Large-scale ordered motion in a z=3.24 galaxy core

We present a study of the spatially resolved strong [OIII]λ5007 line emission from the z=3.24 gravitational arc behind the cluster 1E0657-56, based on 190 minutes of SPIFFI K band data. Detailed modelling of the lensing potential suggests that the galaxy center is seen in the arc core, whereas the arc consists of multiple images of peripheral regions of the same source (Mehlert et al. 2001).
Between the arc and the core, we find a velocity offset of $\sim$200 kms^{-1}, similar to rotation velocities of present-day massive galaxies. With a magnification factor M $\sim$20, we estimate a mass of $\sim 10^9$ M$_\odot$ within the inner kiloparsec. **This provides one of the most robust observations of small-scale ordered gravitational motion in the core of a high redshift galaxy and suggests that at least some galactic cores were already assembled by z$\sim$3.**

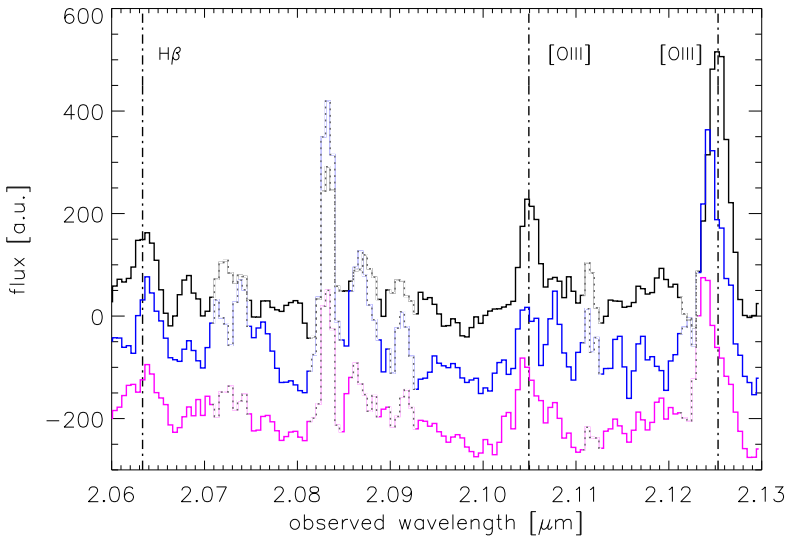

Fig. 1: Integrated spectra of the boxes in Fig. 2. Spectra of the arc core, box 'arc 1' and the sum of boxes 'arc 2' to 'arc 4' are shown in black, blue, and purple, respectively. The arc spectra were shifted and scaled by arbitrary amounts. Dotted gray lines indicate strong night sky line residuals.
The large [OIII]/Hβ ratio indicates a low metallicity, similar to those of z$\sim$3 Lyman Break Galaxies (Pettini et al., 2001). Narrow widths and uniform line ratios in distinct regions disfavor strong AGN contribution. Velocities relative to the core are 117$\pm$19 kms^{-1} (arc 1) and 213$\pm$18 kms^{-1} (arc 2-4). In the arc, [OIII] is blueshifted relative to Hβ by $\sim$250 kms^{-1}, hinting star-formation triggered outflows.

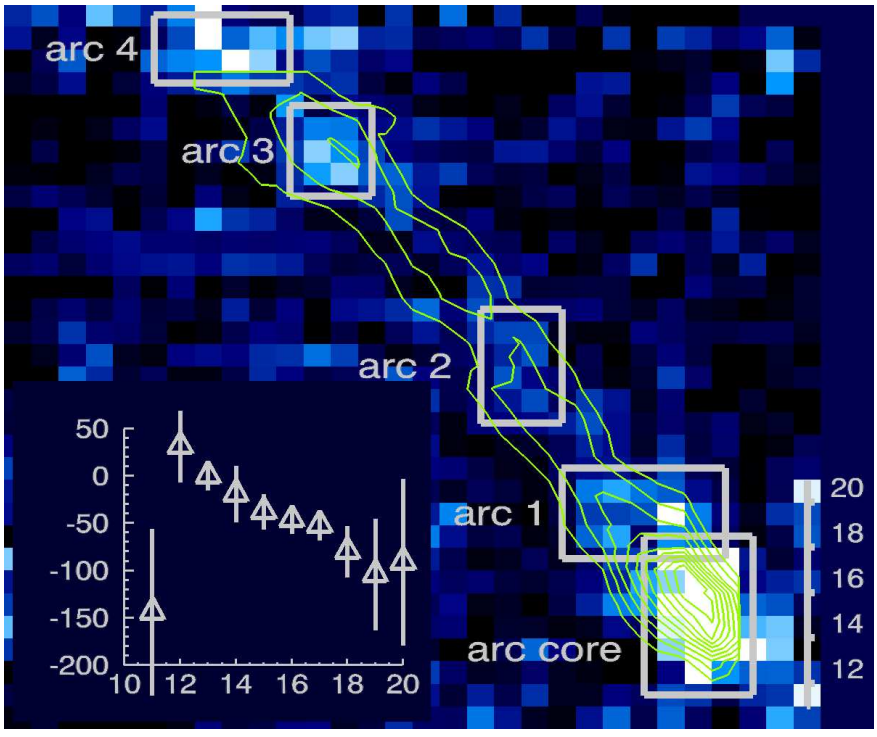

Fig. 2: Continuum-subtracted, combined [OIII]λ4959,5007 line image of the strongly lensed galaxy in the FORS deep field. The boxes indicate the areas from which the spectra in Fig. 1 were extracted. Contours show the rest-frame UV flux measured with FORS 1.
The inset shows the relative velocities in North-South direction, obtained from the integrated arc core emission in each slitlet. They indicate ordered motion extending over $\sim$3 seeing disks. The location (in pixels) is given on the abscissa. The vertical axis to the right of the arc core shows the origin of each data point in the image. Velocities are given in kms^{-1}, the reference velocity is chosen arbitrarily.

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