KROSS: Mapping the Hα emission across the star-formation sequence at $z \approx 1$

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ABSTRACT

We present first results from the KMOS Redshift One Spectroscopic Survey (KROSS), an ongoing large kinematical survey of a thousand, $z \sim 1$ star forming galaxies, with VLT KMOS. Out of the targeted galaxies ($\sim$ 500 so far), we detect and spatially resolve Hα emission in $\sim$ 90% and 77% of the sample respectively. Based on the integrated Hα flux measurements and the spatially resolved maps we derive a median star formation rate (SFR) of $\sim 7.0\,M_{\odot}\,yr^{-1}$ and a median physical size of $\langle r'_{1/2} \rangle = 5.1$ kpc. We combine the inferred SFRs and effective radii measurements to derive the star formation surface densities (Σ_{SFR}) and present a "resolved" version of the star formation main sequence (MS) that appears to hold at sub-galactic scales, with similar slope and scatter as the one inferred from galaxy integrated properties. Our data also yield a trend between Σ_{SFR} and Δ(sSFR) (distance from the MS) suggesting that galaxies with higher sSFR are characterised by denser star formation activity. Similarly, we find evidence for an anti-correlation between the gas phase metallicity (Z) and the Δ(sSFR), suggesting a 0.2 dex variation in the metal content of galaxies within the MS and significantly lower metallicities for galaxies above it. The origin of the observed trends between $\Sigma_{SFR} - \Delta$(sSFR) and Z $-\ \Delta$(sSFR) could be driven by an interplay between variations of the gas fraction or the star formation efficiency of the galaxies along and off the MS. To address this, follow-up observations of the our sample that will allow gas mass estimates are necessary

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銀河のMain Sequence (MS) を面密度から考える。

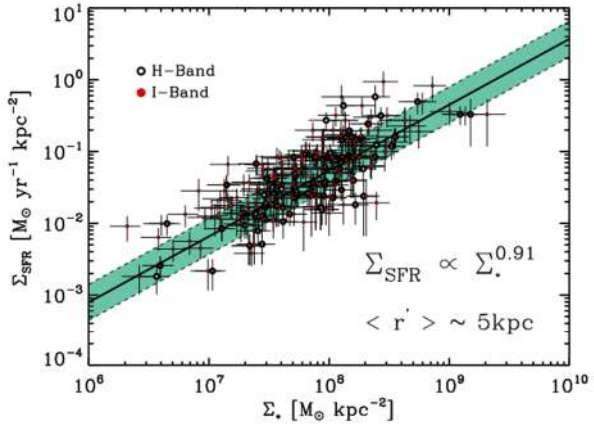
- ❑ VLT/KMOS KROSS Survey (ongoing) から ~500天体 (z ~ 1)
- ❑ Hα data : ~ 2.5hr/obj.、R=3300、HWHM ~ 0.31" ~ 2.5kpc
  - ❑ （Hαが受からない or 受かったが分解できないものの多くは massive/passive銀河。）
  - ❑ Hα flux → 星形成率(SFR)、そのサイズ(r')と面密度(Σ_{SFR})
  - ❑ N2 index → metallicity
- ❑ u – IRAC catalog → SED fitting → M_*, A_V, age

- ➢ どの時代でもtightに見られるMS → secular evolutionを示唆
- ➢ MSから上に外れるstarburstはmore compact, intense SFの兆候を示す (high SFE, high T_{dust},,,)
- ➢ → Hαの面密度 (Σ_{SFR}) としてそれらの傾向を観測的に確認できるか。

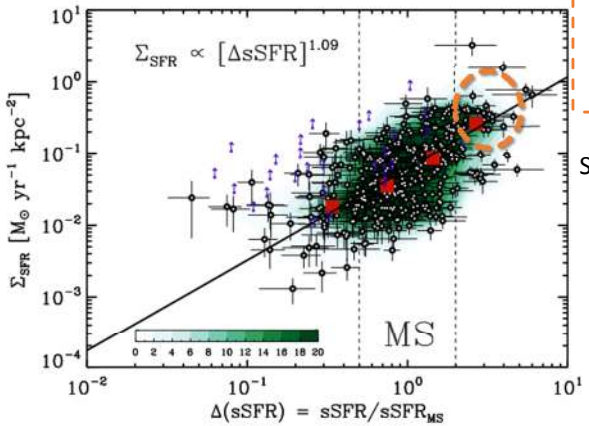
⇩

MSより上に位置する (starburst) 銀河は、denser SF, metal poor な傾向を示した。
MSとgas (SFE, M_{gas}) の関係をALMA等で詳細に調べる必要がある。

HST dataで求めたstellar componentの面密度 vs. Hα mapで求めた星形成領域の面密度



MSからのズレ vs. 星形成領域の面密度



Starbusty
→ denser SF
(and more compact)
↓
Suggesting higher SFE, M_{gas}

Starbusty
→ metal poor
↓
Higher Inflow rate of flesh gas

MSからのズレ vs. 金属量

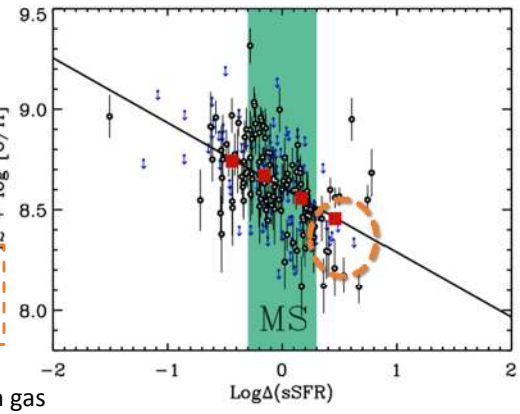


Figure 3. Left) A "resolved" (down to, on average, ≈ 5.0 kpc) version of the star formation main sequence, showing the projected star formation rate density as a function of stellar density. It appears that the correlation between the ongoing and past star formation activity, as observed in the integrated properties of the galaxies holds at sub-galactic scales. The black solid and dashed lines represent the best fit to the data and the corresponding scatter (0.25 dex). **Right)** Projected star formation rate density as a function of distance from the main sequence. The black line corresponds best fit to the data, with a slope 1.09. The red boxes corresponds to the mean Σ_{SFR} in four Δ(sSFR) bins ($0.1 \leqslant \Delta(sSFR) < 0.5$, $0.5 \leqslant \Delta(sSFR) < 1$, $1 \leqslant \Delta(sSFR) \leqslant 2$ and $2 < \Delta(sSFR) < 10$). The vertical dashed lines enclose the area of the main sequence, while the green contours depict the number density of the sources in the plot. Purple arrows correspond to lower limits for spatially unresolved sources with Hα detection. This plot demonstrates that, on average, galaxies with elevated sSFR with respect to the MS, are characterised by denser star formation activity.

Figure 4. Metallicity versus distance from the main sequence. The red boxes correspond to the mean metallicity values in four Δ(sSFR) bins; one below, two within and one above the MS (same as in Figure 3right). The green shaded region depicts the locus of main sequence. The solid line represents the best fit to the data, with a slope of -0.36, suggesting a variation of 0.2 dex in the metallicity of the galaxies within the MS and significantly lower metallicities for star bursting galaxies that sit well above the MS.