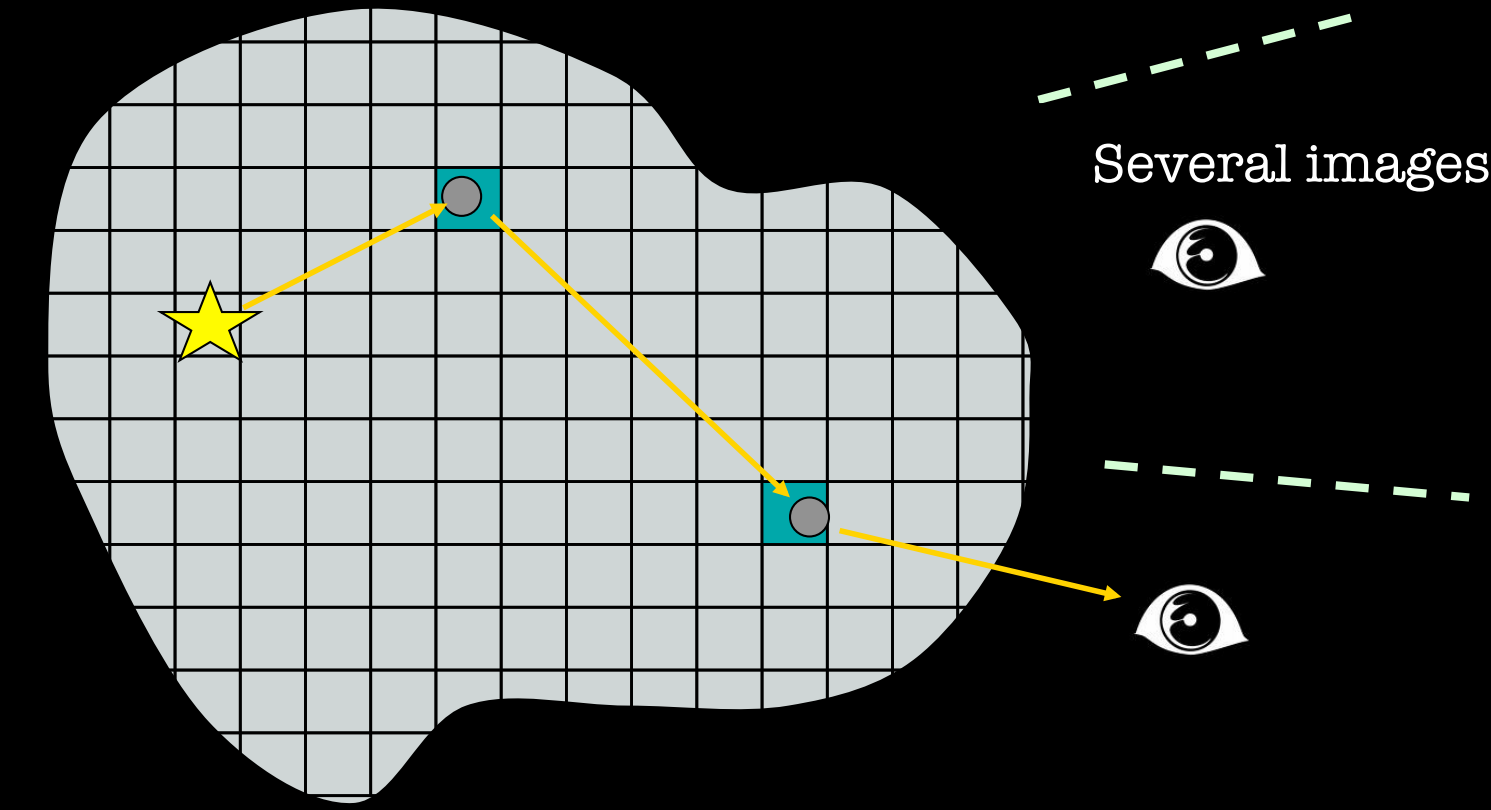
The path of a photon through dust

Emission from stars

Extinction: scattering *or* absorption ?

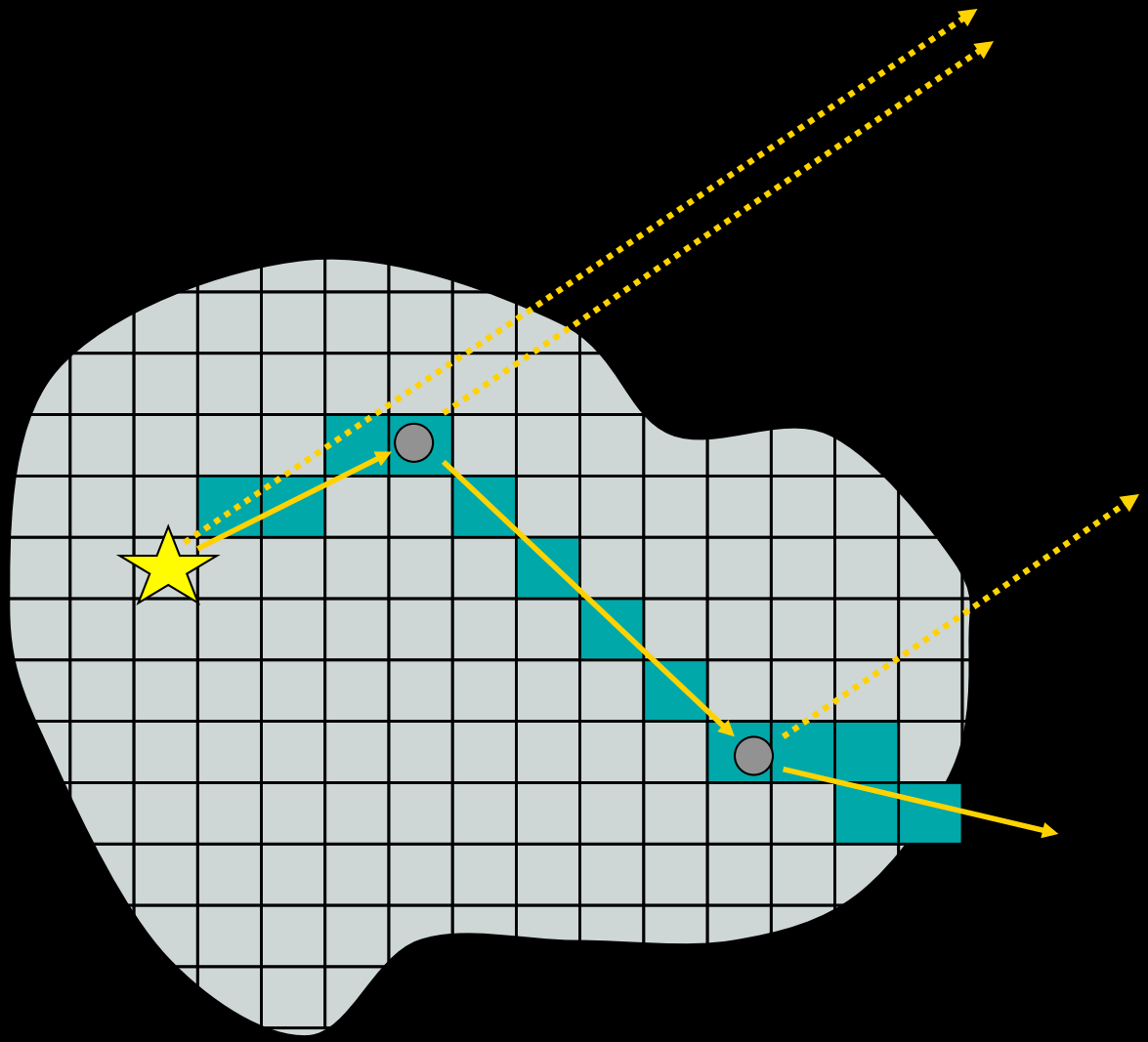
Out of dust: observed

Several images



RT and the Monte Carlo Method

The path of a photon through dust



Optimizations

Photon weights

Forced Scattering
(Cashwell & Everett 1959)

Peeling-off
(Yusef-Zadeh et al. 1984)

Continuous Absorption
(Lucy 1999)

RT and the Monte Carlo Method

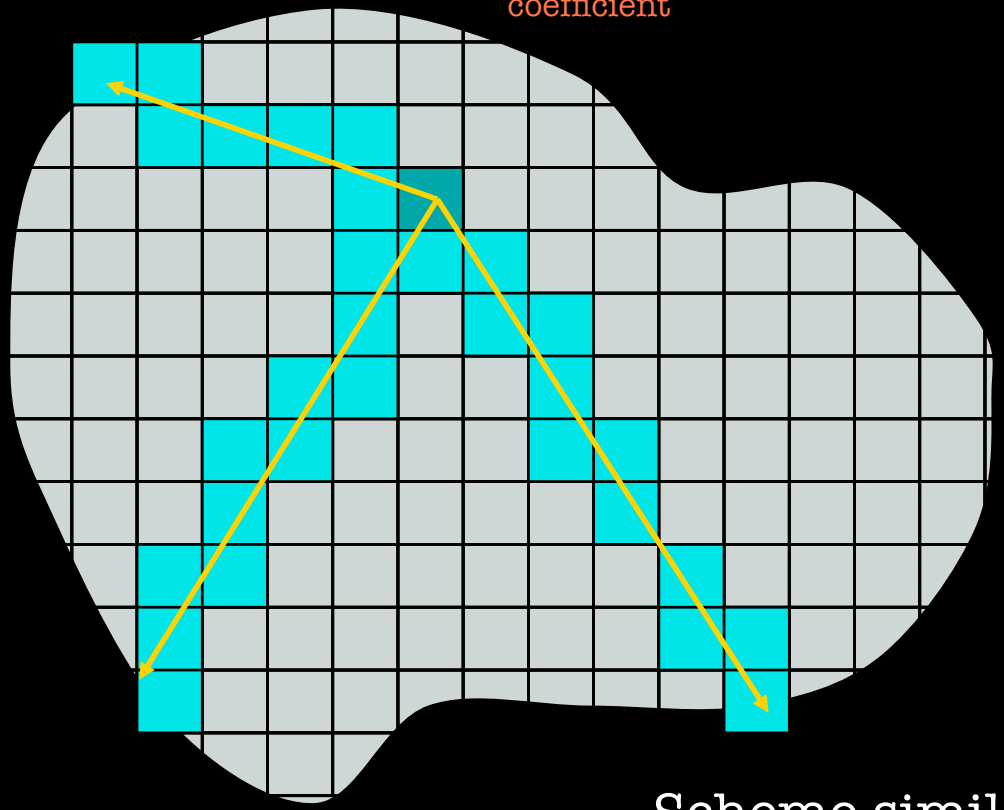
Emission from dust

Local ISRF

$J_\lambda = W_\lambda / (4\pi \kappa_\lambda)$

Absorbed energy

Mean absorption coefficient



j_λ Dust Emission Coefficient
Thermal & Stochastic heating

Dust self absorption (iteratively)

Scheme similar to DIRTY (Misselt et al. 2001)

RT and the Monte Carlo Method

Emission from dust

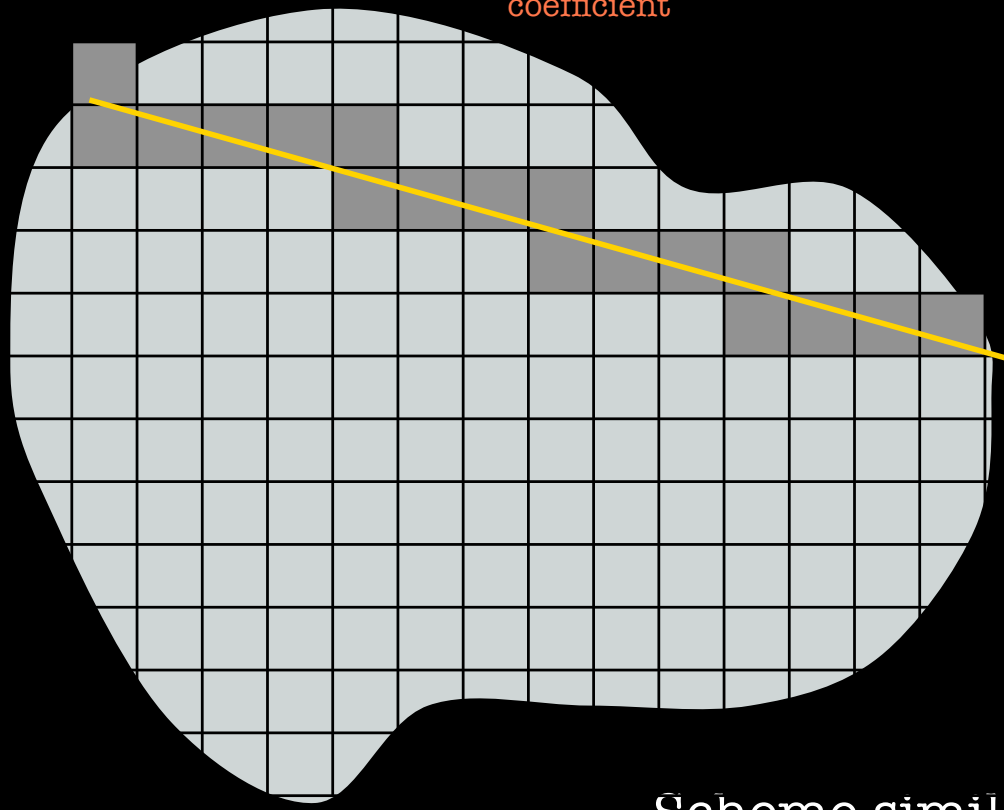
Local ISRF

$J_\lambda = W_\lambda / (4\pi \kappa_\lambda)$

Absorbed energy

Mean absorption coefficient

j_λ Dust Emission Coefficient
Thermal & Stochastic heating



Dust self absorption (iteratively)

l.o.s. integration

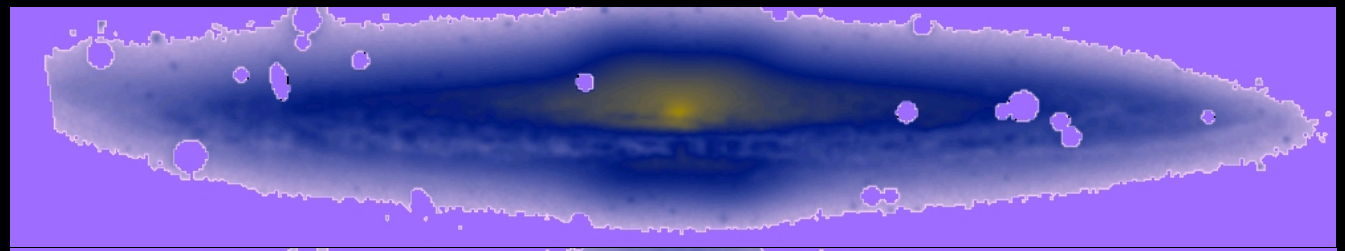
Scheme similar to DIRTY (Misselt et al. 2001)

Real galaxies vs models

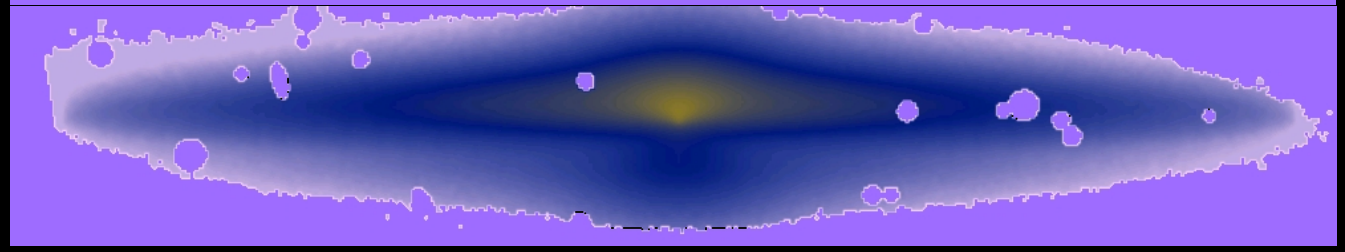
NGC 5746

+ 6 other objects
Bianchi (2007)

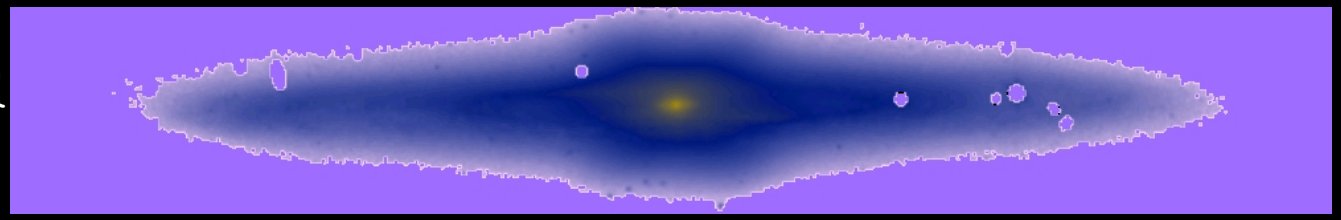
V band



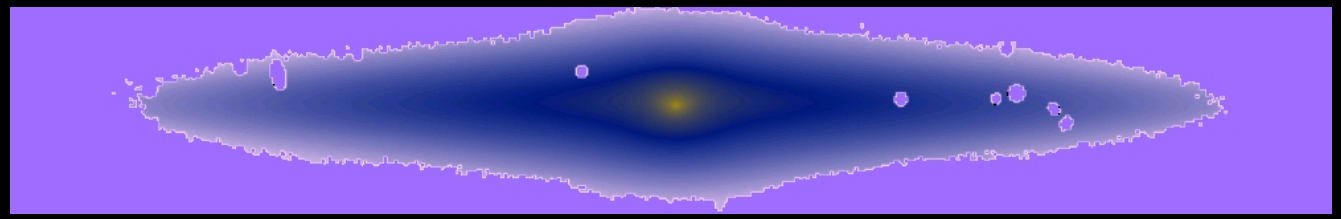
model



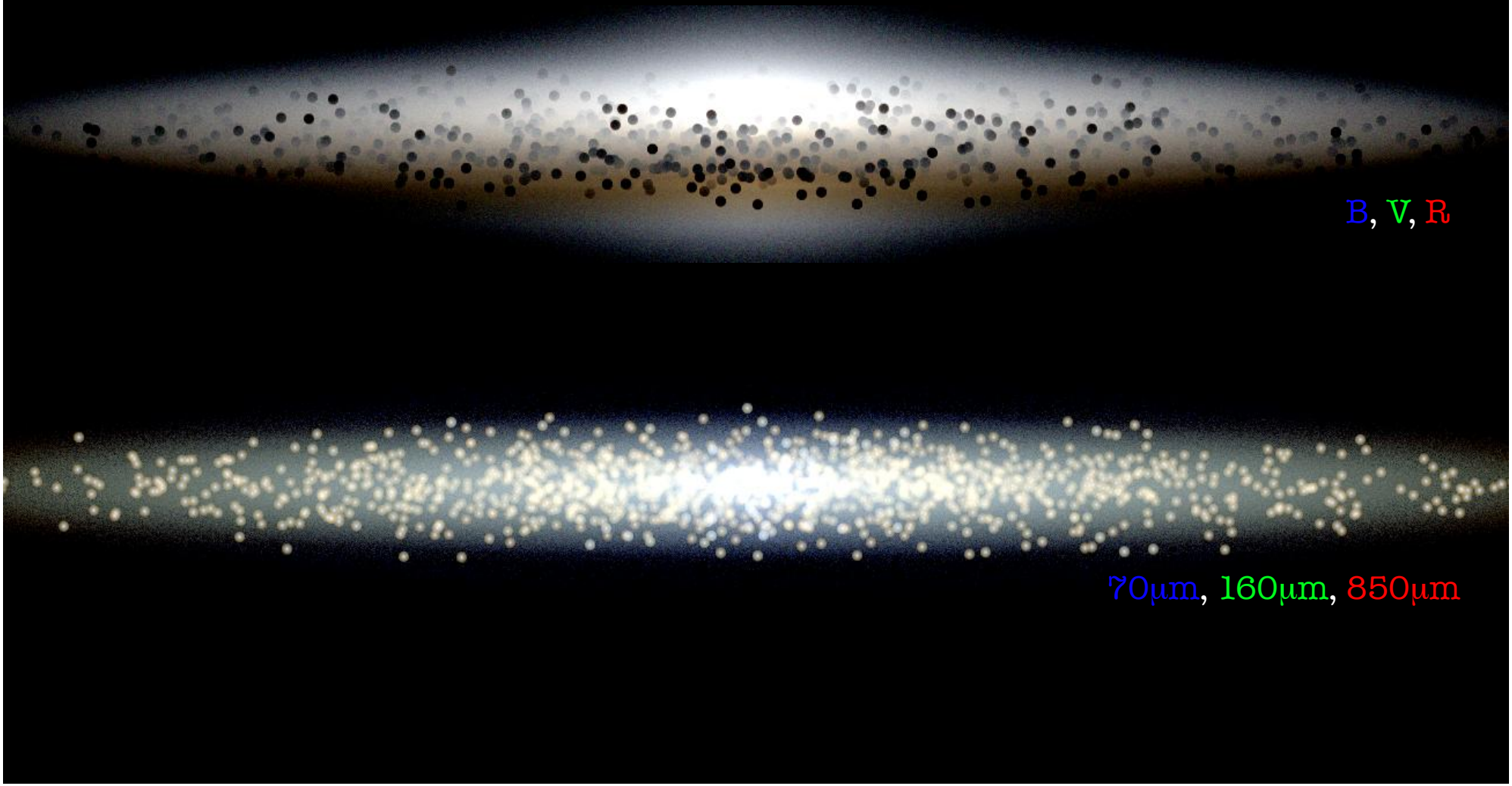
K' band



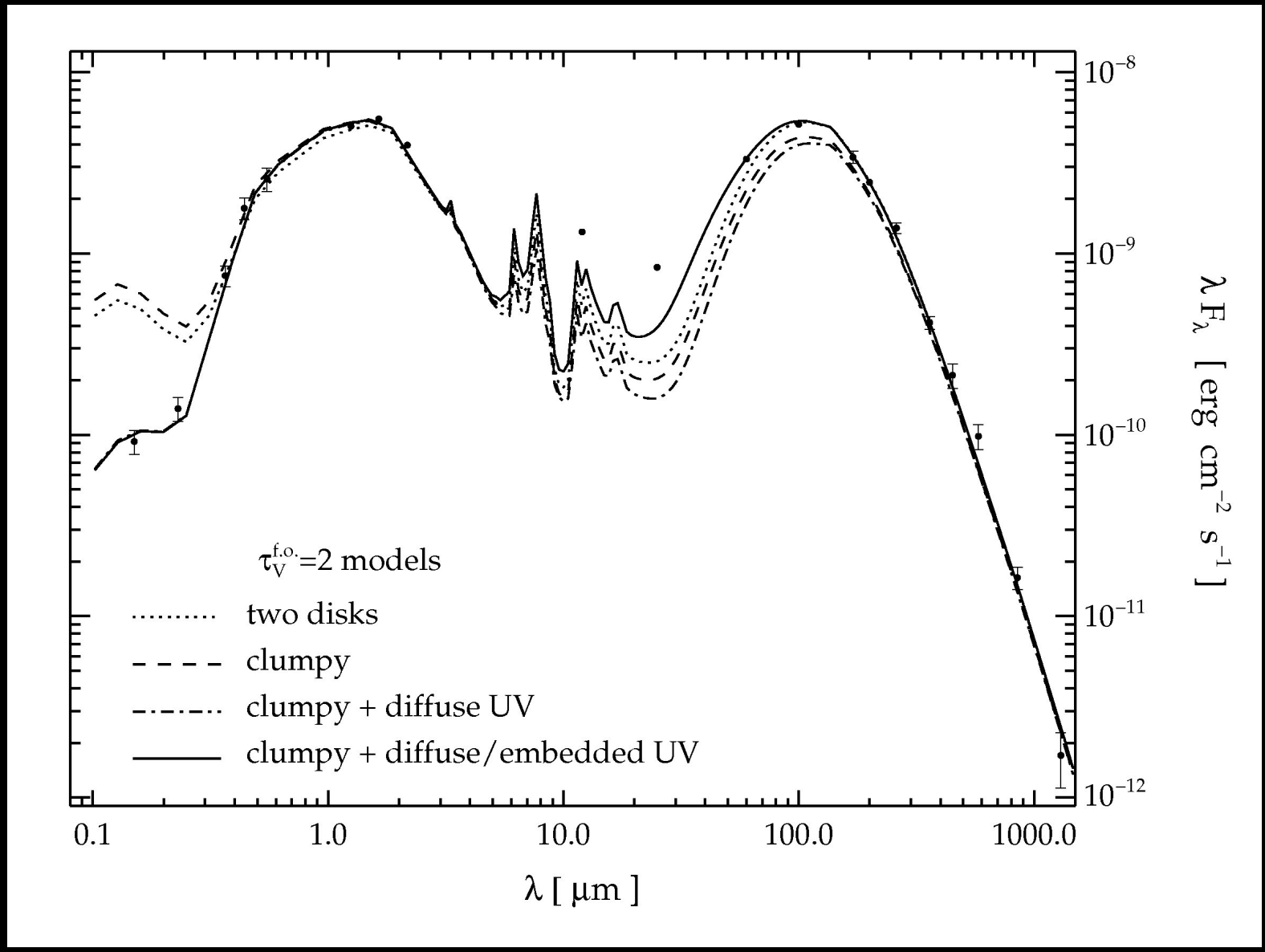
model



Model of an NGC891-*like* galaxy seen at i=86° (Bianchi 2008)

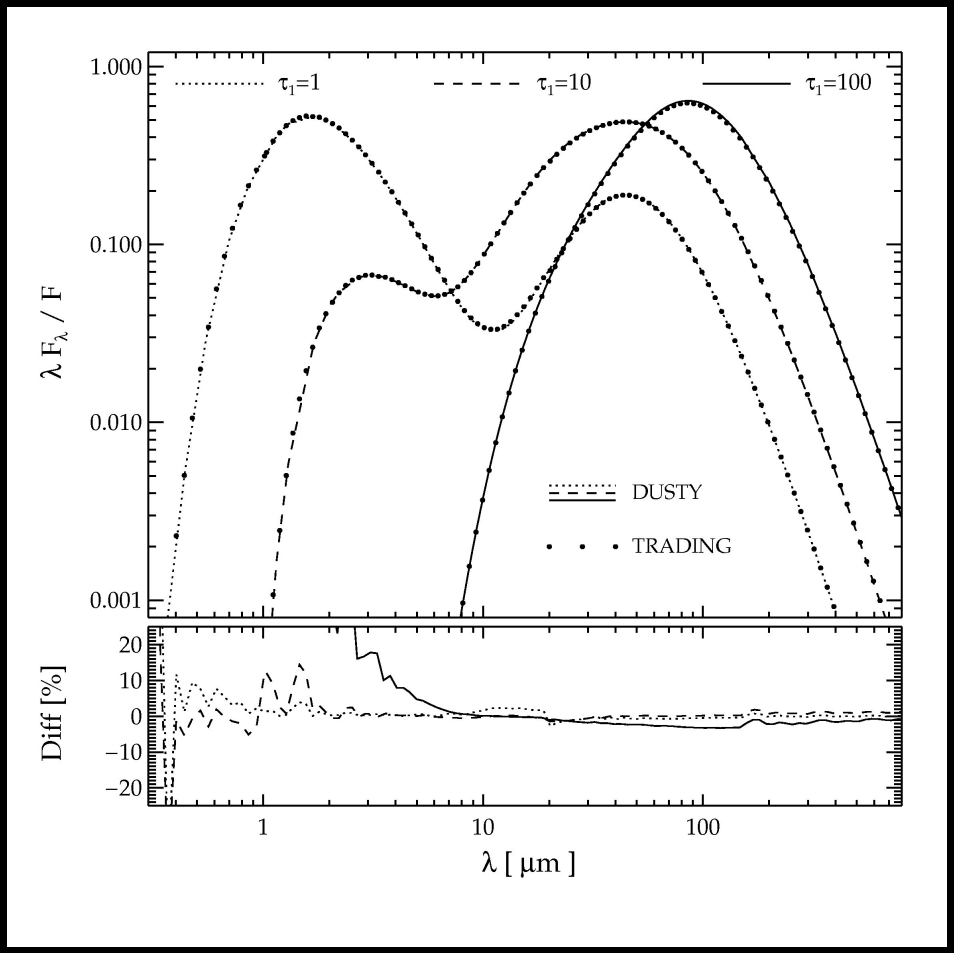


Spectral Energy Distribution

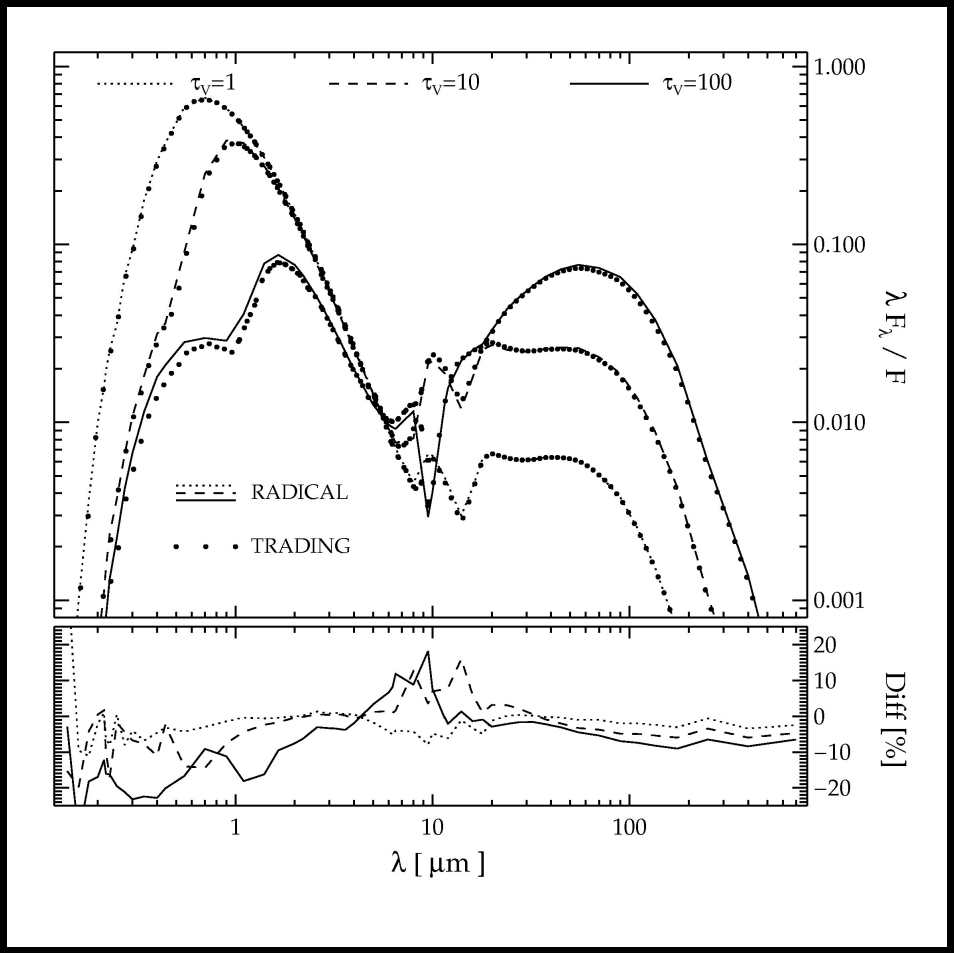


Checking the code

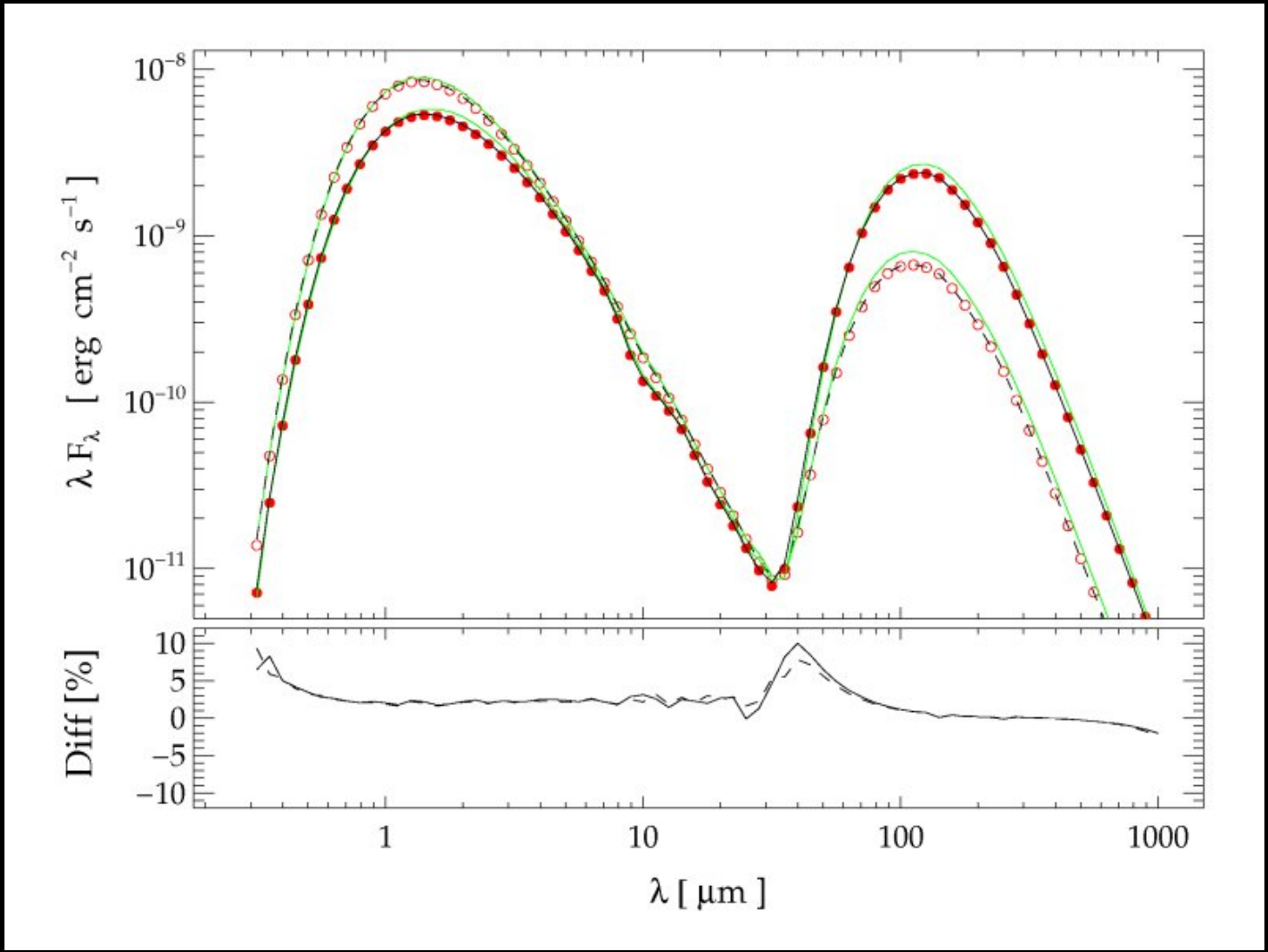
Ivezic et al. 1996



Pascucci et al. 2004



Checking the code



Comparison with SKIRT (Baes et al 2005)

TRADING in MODULO

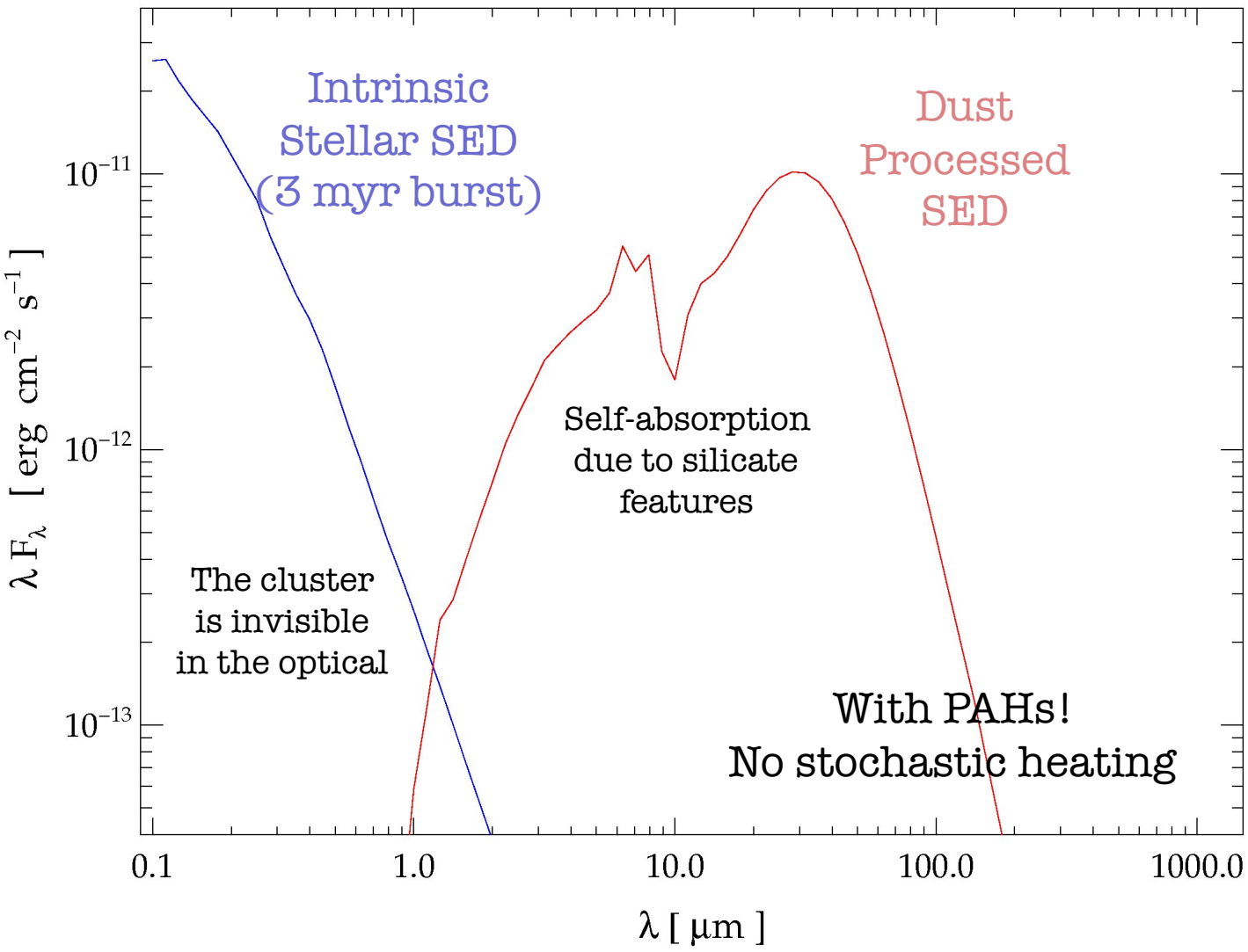
Dust mass in BCDs via SED fitting (Hunt et al. 2005)

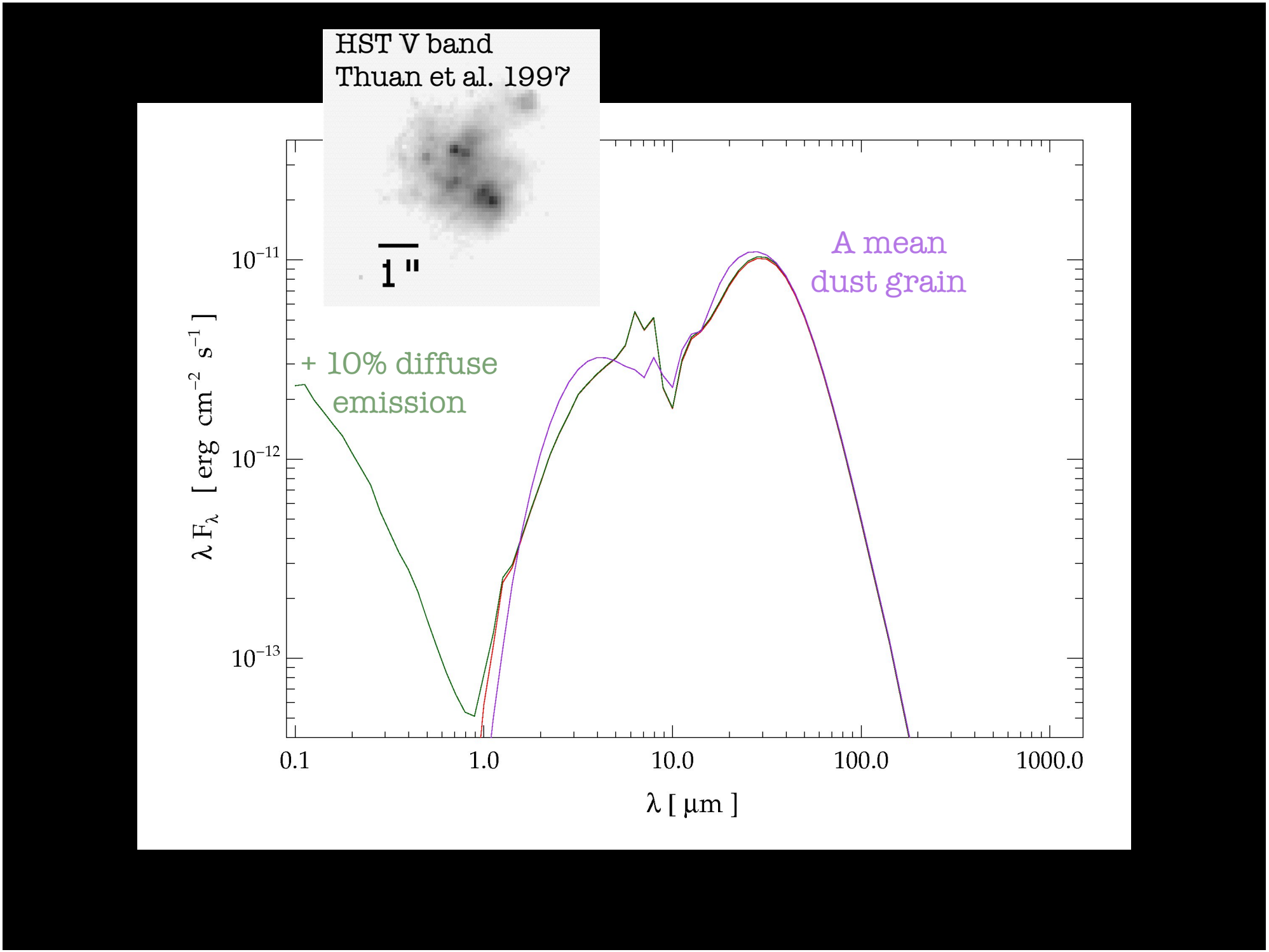
Use of DUSTY (Ivezic & Elitzur, 1997)

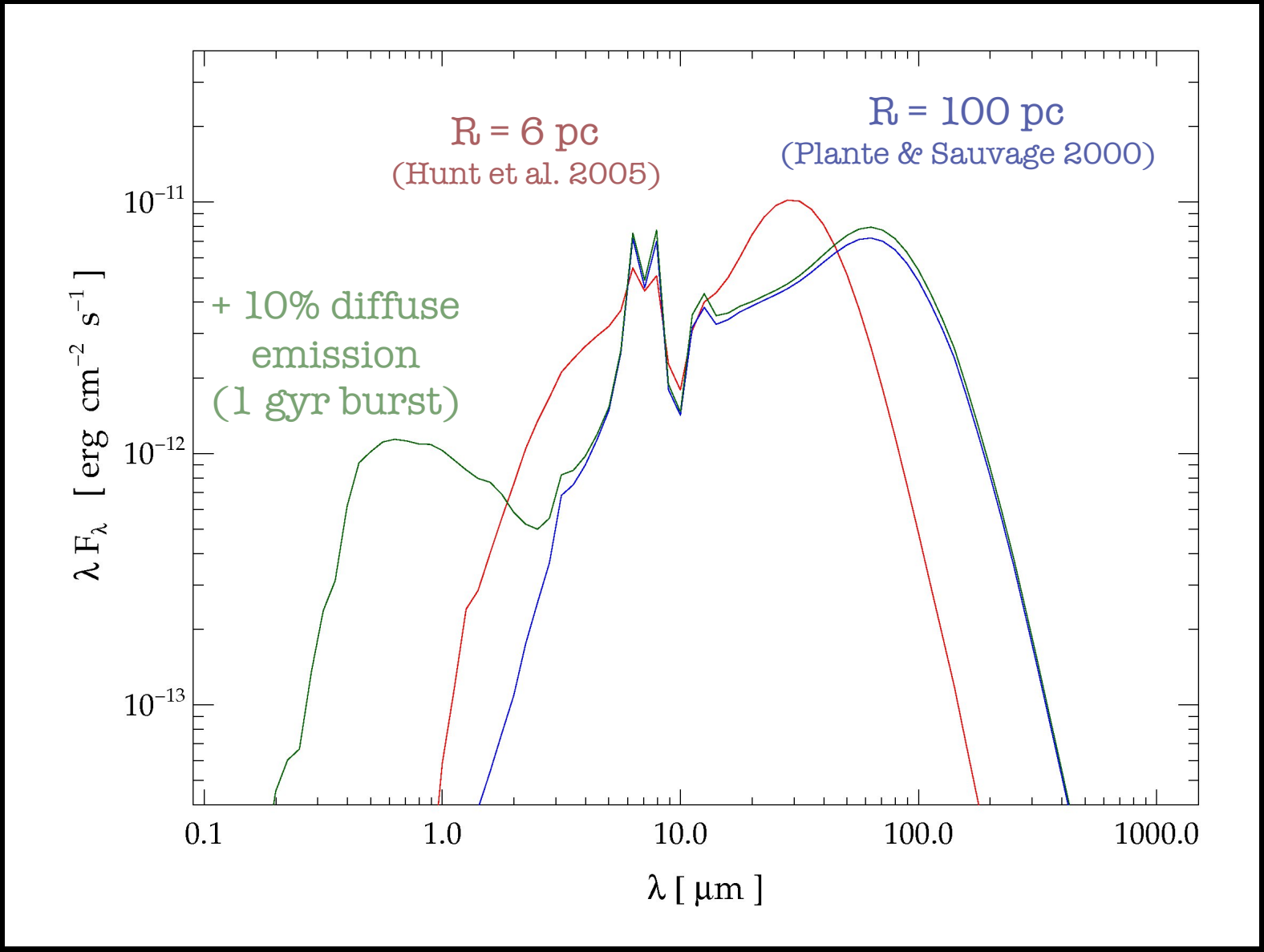
- point source in a dusty sphere (compact/*active*)
- fast & *exact*
- mean opacity, isotropic scattering, no PAHs

An example: the *active* BCD SBS0335-052

- A SSC with L=1-2 x 10^9 $L_\odot$
- in a τ_V=30 sphere
- R = 6 – 100 pc (Hunt et al. 2005, Plante & Sauvage 2000)


Intrinsic
Stellar SED
(3 myr burst)
Dust
Processed
SED
Self-absorption
due to silicate
features
The cluster
is invisible
in the optical
With PAHs!
No stochastic heating
10^{-11}
10^{-12}
10^{-13}
λF_λ [erg cm^{-2} s^{-1}]
0.1
1.0
10.0
100.0
1000.0
λ [μm]


HST V band
Thuan et al. 1997
1 "
A mean
dust grain
+ 10% diffuse
emission
10^{-11}
10^{-12}
10^{-13}
λF_λ [erg cm^{-2} s^{-1}]
0.1
1.0
10.0
100.0
1000.0
λ [μm]


R = 6 pc
(Hunt et al. 2005)
R = 100 pc
(Plante & Sauvage 2000)
+ 10% diffuse
emission
(1 gyr burst)
10^{-11}
10^{-12}
10^{-13}
λF_λ [erg cm^{-2} s^{-1}]
0.1
1.0
10.0
100.0
1000.0
λ [μm]

Some conclusions...

For compact/active objects, point source geometry (DUSTY) should be OK

For less compact (passive) objects it might be important to include diffuse emission (if any)