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Gas-phase metallicity for the Seyfert galaxy NGC 7130

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В чем суть работы

- В обычных HII областях понятно как мерить металличность (прямой метод, метод сильных линий и др)
- В AGN все сложнее. Прямой метод точно не работает (Dors+, 2015 <https://arxiv.org/pdf/1508.07802>). Для метода сильных линий есть калибровки
- Но оценки металличности есть не для многих галактик с AGN, поэтому работы с такими оценками интересны (как с точки зрения методов, так и с точки зрения результатов)
- Особенно важно не абсолютное значение металличности, а распределение по радиусу (есть ли градиент, и какой)

Обычно градиент металличности в галактиках отрицательный, что согласуется со сценарием формирования галактик inside-out. Но положительный тоже встречается

“for the first time, we have studied, separately, the metallicity gradients in the disc and the low- and high-velocity dispersion components of NGC 7130 by using the multi-component fits of the emission lines”

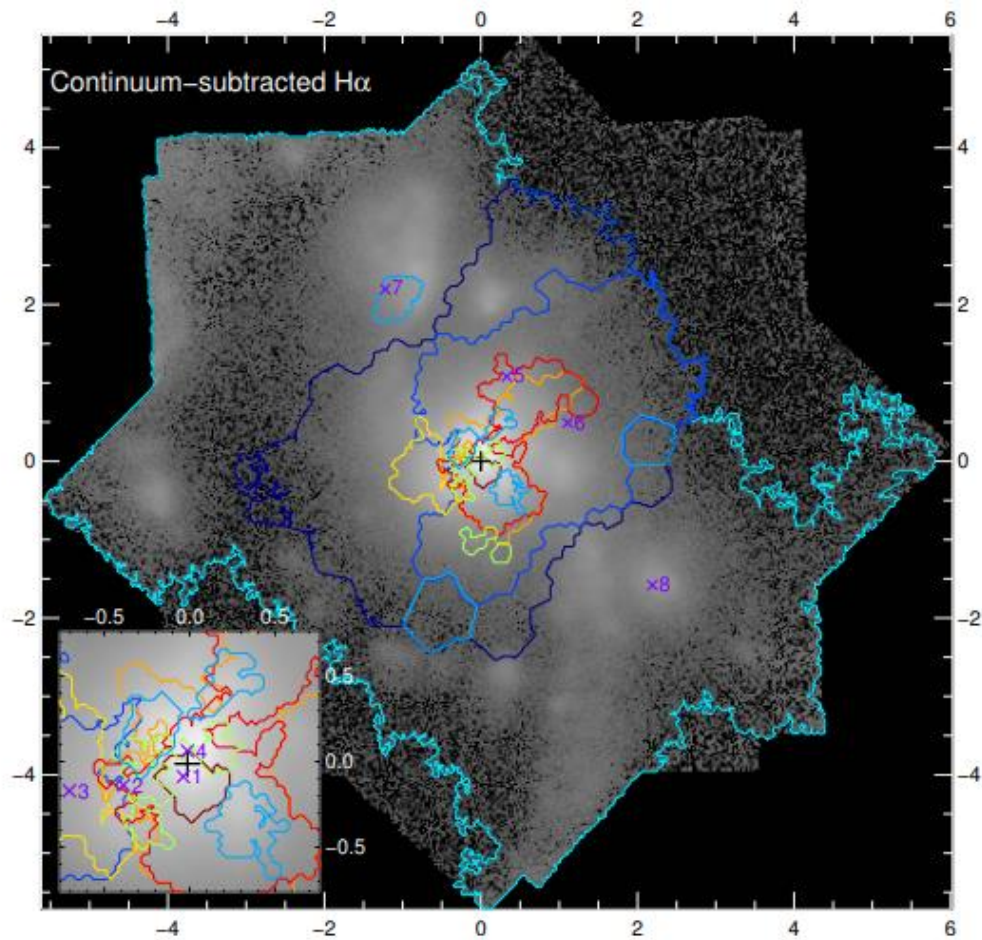


Fig. 6. Outlines of the nine kinematic components shown in Fig. 5 overlaid on the continuum-subtracted $H\alpha$ image from Fig. 1. The contours are colour-coded according to the labels identifying each component in Fig. 5. To ease the readability of the figure, we omitted holes within components and regions smaller than $N = 50$ spaxels disconnected from the main body of the component. The purple x symbols and numbers indicate the bins whose spectra are discussed in Appendix A. Those corresponding to bins in the inner $1''.5 \times 1''.5$ are indicated only in the inset to avoid clutter.

Спектры сложные, их декомпозировали в предыдущей работе. Получены с помощью **laser guide star adaptive optics mode for MUSE at the VLT**. Для многокомпонентного фиттинга использовали GandALF software

Один из спектров как пример

S. Comerón et al.: The complex multi-component outflow of the Seyfert galaxy NGC 7130

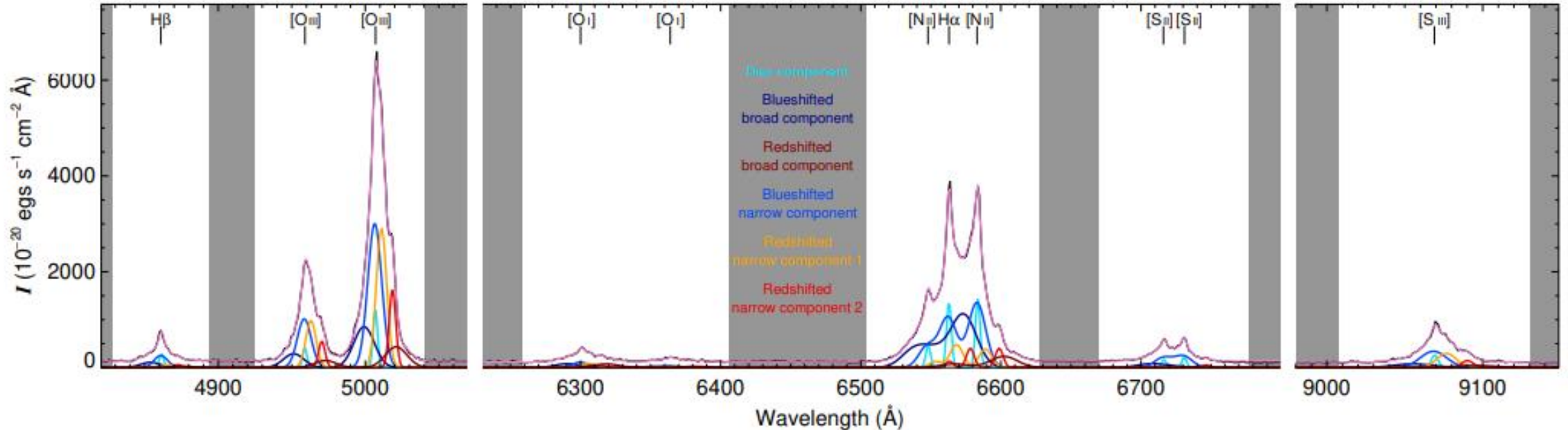


Fig. A.1. Spectrum of Voronoi bin discussed as Example 1 in Appendix A, and indicated by a number ‘1’ in Fig 6. The black line describes the spectrum and the almost coincident purple line describes the fit. The contribution of the six components in this fit are indicated by curves, colour-coded as in Figs. 5 and 6. The shaded areas were masked away while using pyGandALF. The wavelengths are displayed at the rest frame of $z = 0.016151$.

Еще несколько картинок для понимания геометрии

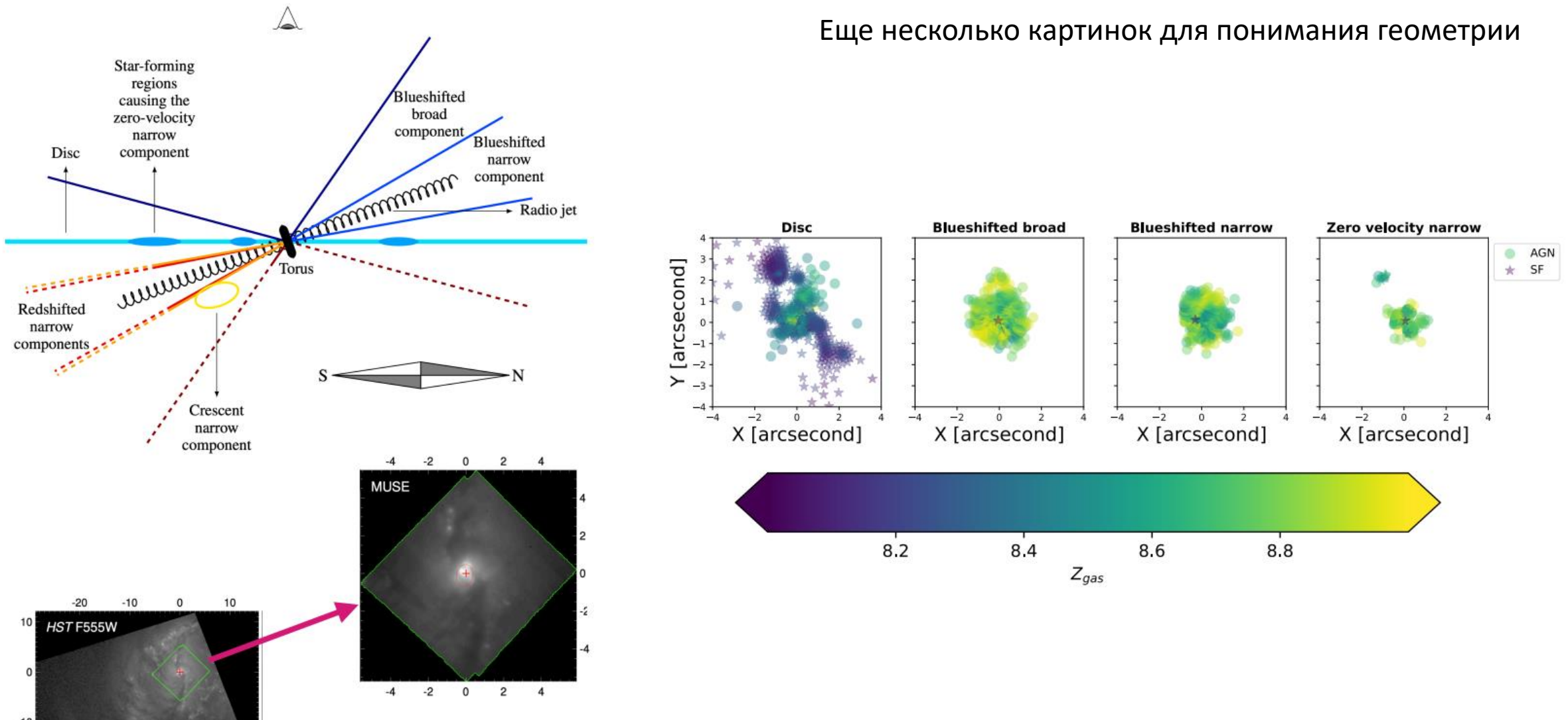


Fig. 3. *Hubble* Space Telescope F555W image of the central region of NGC 7130 superimposed on the MUSE-Narrow Field Mode(NFM) coverage area and the MUSE data cube integrated along the spectral direction (lower-left panel). The top-left panel illustrates the ionised circumnuclear gas in NGC 7130 using the toy model from Comerón et al. (2021). The right panel displays the spatial (X, Y) distribution of bins for four of the nine components in NGC 7130. The circles mark the AGNs determined based on the BPT classification, and stars mark SF regions. The coordinates are given in arcseconds in each panel, and the colour bar is for the Z_{gas} .

Методы оценки металличности

- Метод сильных линий, основанный на линиях [O iii] λ 5007, [N ii] λ 6584, H α , H β , [S ii] λ 6716 and [S ii] λ 6716.
- Для регионов, ионизованных SF, использовалась калибровка из Curty et al., 2017
- Для регионов, ионизованных AGN брали калибровку из Storchi-Bergmann et al., 1998
- The metallicity value should be corrected in order to take into account electron density (Ne) effects – брали из Comeron et al., 2021

BPT диаграммы для компонент. Вклад от SF наблюдается только в диске

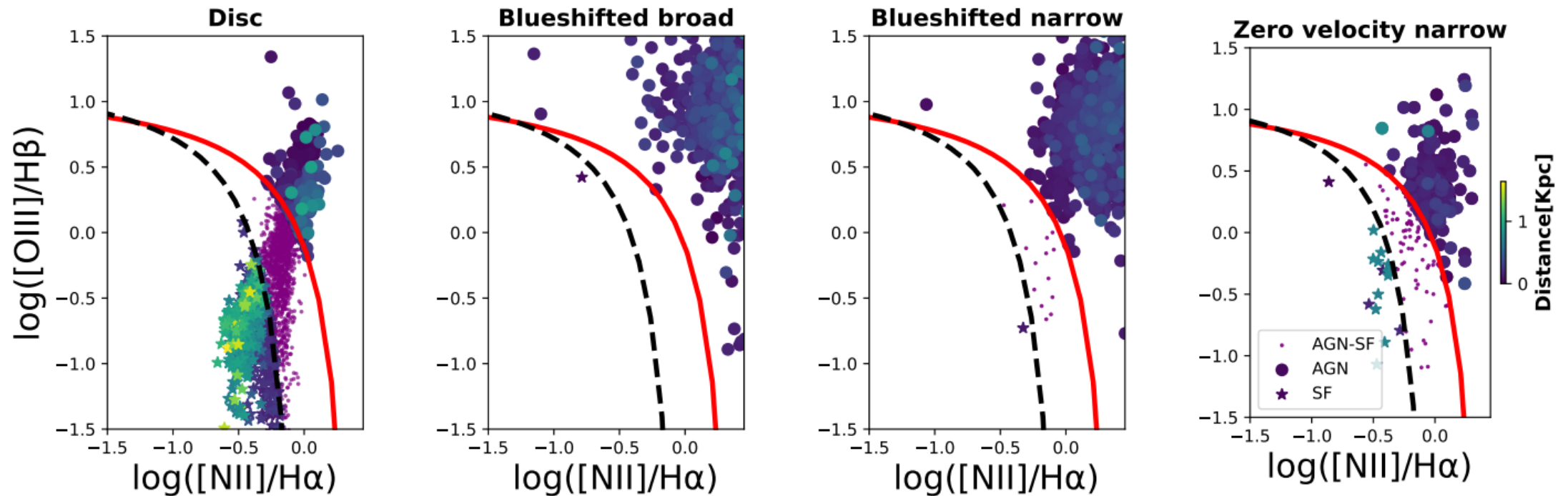


Fig. 1. BPT diagnostic diagram to discriminate between SF- and AGN-ionised regions. The dashed black line and the solid red line show the separations between the two populations according to the boundaries from [Kewley et al. \(2001\)](#) and [Kauffmann et al. \(2003\)](#), respectively. Circles and blue stars mark AGN- and SF-dominated regions, respectively. Plots are colour-coded according to how far bins are from the centre. We have not investigated the regions located between the two lines (purple circles).

Металличность по компонентам

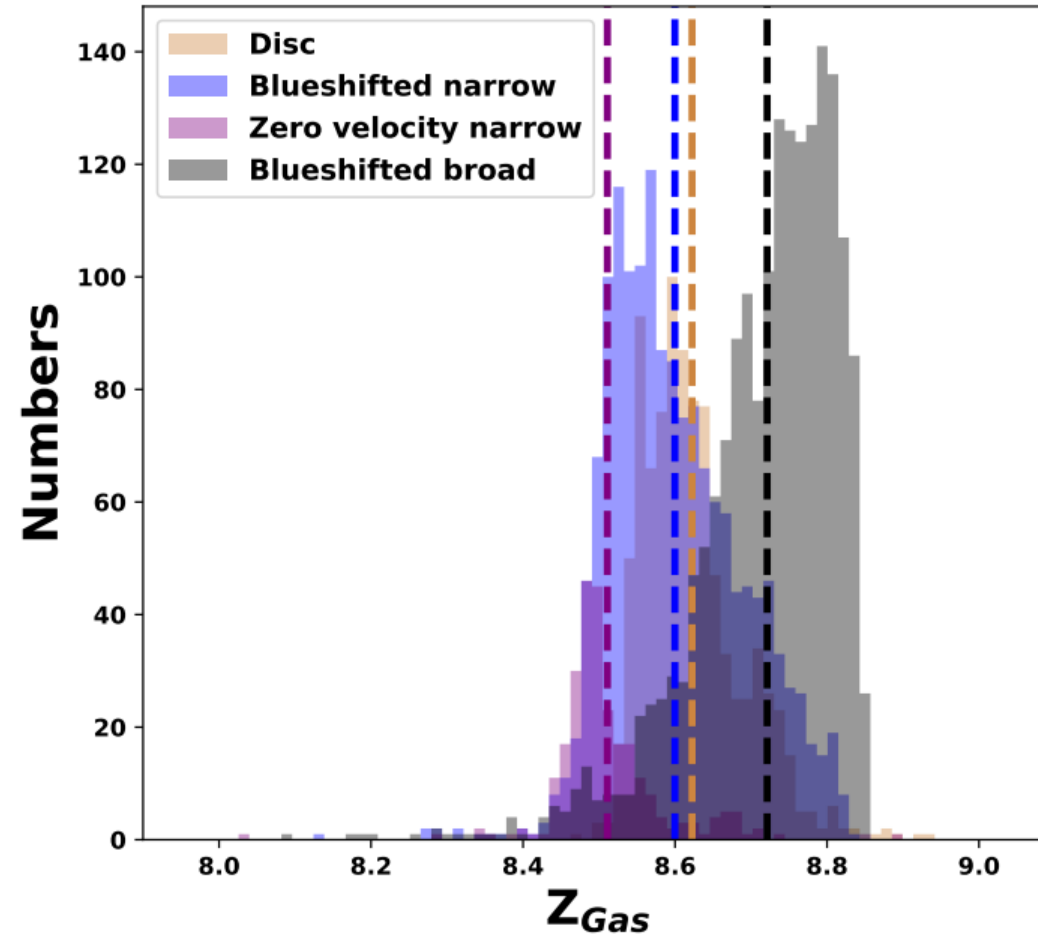


Fig. 2. Distribution of Z_{gas} for the four components described Sect. 2. The vertical dashed lines show the median value of Z_{gas} for each of the components.

Результаты: градиент металличности **положительный**

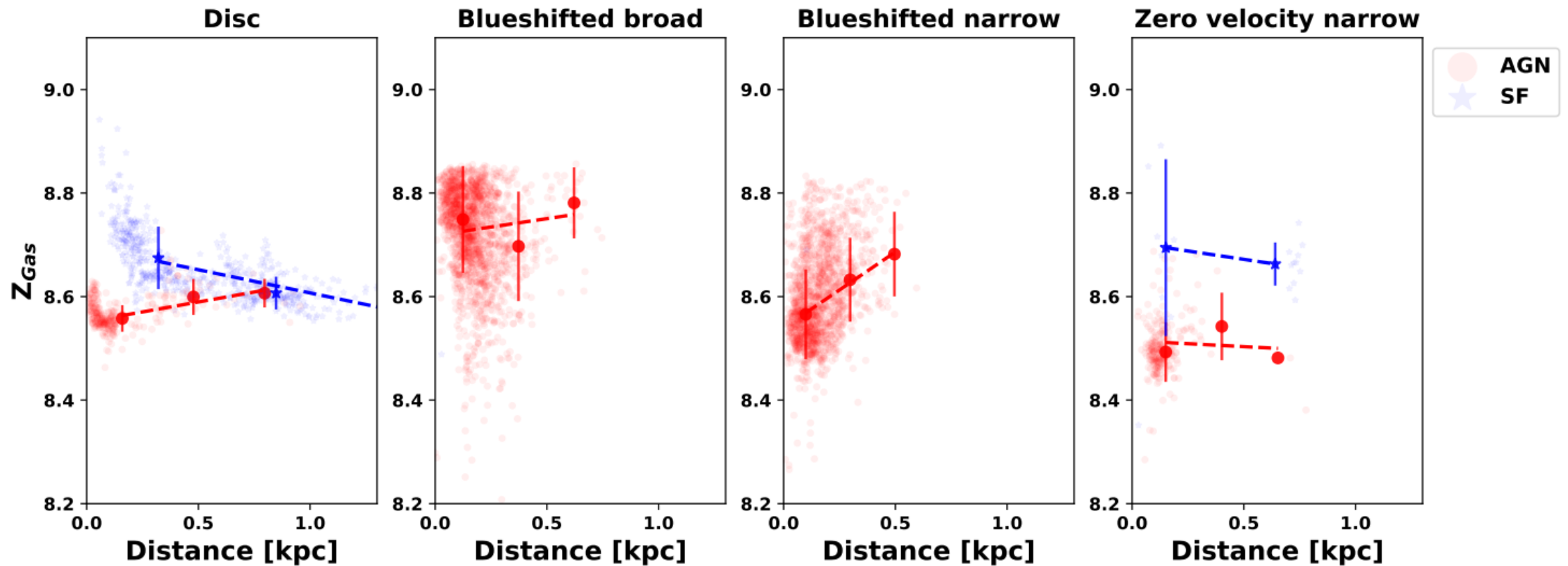


Fig. 4. Metallicity gradient profiles for each component using the [Storchi-Bergmann et al. \(1998\)](#) and [Curti et al. \(2017\)](#) metallicity relations for AGNs (red circles) and SF regions (blue stars), respectively, with the radius (in kpc) given on the bottom axis. Overplotted are binned linear fits to the radial metallicity gradient in AGNs (dotted red lines) and SF regions (dotted blue lines). The bigger dots mark the binned median values, and error bars represent the scatter in the data within each bin.