Far-infrared and dust properties of present-day galaxies in the EAGLE simulations

Peter Camps

Astronomical Observatory
Ghent University, Belgium

GHENT
UNIVERSITY

Introduction

Far-infrared and dust properties of
present-day galaxies in the EAGLE simulations
   Peter Camps, James Trayford, Maarten Baes, Tom Theuns, et al.
   MNRAS 2016, 462, 1057–1075

- Create mock observations of galaxies simulated in a cosmological setting, including the effects of dust

- Compare infrared/submm results to observed galaxies to constrain the parameters in the model

EAGLE

Schaye et al. 2015

Cosmological simulation(s)

100 Mpc box

7 billion particles

Dark matter
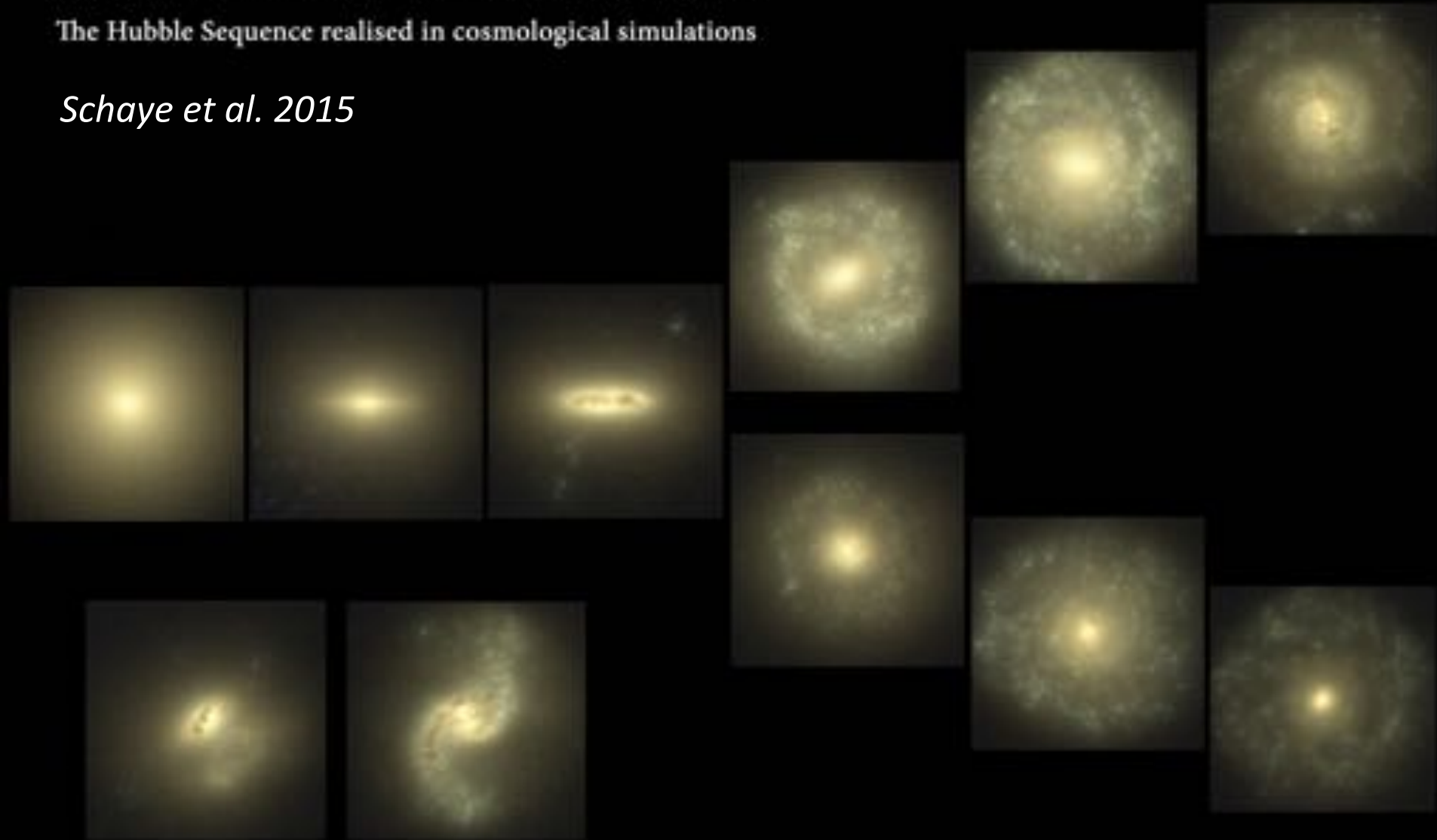
Baryons

Star formation & feedback

Calibrated to reproduce present-day
galaxy stellar mass function

The Eagle Simulations

EVOLUTION AND ASSEMBLY OF GALAXIES AND THEIR ENVIRONMENTS

The Hubble Sequence realised in cosmological simulations
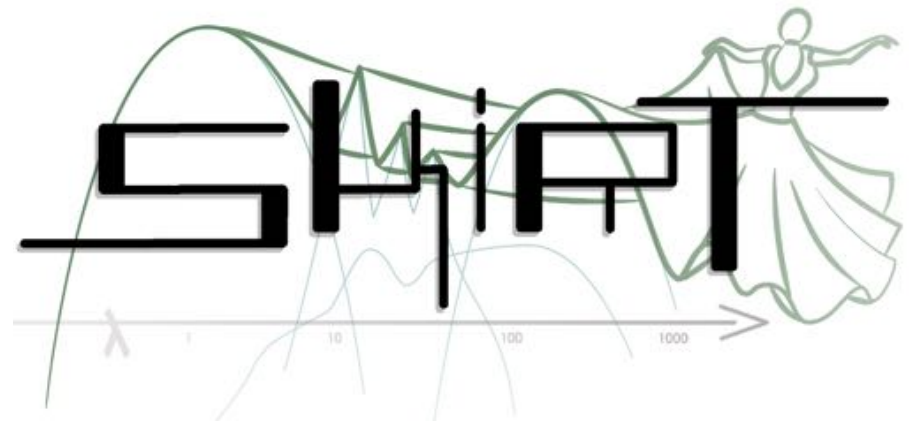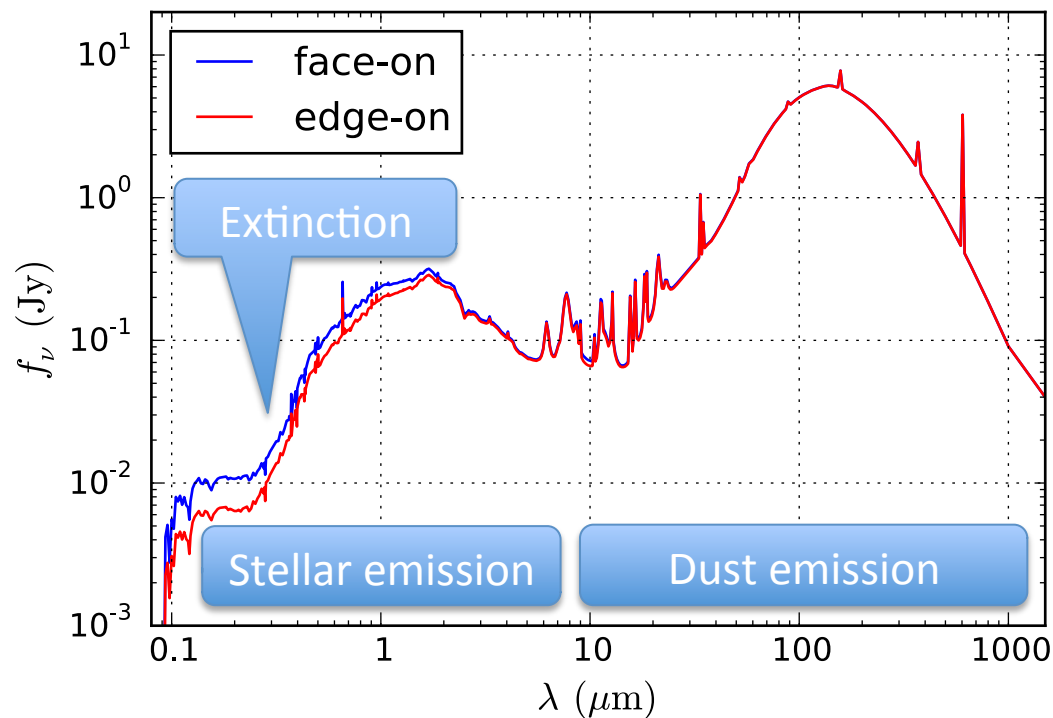
Schaye et al. 2015

SKIRT

*Baes et al. 2003, 2011*
Camps & Baes 2015

www.skirt.ugent.be

3D dust continuum Monte Carlo radiative transfer

Extinction

Stellar emission

Dust emission

face-on
edge-on

f_ν (Jy)

λ (μm)

Define geometry and properties of sources (stars) and sinks (dust)

Construct images and SEDs, taking into account scattering, absorption and NLTE emission by dust
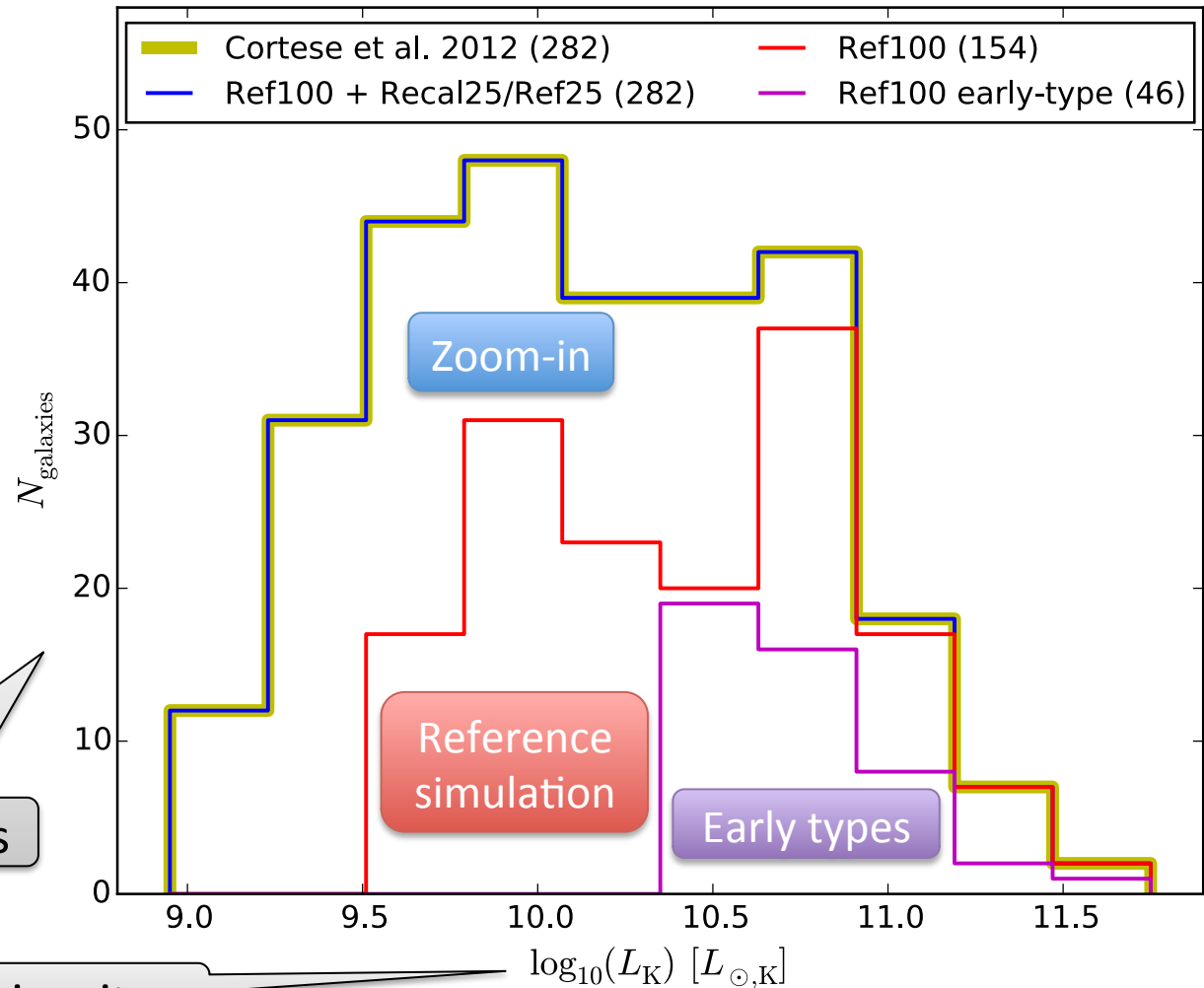
Constructing mock observations
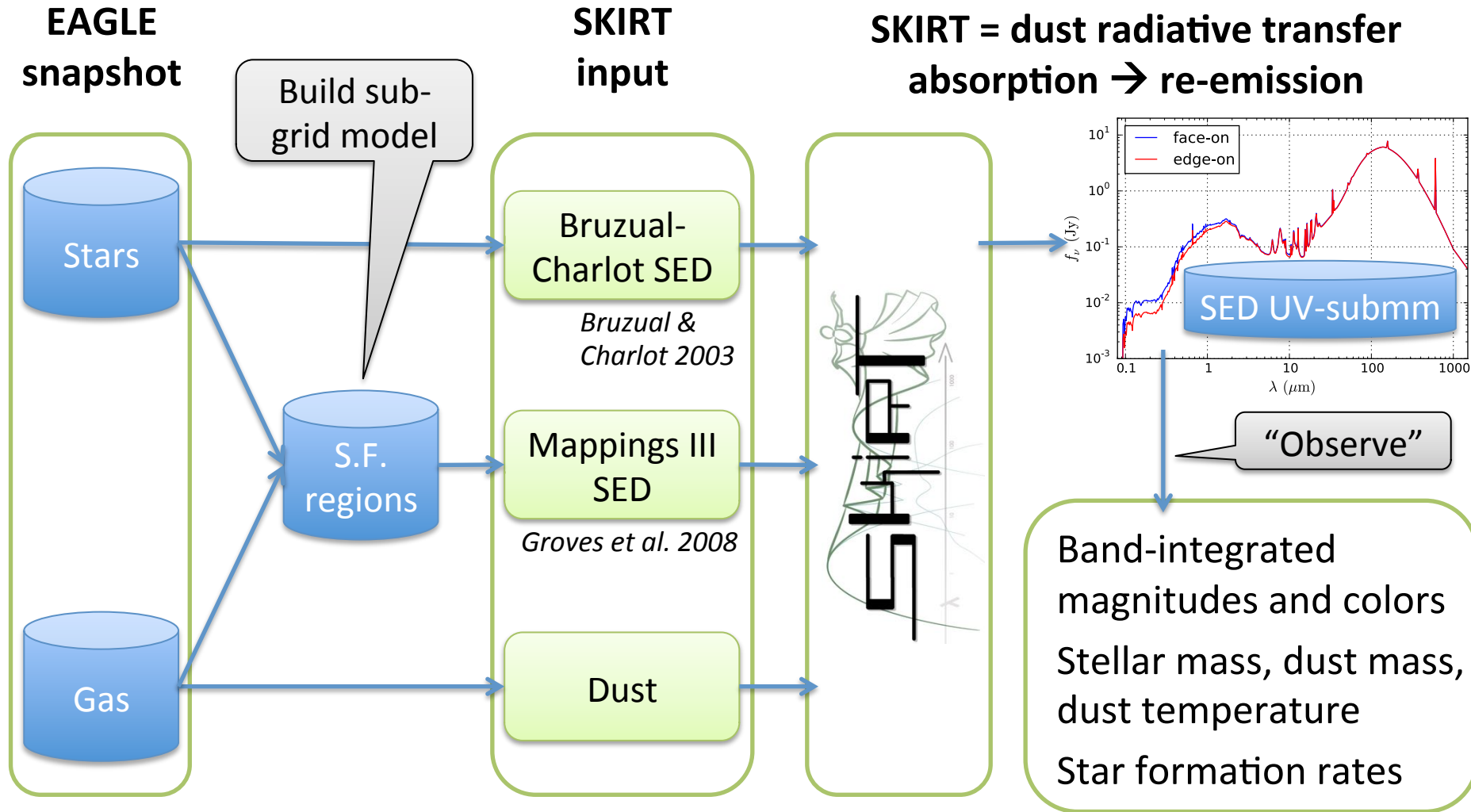
EAGLE galaxy set matching HRS sample

Match 282 galaxies in *Herschel* Reference Survey (HRS) sub-sample

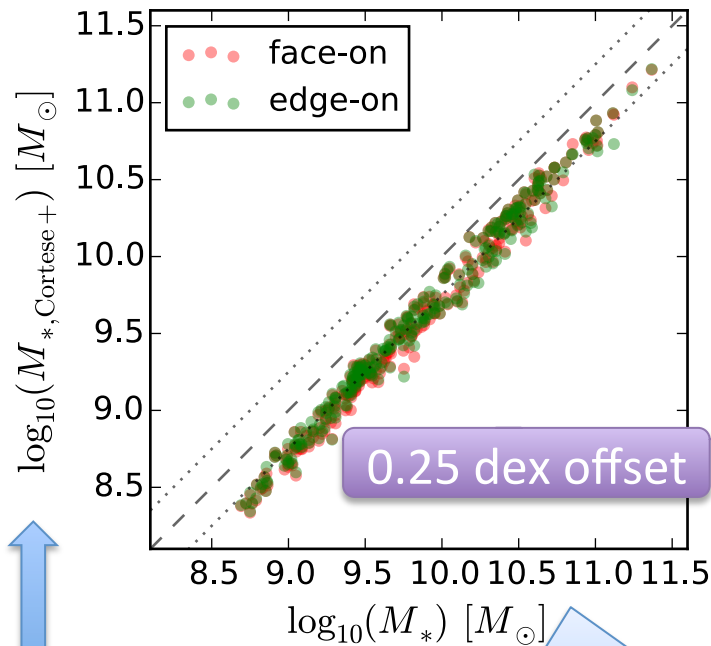*Boselli et al. 2010,2012*
Cortese et al. 2012

- *K*-band luminosity
- Late vs. early types

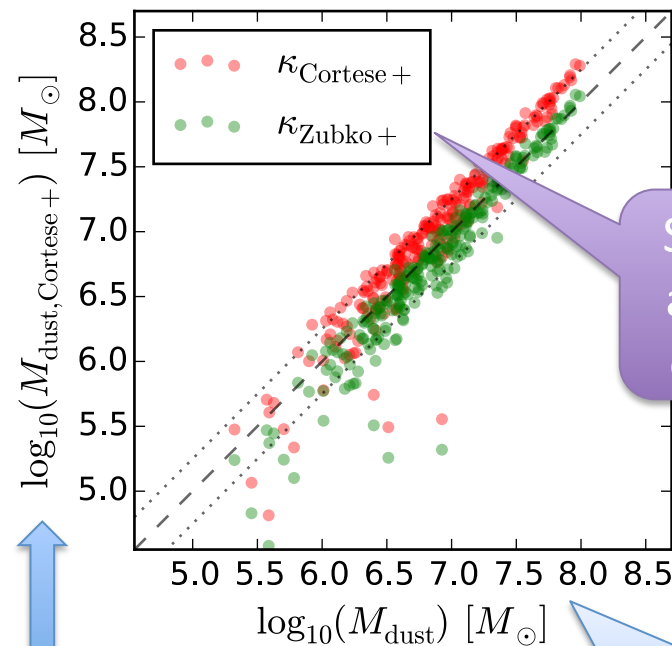Number of galaxies

K-band luminosity

Inferred stellar and dust mass

0.25 dex offset

Scales with absorption coefficient
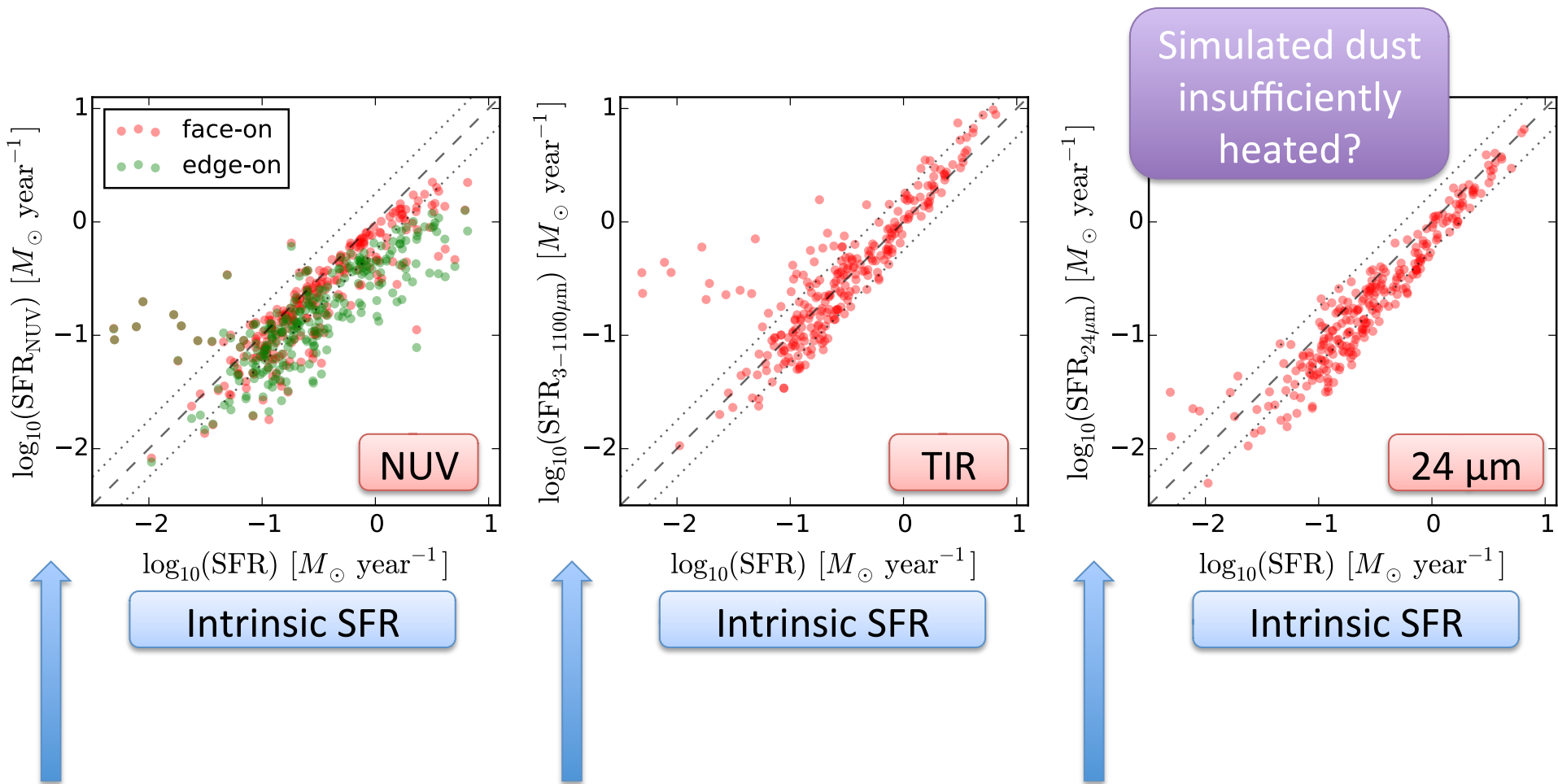
Intrinsic stellar mass

Intrinsic dust mass

Stellar mass from mock observations of optical (*g* and *i* band) fluxes, mimicking the procedure of *Cortese et al. 2012* (or *Zibetti et al. 2009*)

Dust mass from mock observations of far-infrared/submm fluxes (150/250/500 μm) mimicking the procedure of *Cortese et al. 2012*
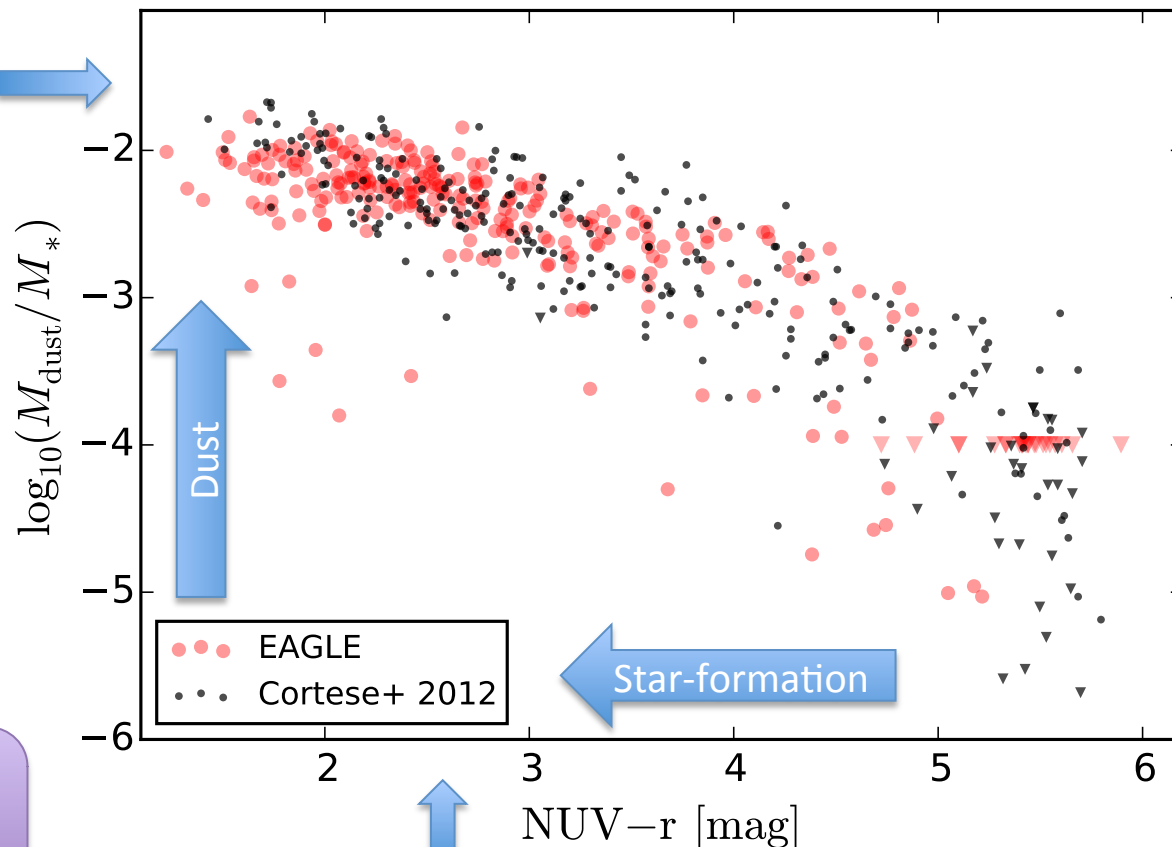
Inferred star-formation-rate indicators

Star-formation rate from mock observations, mimicking the calibrations listed in *Kennicutt & Evans 2012* in three different wavelength ranges

Dust scaling relation

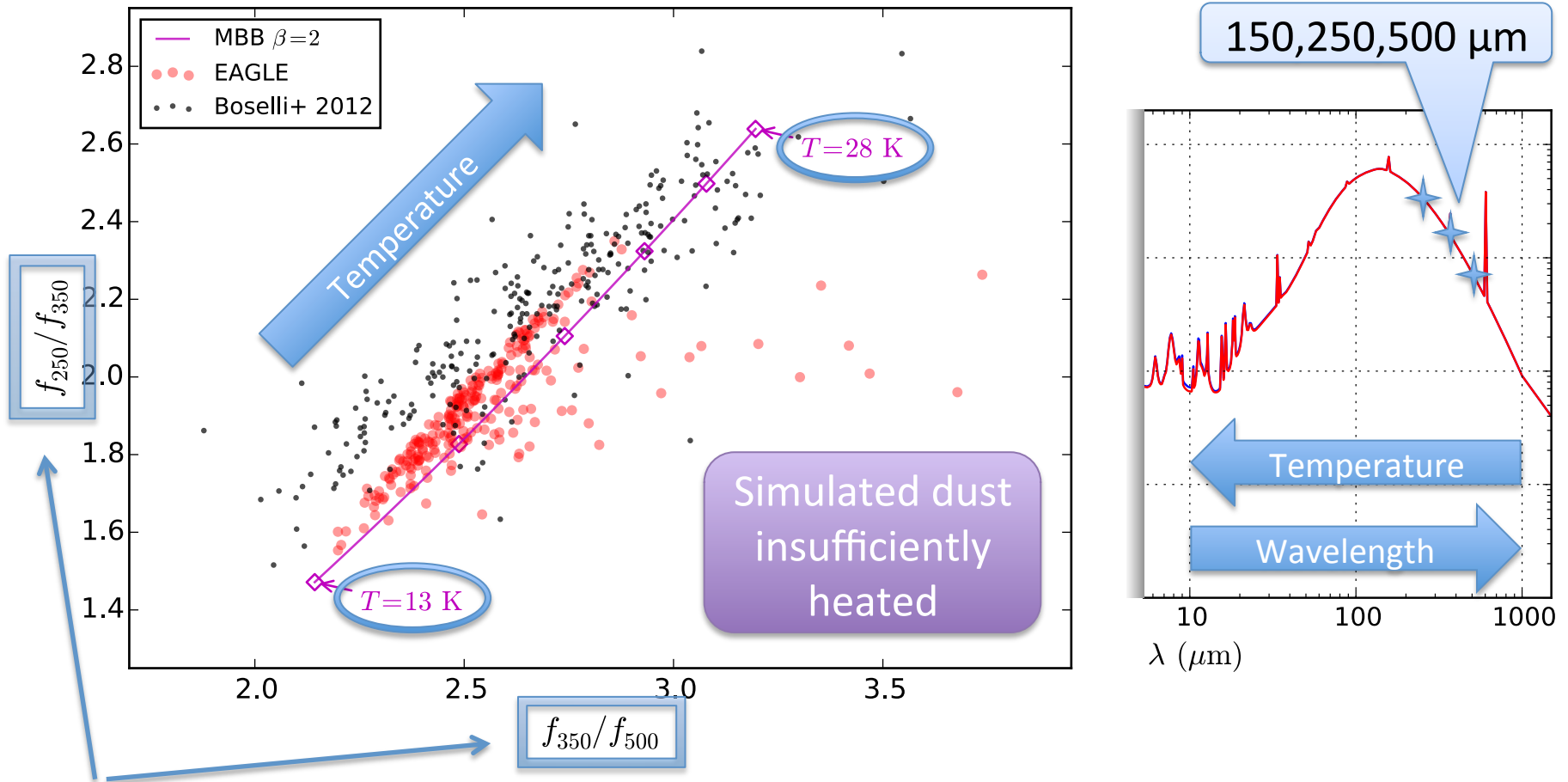Mock EAGLE results (red) versus observations (black) – (*Cortese et al. 2012*)

Dust-to-stellar mass ratio, derived from mock EAGLE fluxes mimicking the observational procedure of *Cortese et al. 2012*

Observations are reproduced well, including the turn-off

NUV-r colour, often used as an indicator for specific star-formation rate (sSFR)

Submm colour-colour relation

Mock EAGLE submm flux ratios (red) compared to observations (black) – (*Boselli et al. 2012*)

Conclusions

- Mock UV-submm observations (including effects of dust) of galaxies in the cosmological EAGLE simulation reproduce HRS observations reasonably well

- Body of dust is insufficiently heated, most likely because of identified limitations in the employed sub-grid models

Questions?

Peter Camps
peter.camps@ugent.be
Astronomical Observatory
Ghent University, Belgium

GHENT
UNIVERSITY