The Circumgalactic Hα Spectrograph (CHαS) I. Design, Engineering, and Early Commissioning

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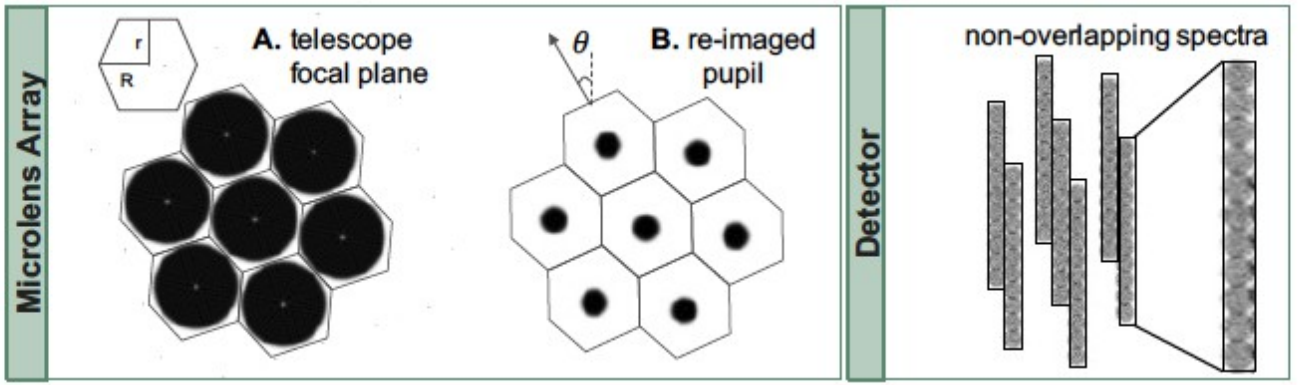
ApJ accepted

Цель – глубокое картирование ультра-слабой эмиссии межгалактического газа (circumgalactic medium (CGM) surrounding low-redshift galaxies)

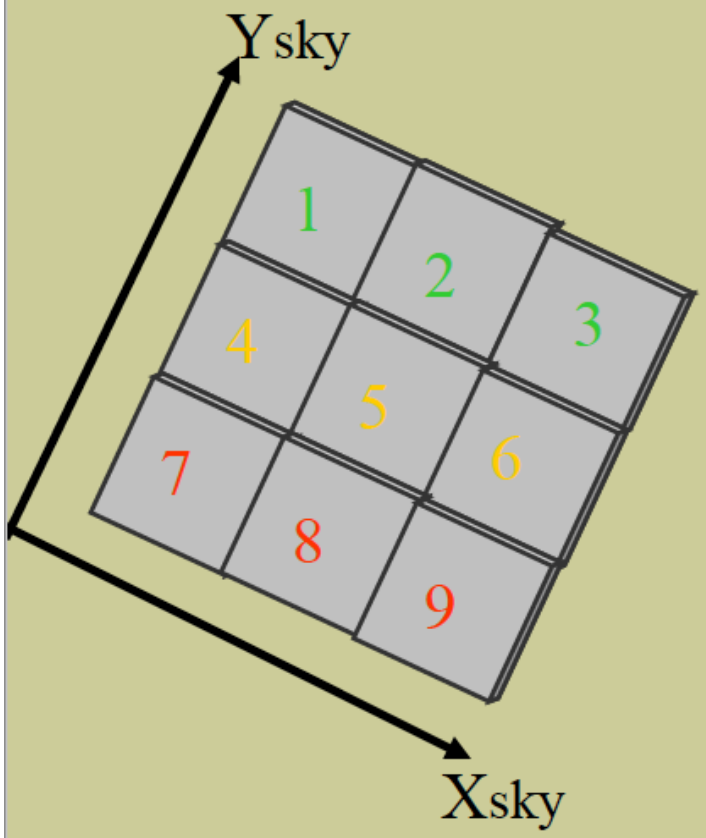
R=10 000 – 20 000 @ 400-900 nm – от [OII] 3727 до [SII]
FOV=10 arcmin (!)
Spaxel: ~1.2 & 2.4 arcsec
(напрямую масштаб не указан, расчет исходя из размера растров и заявленного числа спектров (~240000 & ~60000) дает разброс +-10%

Но авторы утверждают, что spatial resolution= 1.3-2.8"

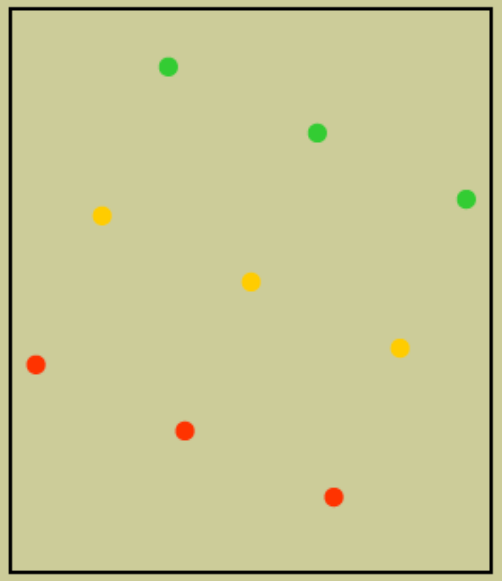
Классическая схема TIGER
с шестиугольными линзами по Bacon

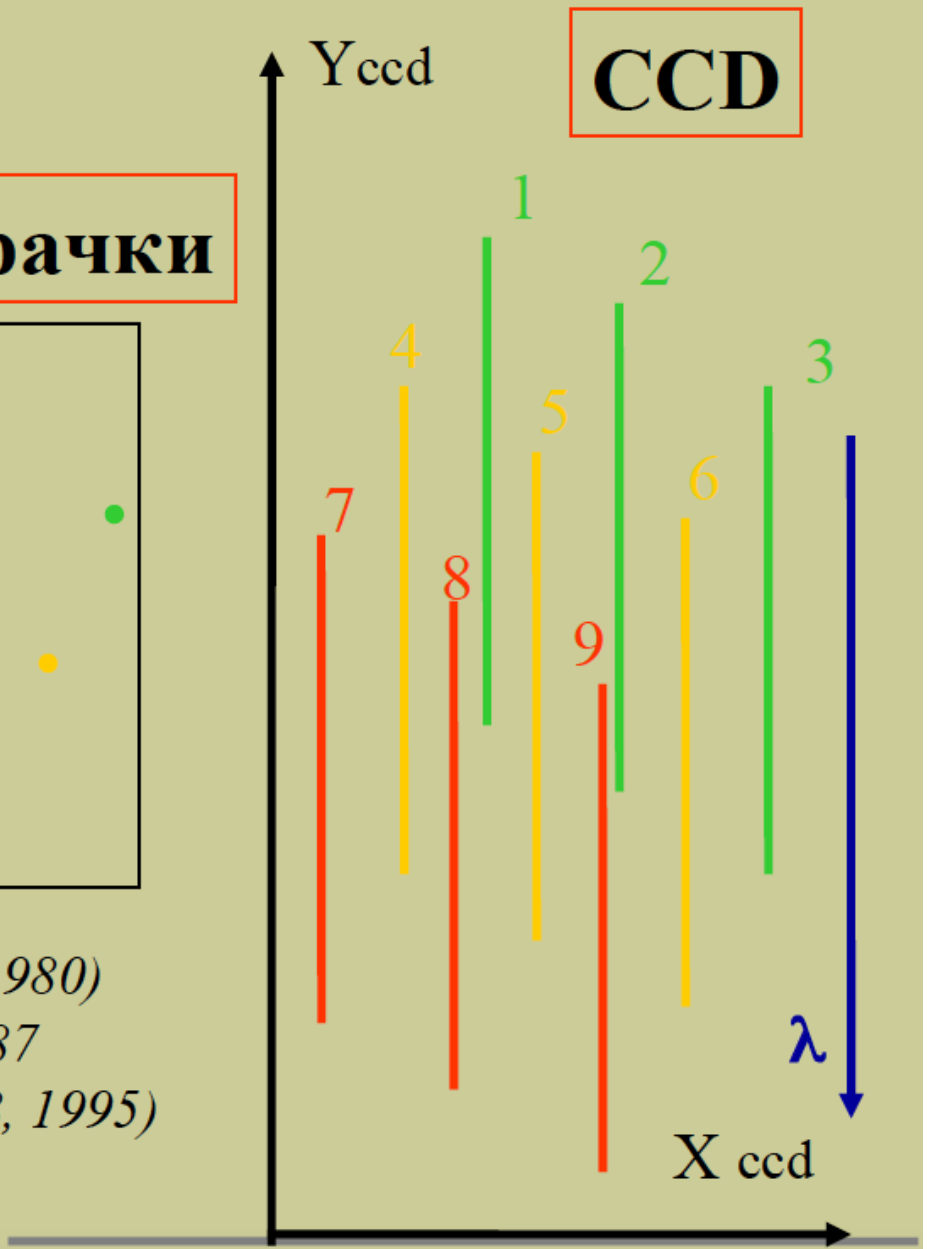


TIGER: Traitement Intégral des Galaxies par l'Etude de leaurs Raies



микрозрачки





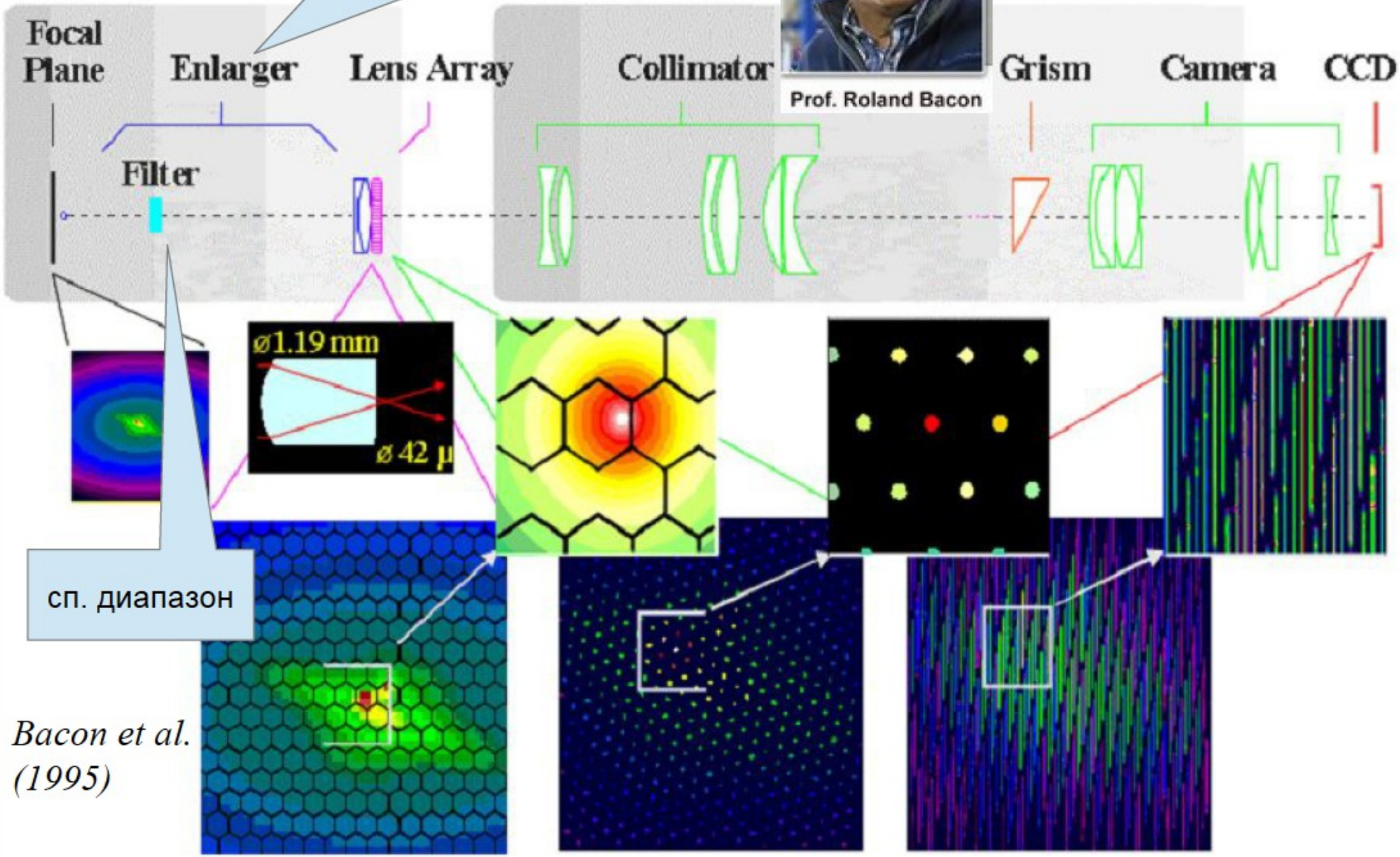
Микролинзы
("микро" условно – 2.4 мм

Идея – Courtes (1980)
CFHT 3.6 м - 1987
Bacon et al. (1988, 1995)

TIGER MODE OP[illegible] LAYOUT

Prof. Roland Bacon

x10-x20, размер линзы 1-2 мм



Bacon et al. (1995)

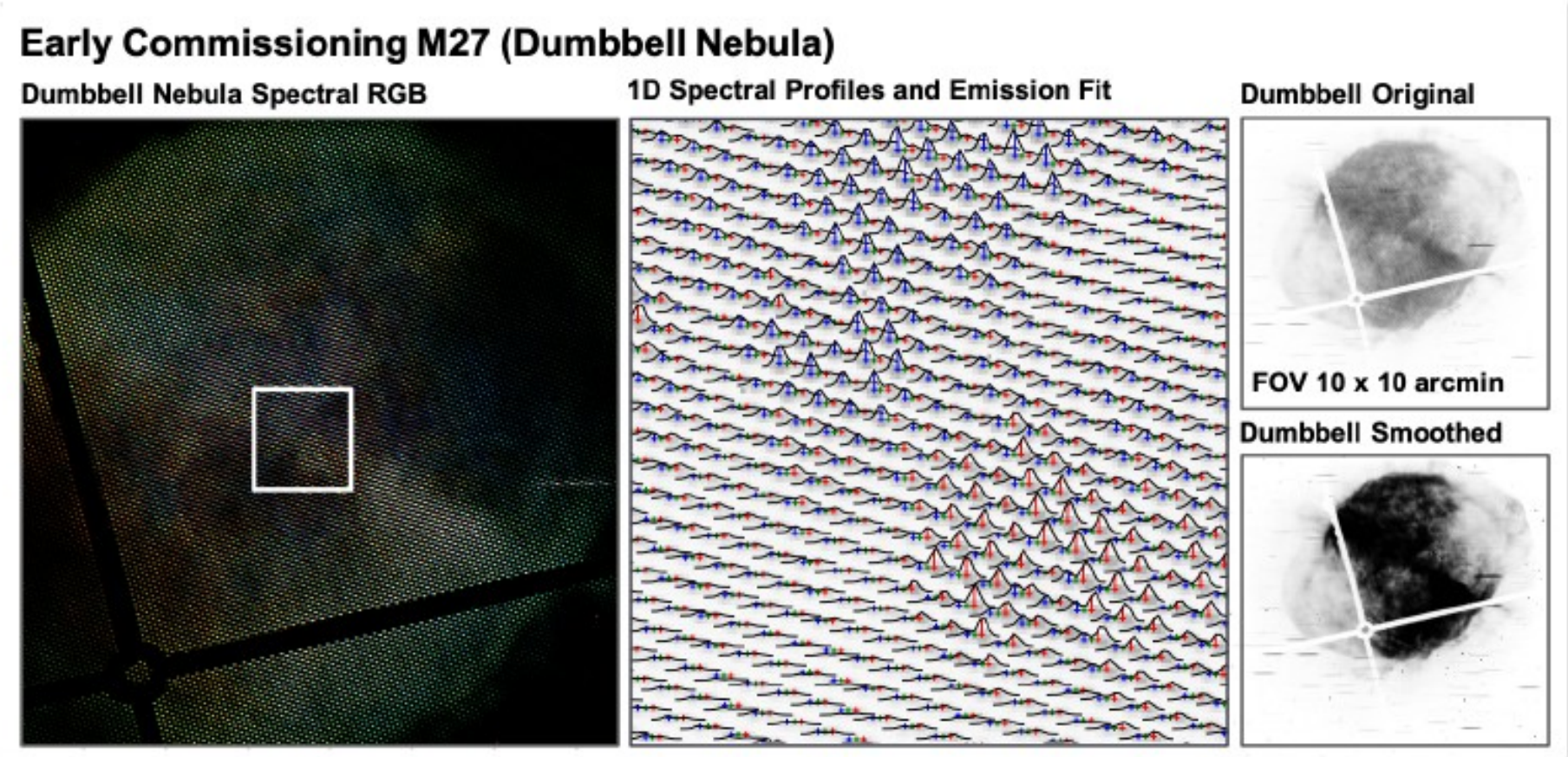
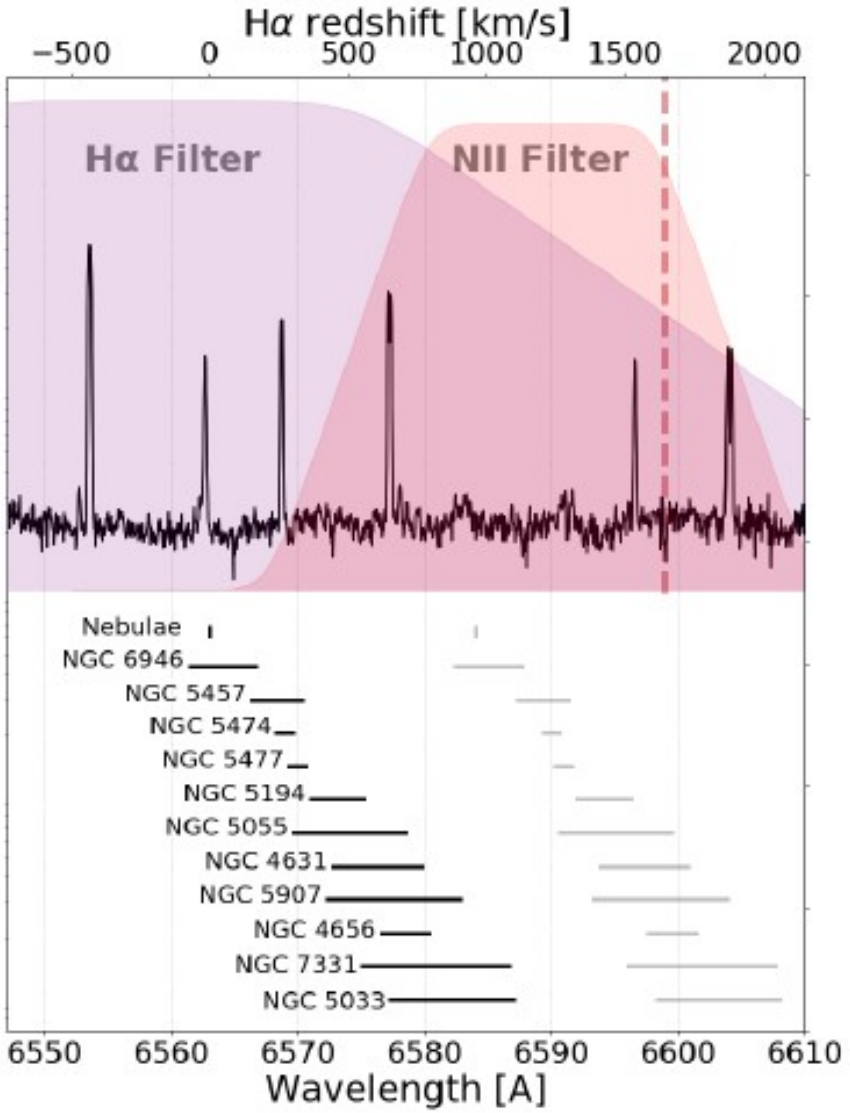


Figure 9. Example data from early commissioning. The left panel is an RGB image of the CHαS spectra colored by velocity. This map has a resolution of ± 2 pixels or ± 60 km/s. If we zoom in on the center of the nebula and create a plot of the 1D spectral profiles (middle panel) we see the expansion of the nebula. Emission lines in each 1D profile have been fit and colored based on if they are redshifted or blueshifted. In the rightmost panels we see that the Dumbbell nebula nearly fills the $10' \times 10'$ FOV. The smoothed CHαS Data resembles a narrowband Hα image of the nebula. The cross-hair artifact is a calibration mask installed throughout the commissioning run.



Ограничение по сп. диапазону:
30A: +/-600 км/с в Halpha

Table 4. Primary target integration summary from early commissioning May/June 2021. Each integration is composed of 180 second exposures. We require a Moon illumination of $\leq 50\%$ and a Moon separation of $\geq 55°$.

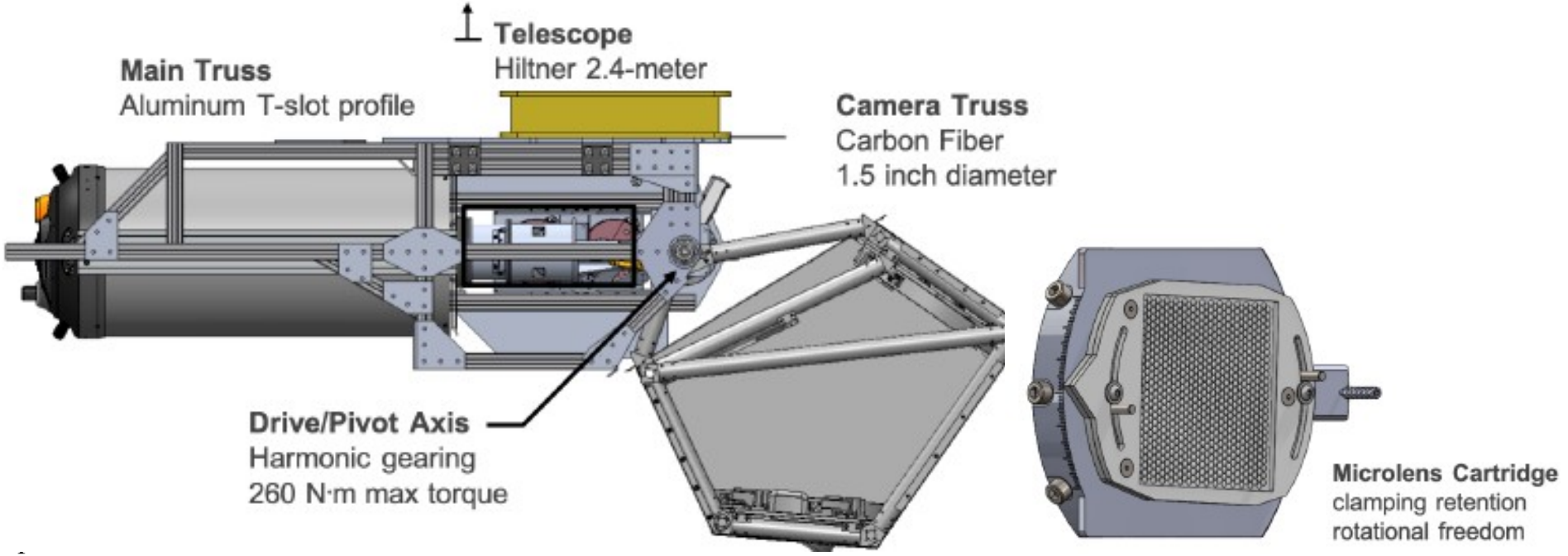
Target	Alternate Name	Total Integration
NGC 4631	Whale Galaxy	3.0 hrs
NGC 4656	Whale Friend Galaxy	2.1 hrs
NGC 7331	Deer Lick Galaxy	4.1 hrs
NGC 5906	Cat Scratch Galaxy	5.05 hrs
NGC 6946†	Fireworks Galaxy†	1.2 hrs
NGC 5033	Dungeness Galaxy	1.85 hrs

The Hiltner 2.4-Meter Telescope

The MDM Observatory consists of 2 reflecting telescopes. The Hiltner 2.4-meter telescope William Albert Hiltner, who discovered the interstellar polarization of starlight.

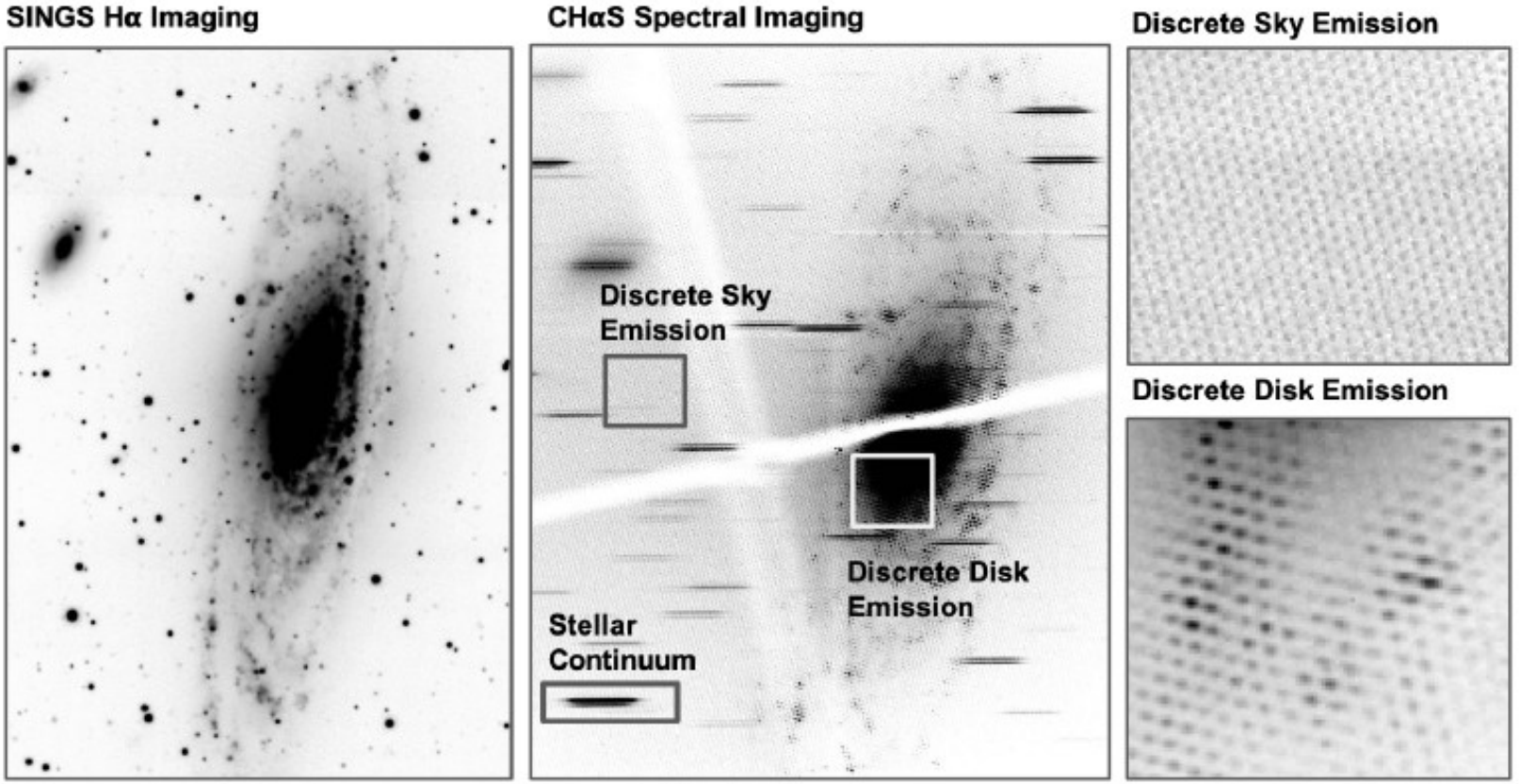
Очень подробное описание технических и оптических деталей.
Упор на модульность, максимум коммерческих элементов, реплику для больших телескопов
На все диапазоны – одна наклоняемая решетка VPHG1200

Из минусов описания:
- детектор MDM 4K – без комментариев, кроме того, что это “мозаика”, шум 5e :(
- не указан внятно размер растров. Разные оценки по цифрам из статьи дают от 240x240 до 270x270 и от 490x490 до 540x540 (не все засвечены)?
- оценка и пространственного и спектрального разрешения:
Дисперсия 0.37A/px, но в наблюдениях абсорбций M-звезды получили:
с крупным растром (ML250) FWHM=1.8px (30 км/с)
с мелким (ML125) обещают FWHM=1.01 px(17 км/с) – а как же Найквист?

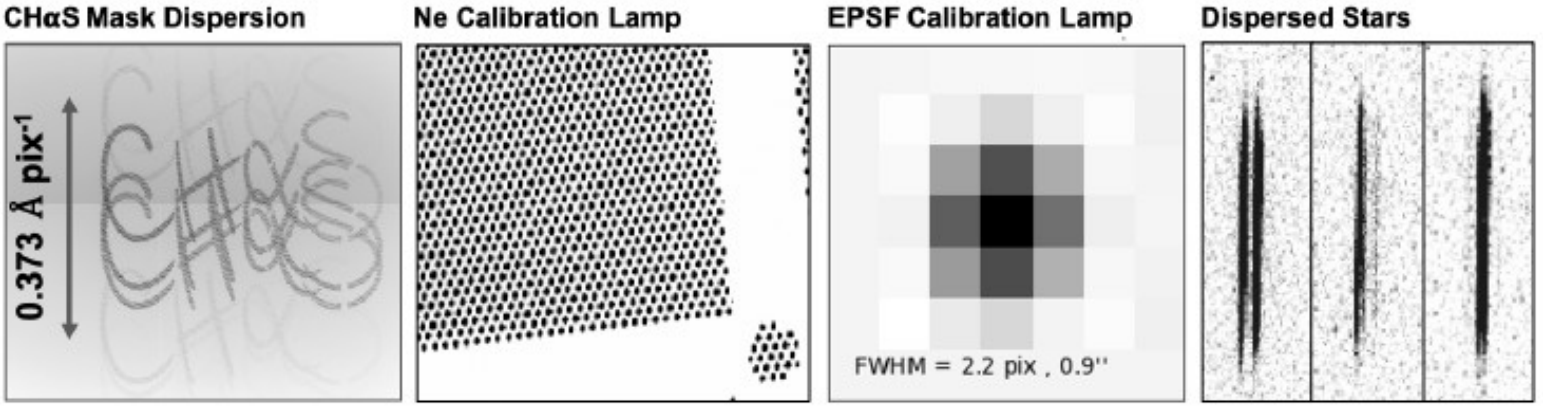


Ce

Early Commissioning NGC 7331 (Deer Lick)



Early Commissioning Calibration



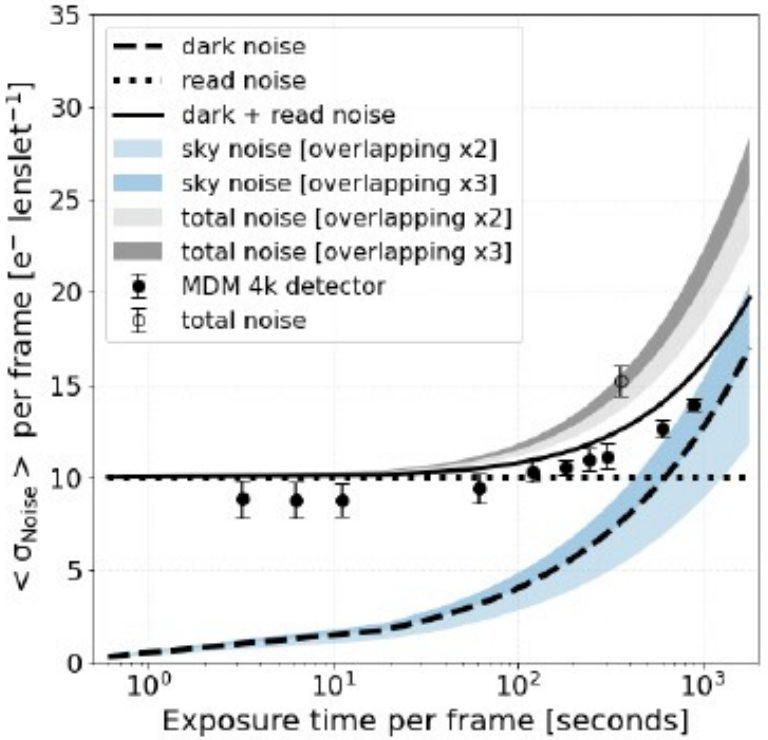
Проблемы:

- тесно расположены спектры

analysis of lenslet spectra on the detector. We extract a spectrum at each of these locations; however, overlap with adjacent lenslets results in a quasi-periodic multi-peaked spectrum. Using a velocity prior, typically an

- заметные гнутия, так что Texp<600 с

Впрочем, уже на 360 с видят шум неба?



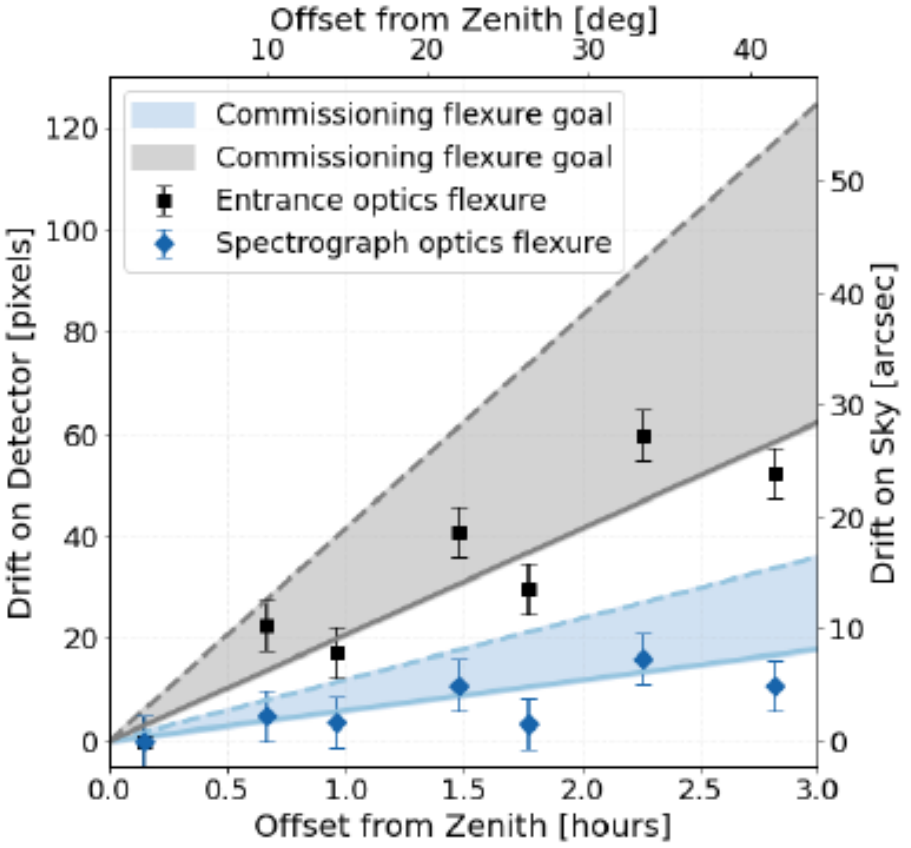


Figure 11. Early commissioning flexure measurements. The blue points are the measured entrance flexure and the black points are the measured spectrograph flexure. Each measurement is the magnitude of the drift calculated by summing flexure along the spectral direction and flexure along the cross-spectral direction in quadrature. The shaded regions represent the expected drift due to flexure over a range of exposure times spanning from 300 seconds (dotted line) to 600 seconds (solid line). These are calculated using the commissioning flexure goals outlined in text.

QE – не сильно впечатляет:
Ожидаемое (без фильтра и телескопа): 19%
Измеренное в 2021 (полное): 8%

Но планируют большие экспозиции:10-100 h

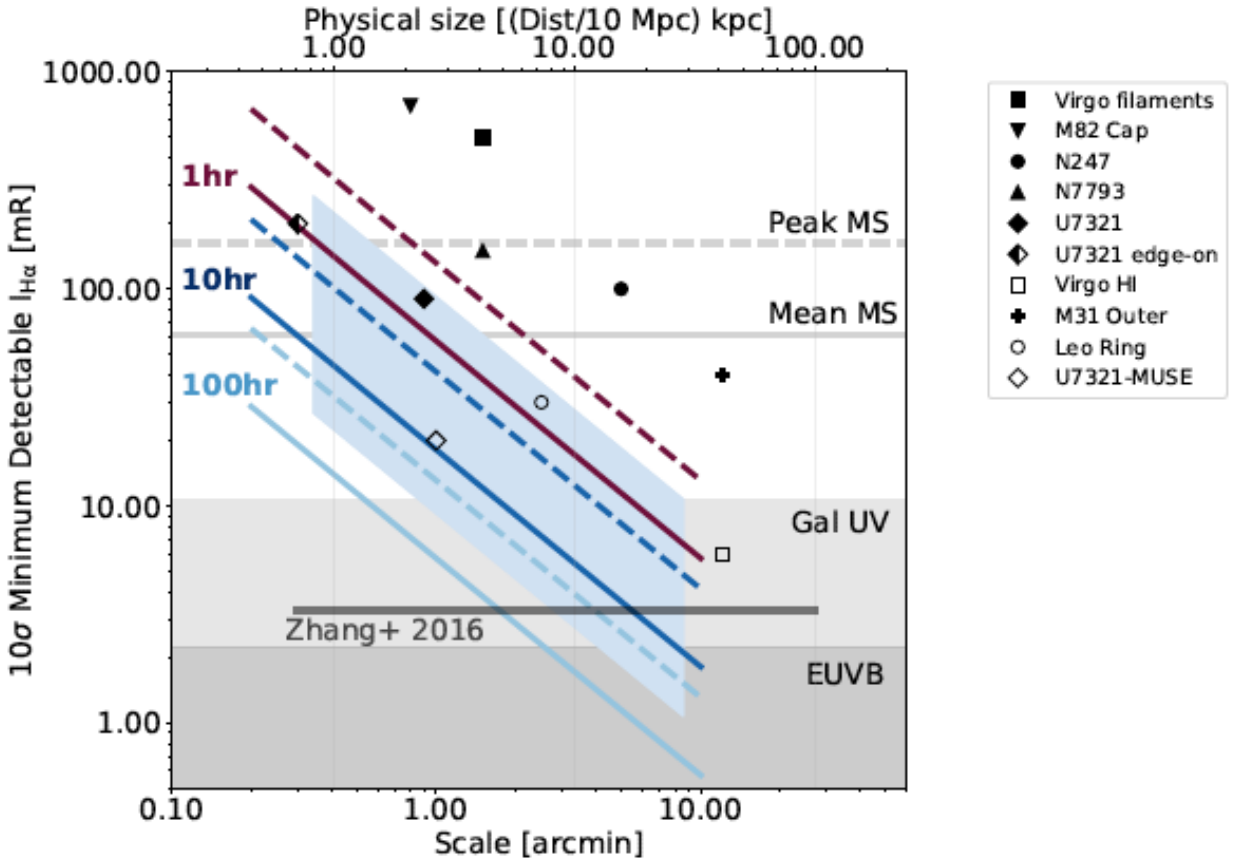


Figure 14. The predicted minimum detectable Hα intensity (S/N = 10) as a function of angular scale at three different integration times: 1 hr, 10 hr, 100 hr. Soid lines are calcuated with an efficiency $\eta = 15\%$ and dashed lines are calculated with an efficiency $\eta = 6\%$. We compare these sensitivity limits with the expected emission flux from the ultra-faint extragalactic

Интересная система,
Заполняет редкую нишу
Не без недостатков, посмотрим за результатами

Смущает, что в статье нет ни одной карты, только мелкие спектры