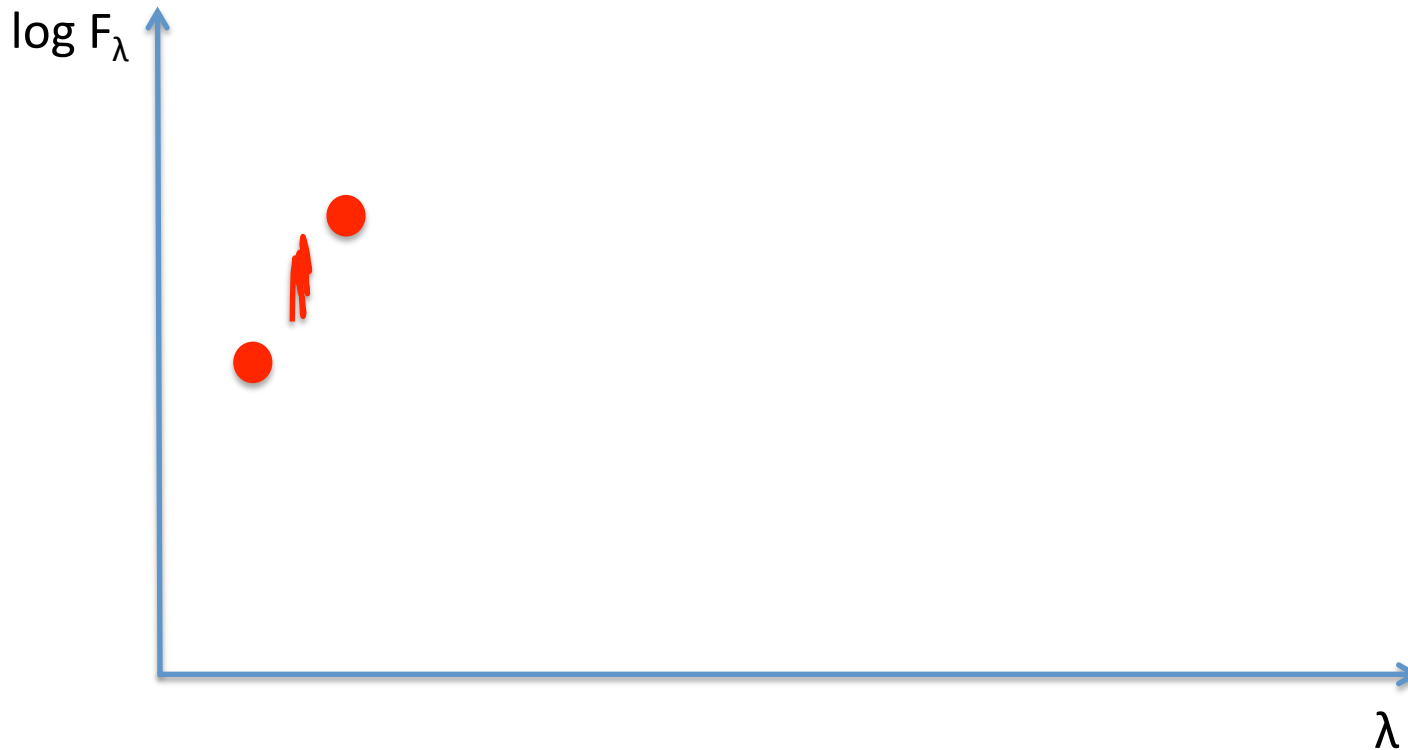*Session:*

Brown Dwarf model atmospheres

Christiane Helling
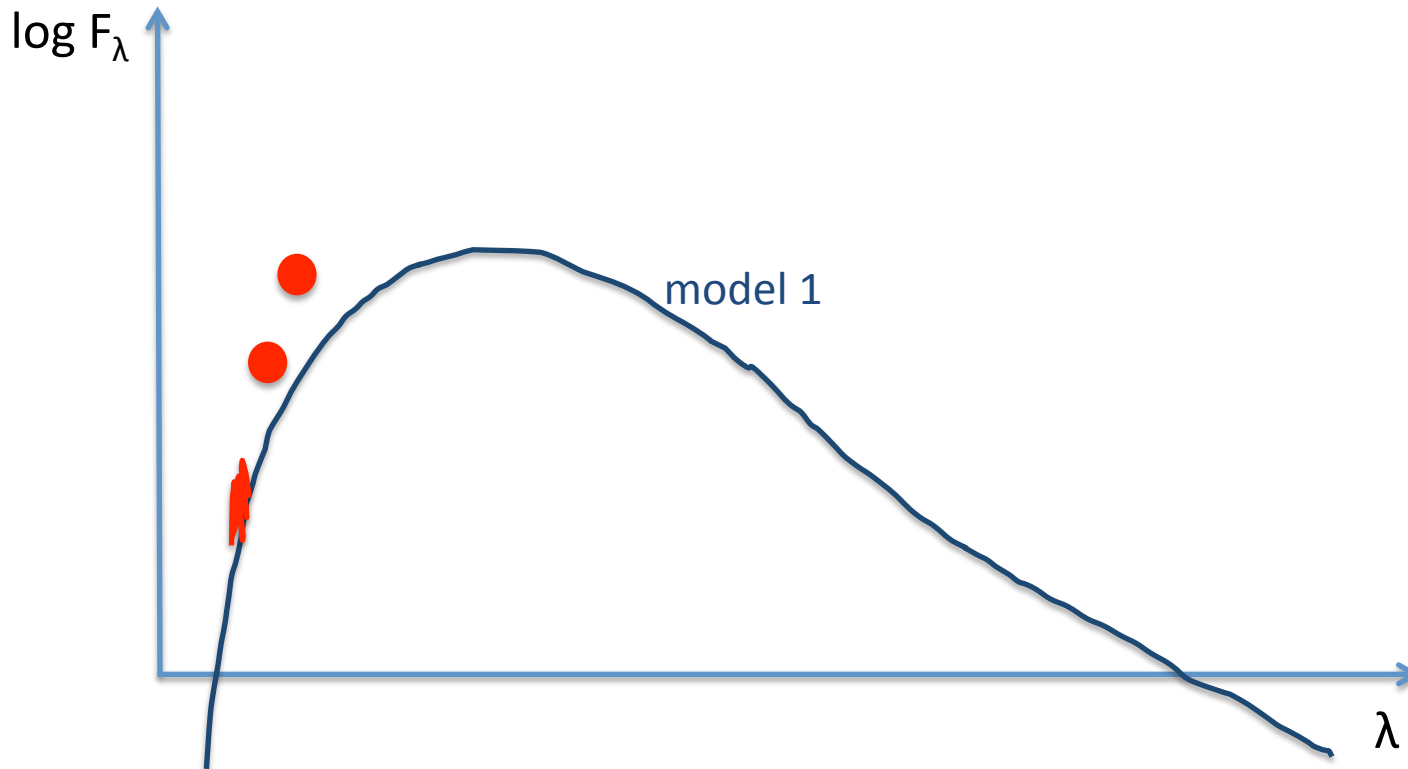
University of St Andrews

Gaia observes

- Parallaxes / distances
- 2 optical photometric fluxes ● (320-660nm; 650-1000nm)
- 847-874 nm high resolution spectrum (narrow wavelength interval)
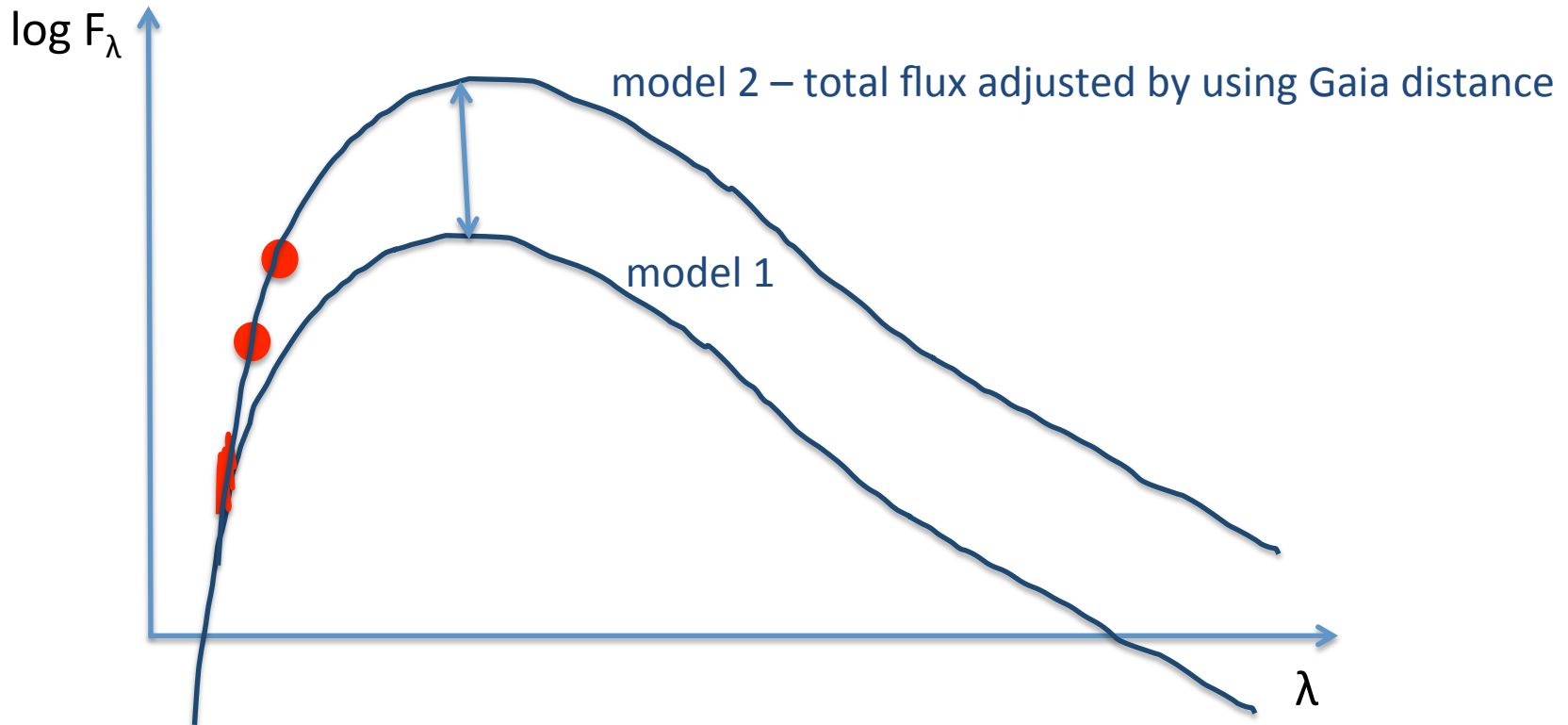
Gaia observes

- Parallaxes / distances
- 2 optical photometric fluxes 🔴
- UV high resolution spectrum (narrow wavelength interval)

Gaia observes

- Parallaxes / distances
- 2 optical photometric fluxes
- UV high resolution spectrum (narrow wavelength interval)

$\log F_\lambda$

model 2 – total flux adjusted by using Gaia distance

model 1

λ

Gaia observes

- Parallaxes / distances ↕

- 2 optical photometric fluxes 🔴

- UV high resolution spectrum (narrow wavelength interval)

log F_λ

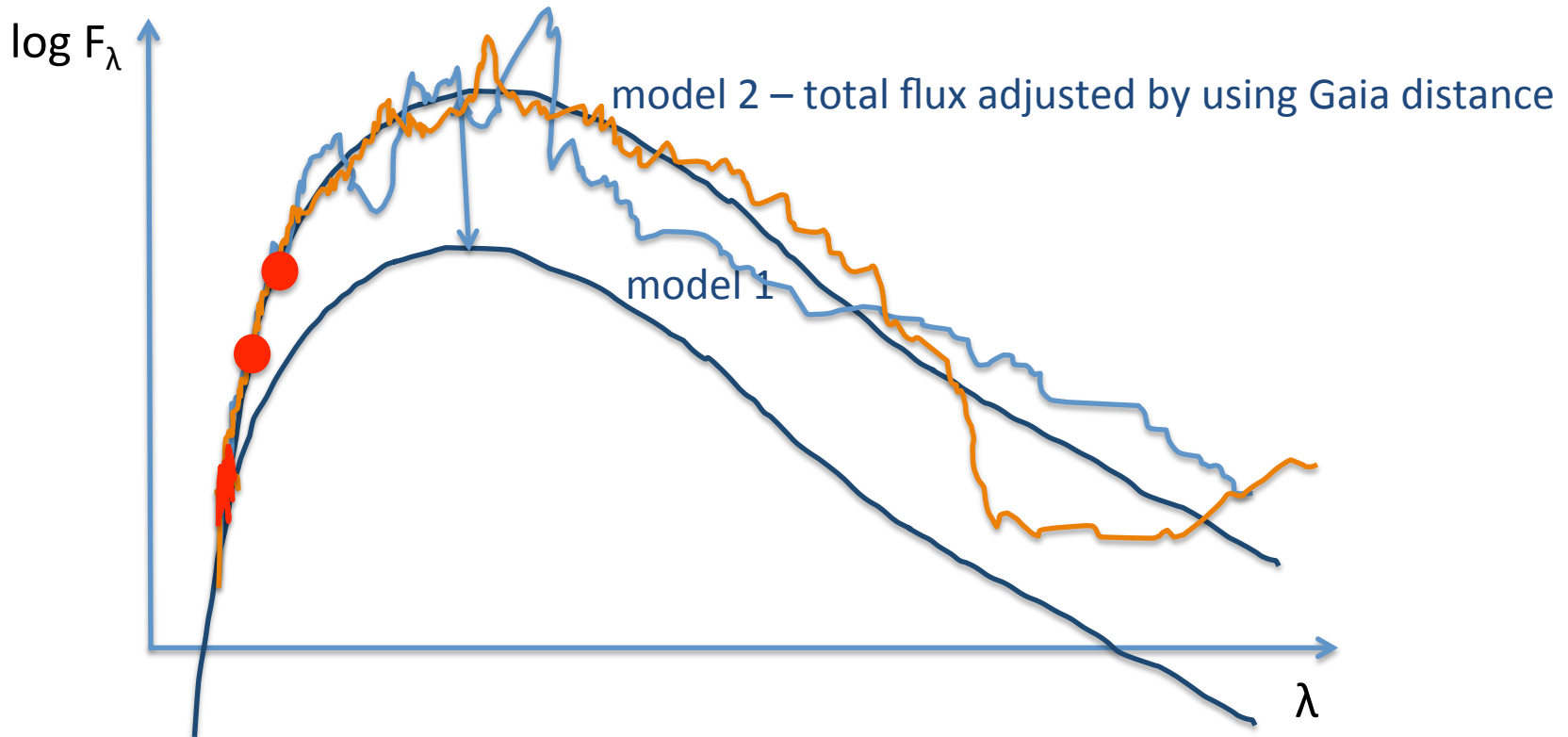model 2 – total flux adjusted by using Gaia distance

model 1

λ

Gaia observes

- Parallaxes / distance
- 2 optical photometric fluxes
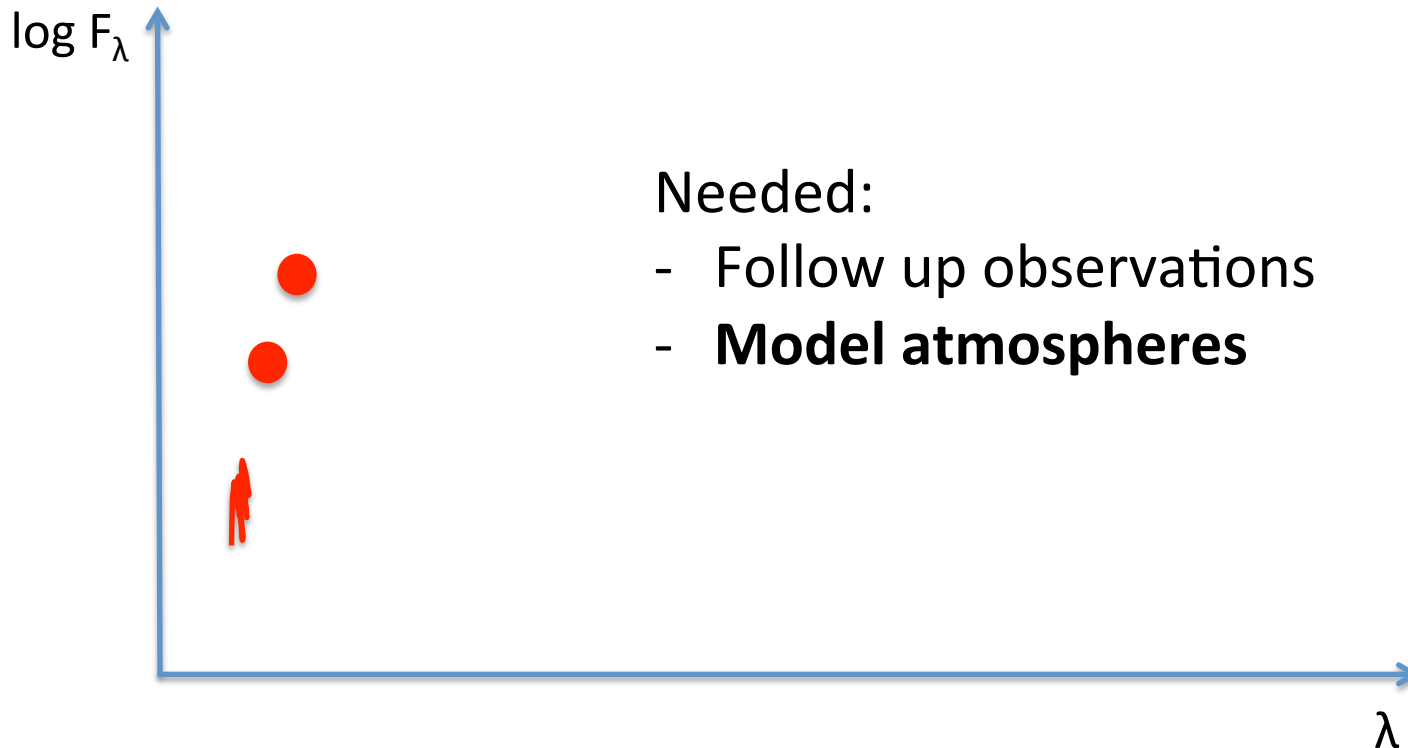- UV high resolution spectrum (narrow wavelength interval)

log F_λ

Needed:
- Follow up observations
- **Model atmospheres**

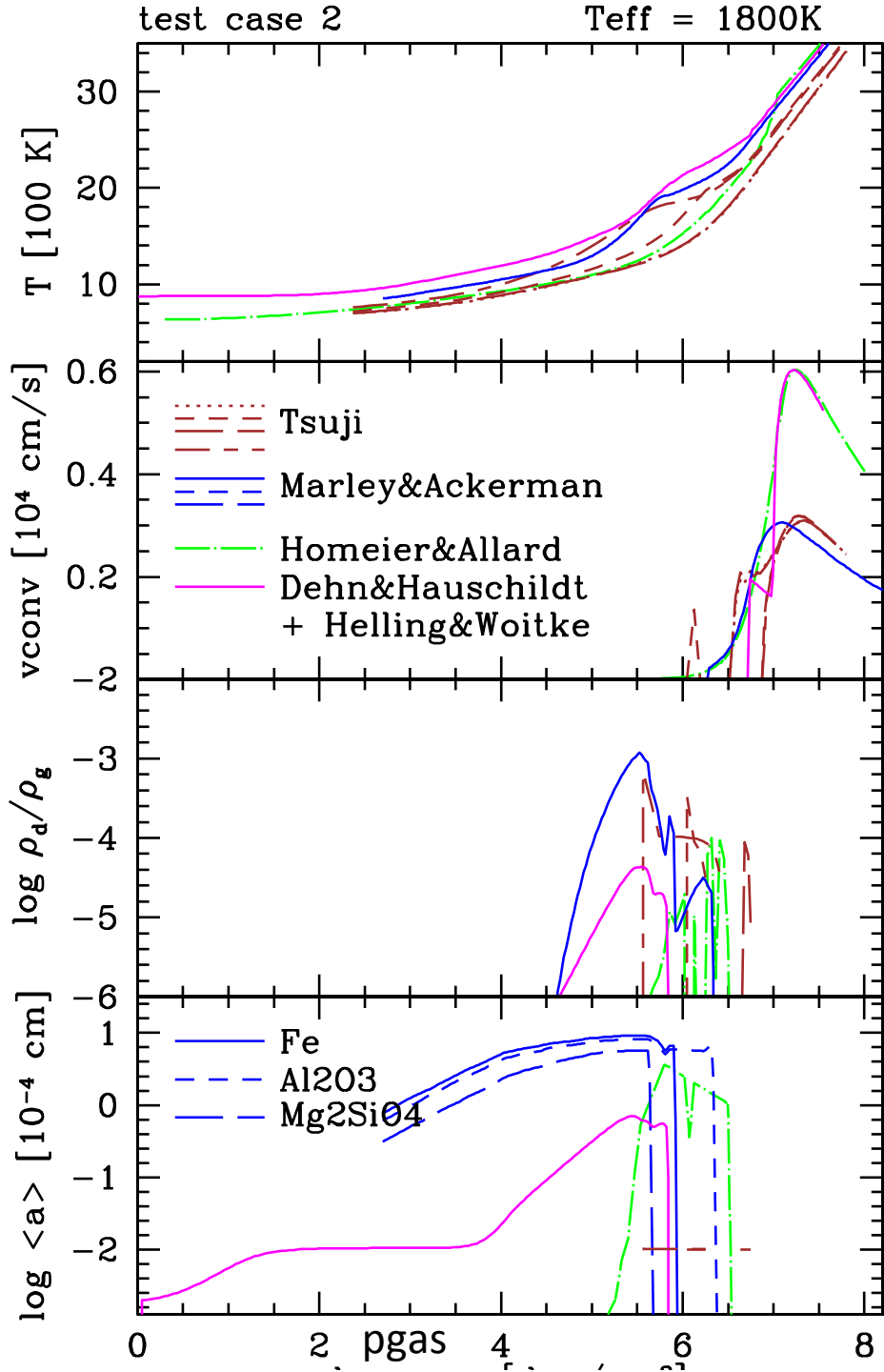λ

Model atmosphere

Aim: consistently describe physical and chemical processes in an atmosphere for a given minimum set of global parameter

Global parameter: effective temperature Teff [K] (total flux)
  surface gravity log(g)
  (radius or mass)
  element abundances

Physical principles: energy conservation (radiative and convective energy transport)
  $\rightarrow$ Tgas , F_λ, v_conv
  hydrostatic equilibrium $\rightarrow$ pgas
  chemical equilibrium $\rightarrow$ number density of gas-phase species
    (opacity sources and cloud formation)

  ++ cloud formation model ($\rightarrow$ opacity source & element sink)
    $\rightarrow$ cloud particle sizes, material composition, number of particles …

test case 2   Teff = 1800K

T [100 K]

vconv [10⁴ cm/s]

Tsuji

Marley&Ackerman

Homeier&Allard
Dehn&Hauschildt
+ Helling&Woitke

log ρ_d/ρ_g

log ⟨a⟩ [10⁻⁴ cm]

Fe
Al2O3
Mg2SiO4

pgas

(Tgas, pgas) profiles

v_conv, convective velocities

dust-to-gas rations
(= How much dust is
   in the atmosphere?)

mean grain sizes of cloud particles

(Helling, Ackerman, Allard, Dehn, Hauschildt, Homeier,
Lodders, Marley, Rietmeijer, Tsuji & Woitke 2008, MNRAS 391)

i frutti di gaia
nature bar

DELIVERY | TAKE AWAY