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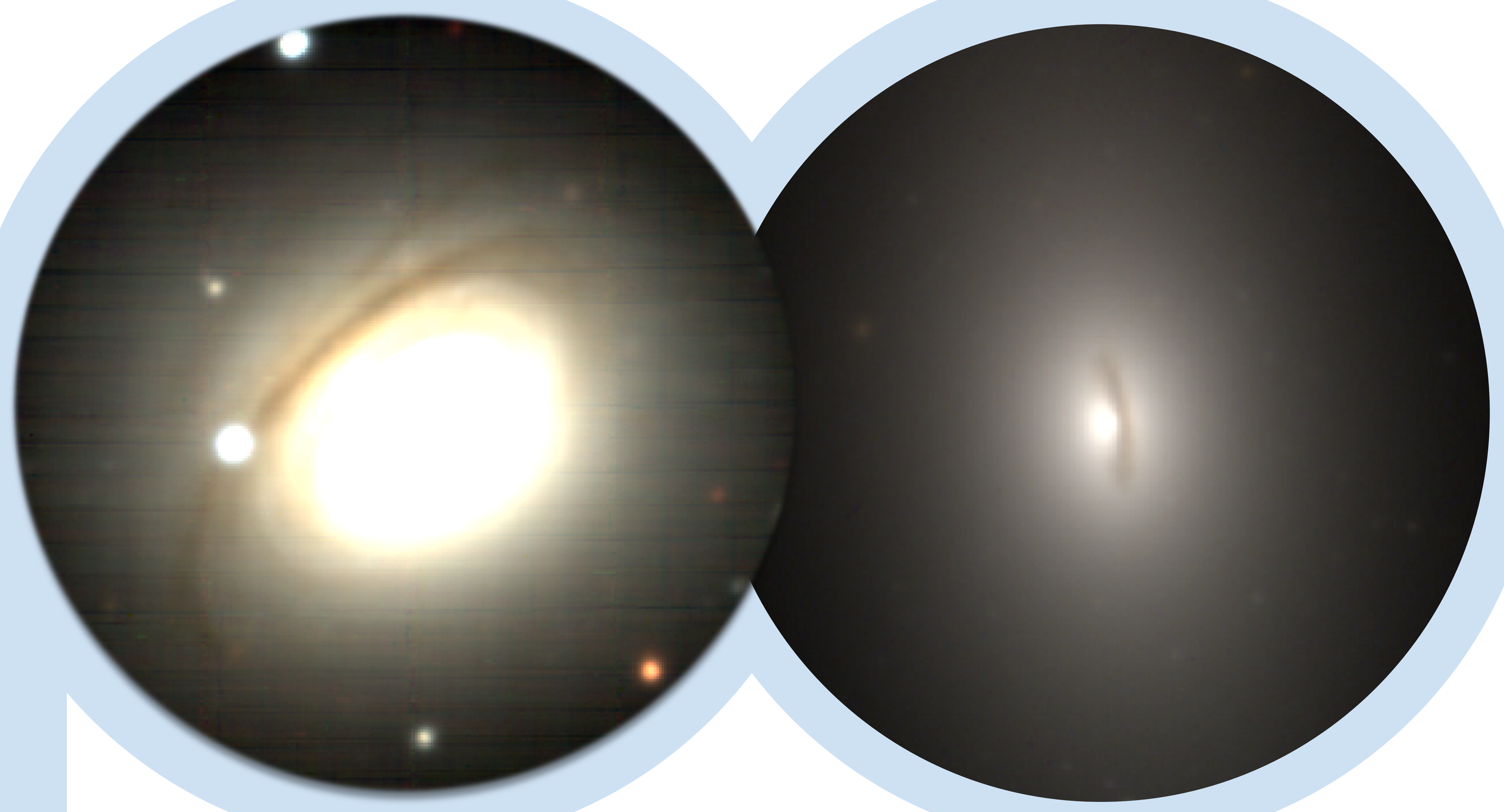
Opening new horizons

Spatially and spectrally resolving attenuation

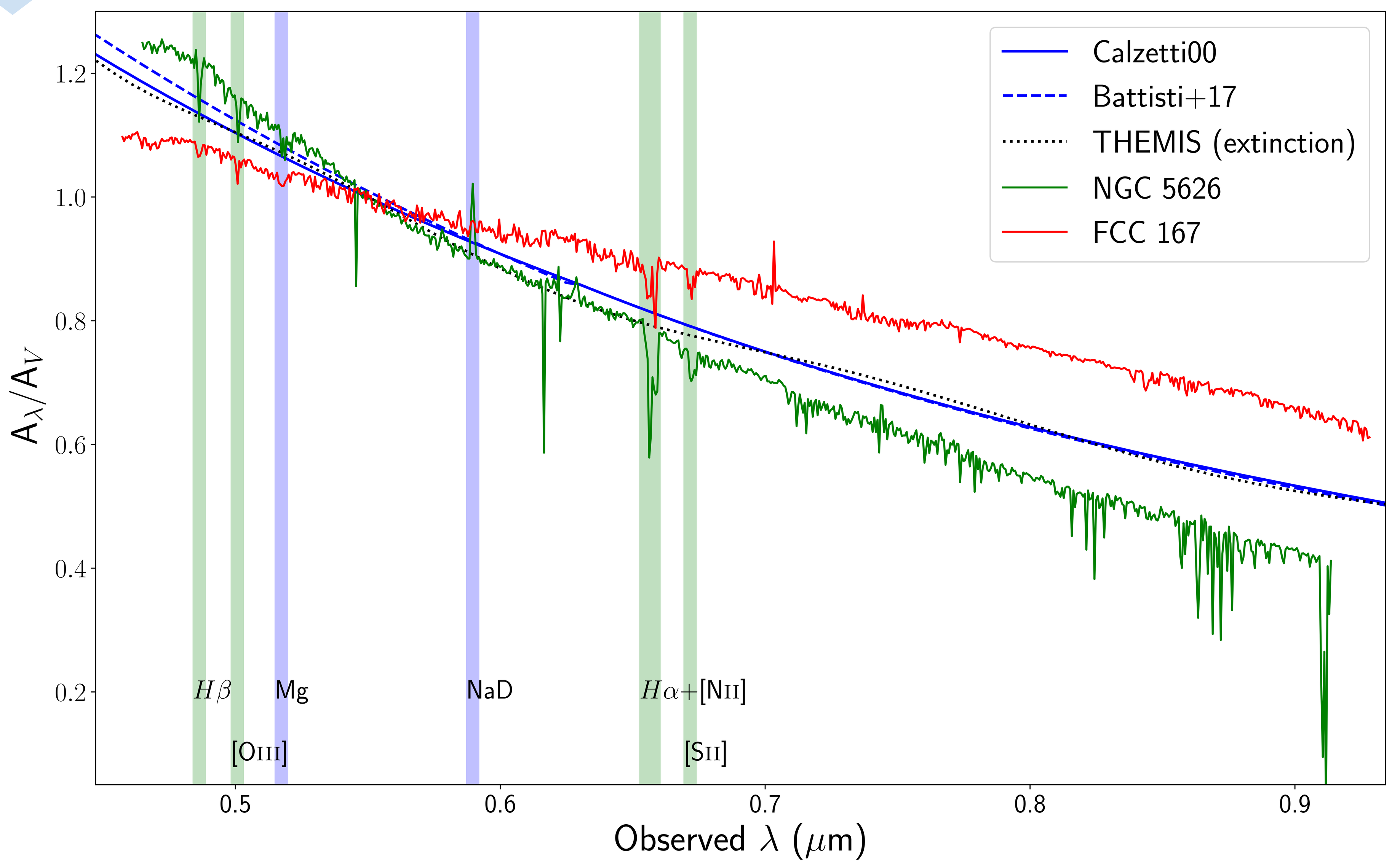
A MUSE view of dust lane early-type galaxies



NGC 5626: large-scale dust lane   FCC 167: nuclear dust lane

- A small fraction of spheroidal galaxies (**4%**) host prominent dust lanes. They are thought to be a remnant of gas-rich minor mergers [2].
- On the one hand, they should be **short lived** as dust doesn't survive long in the harsh environment of massive galaxies. On the other hand, the smooth and regular shape of the dust lane(s) indicates a rather **stable** (or self-shielding?) structure.
- We use MUSE integral-field spectroscopy to **measure and model** the attenuation in two dust-lane ETGs.

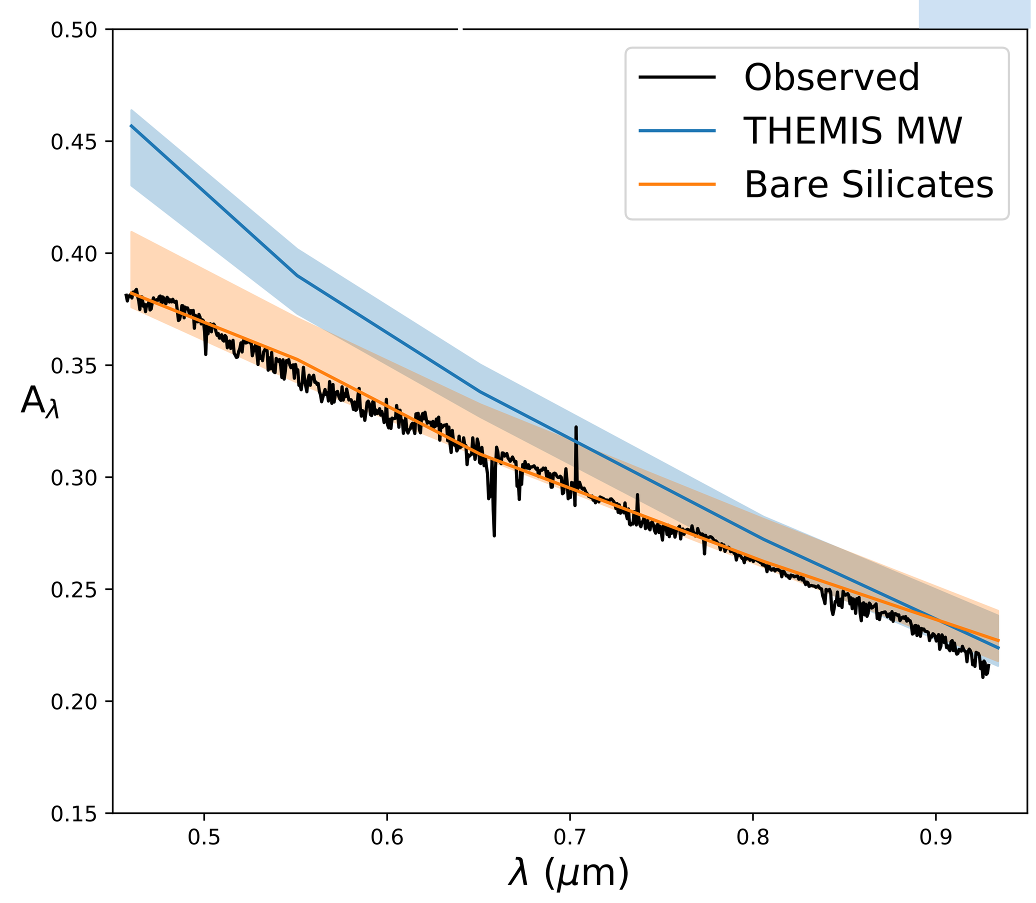
Dust-free models to empirically derive attenuation



At each wavelength slice (Δλ = 6.25 Å), we mask the dust lane and fit a surface brightness model to the remaining pixels [3]. The resulting dust-free model is subtracted from the observation to obtain an attenuation map. We thus spatially and spectrally map the attenuation in the dust lanes. The above figure shows a much steeper curve for NGC 5626, and a flatter one for FCC 167. Both attenuation curves hold several smaller features related to emission and absorption lines, and maybe the intrinsic dust mix.

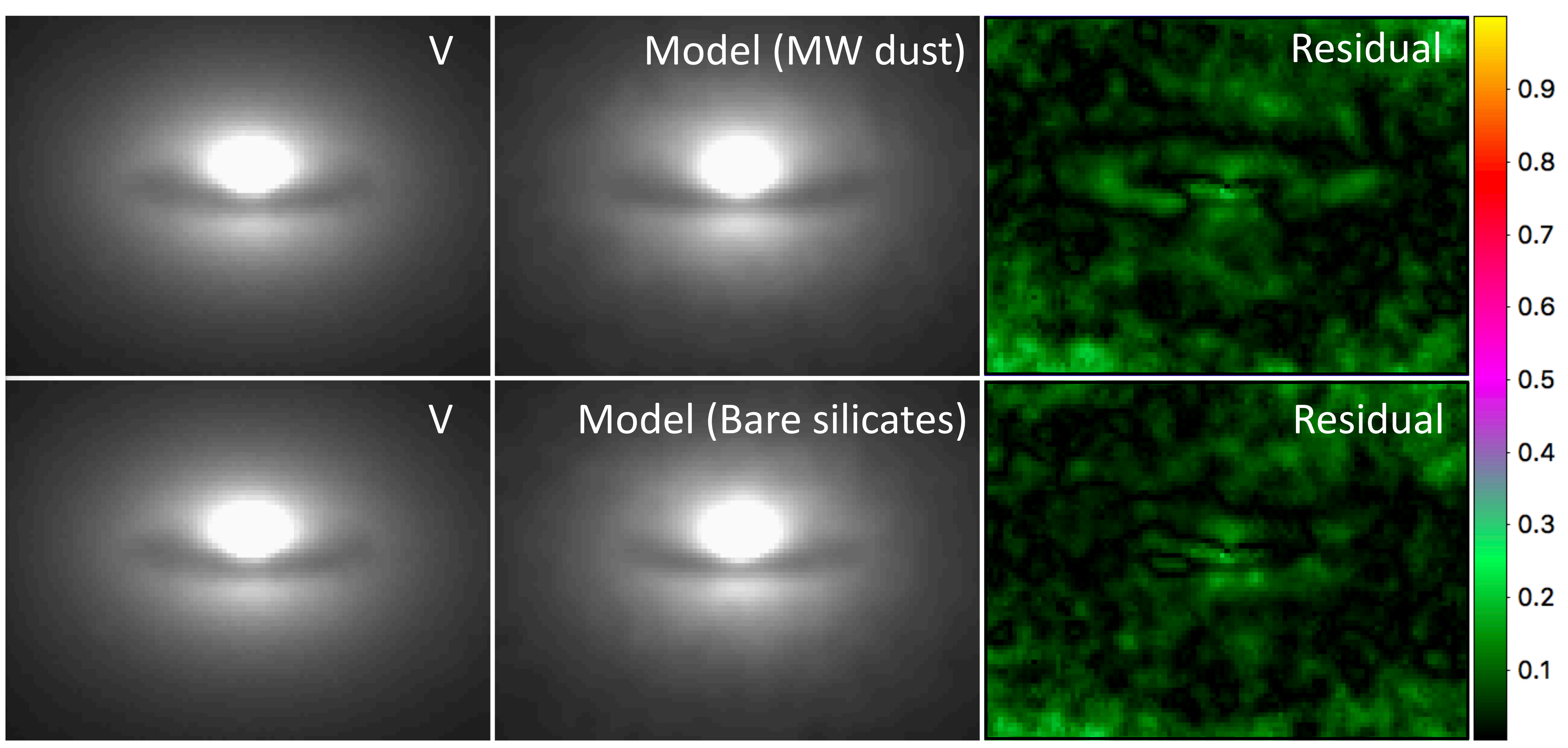
READ THIS (results)

- ✦ Produced first spectral-resolution attenuation curves of galaxies and spatially resolve them.
- ✦ Radiative transfer simulations break the degeneracy between intrinsic dust mix and star-dust geometry.
- ✦ A dust mix without small grains works much better in FCC 167. This implies significant dust processing of the nuclear dust ring, including hot gas sputtering.



Our radiative transfer models solve for the 3D star-dust geometry, and include the effects of scattering. We can finally break the degeneracy between intrinsic dust mix and geometry that both influence the observed attenuation curve. We find that FCC 167 doesn't contain Milky Way-type dust and the bare silicate dust mix (with no small grains) matches the observed attenuation much better.

3D radiative transfer fitting to find the intrinsic dust mix



We perform a series of radiative transfer simulations to fit the observed images of FCC 167. A dust ring geometry was adopted, with free dimensions and dust mass. Two different dust grain size distributions were used. The top row shows the V band observation, model, and residual for a Milky Way dust mix (THEMIS [4]). The bottom row shows the best fit for a dust mix without any small grains, and with the silicate grains stripped of their mantles. Both models perform very well, with only small residuals and a slight preference for the bare silicate dust mix.

References
[1] Sarzi et al. 2018
[2] Kaviraj et al. 2012
[3] Viaene et al. 2017b
[4] Jones et al. 2017