RSS-NIR Imaging Spectroscopy

Fabry-Perot System

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Rutgers
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FP Overview

Tunable narrowband filter – full FOV images

Datacube: scan over spectral feature of interest

Full spatial sampling, temporal spectral multiplex

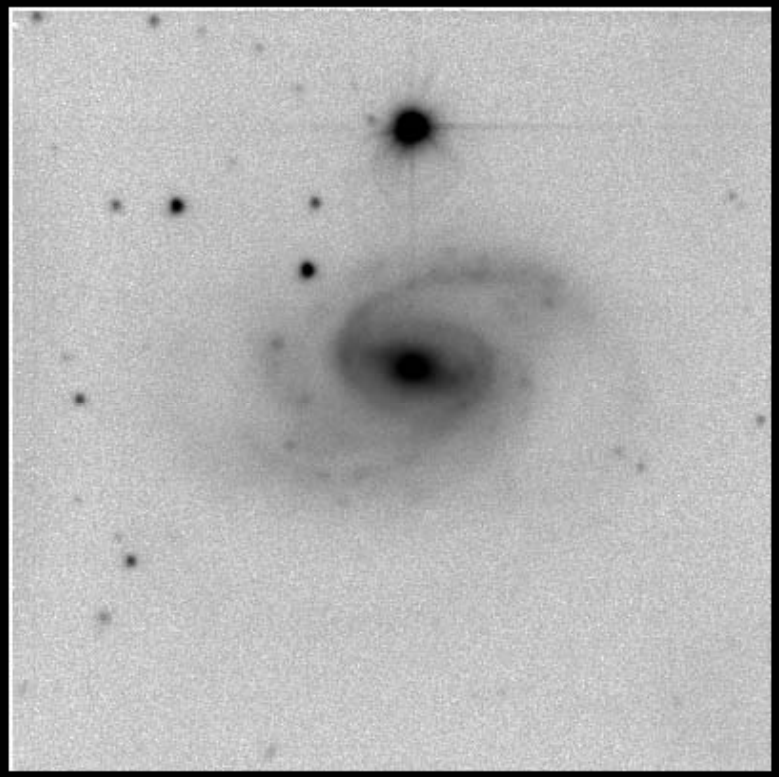
Continuous spectral/kinematic maps

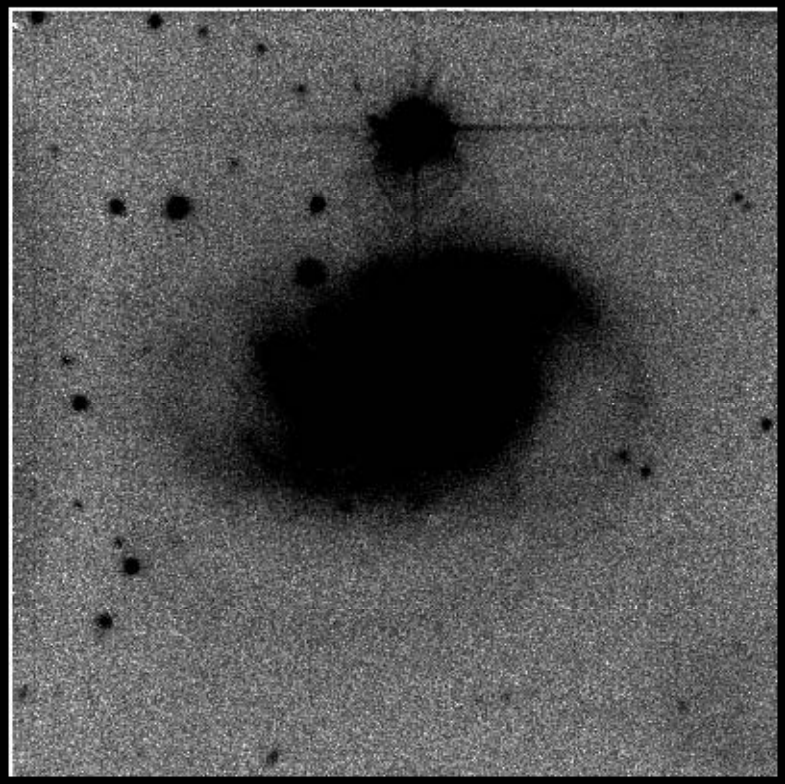
Seeing-limited spectroscopy

Huge efficiency for extended objects

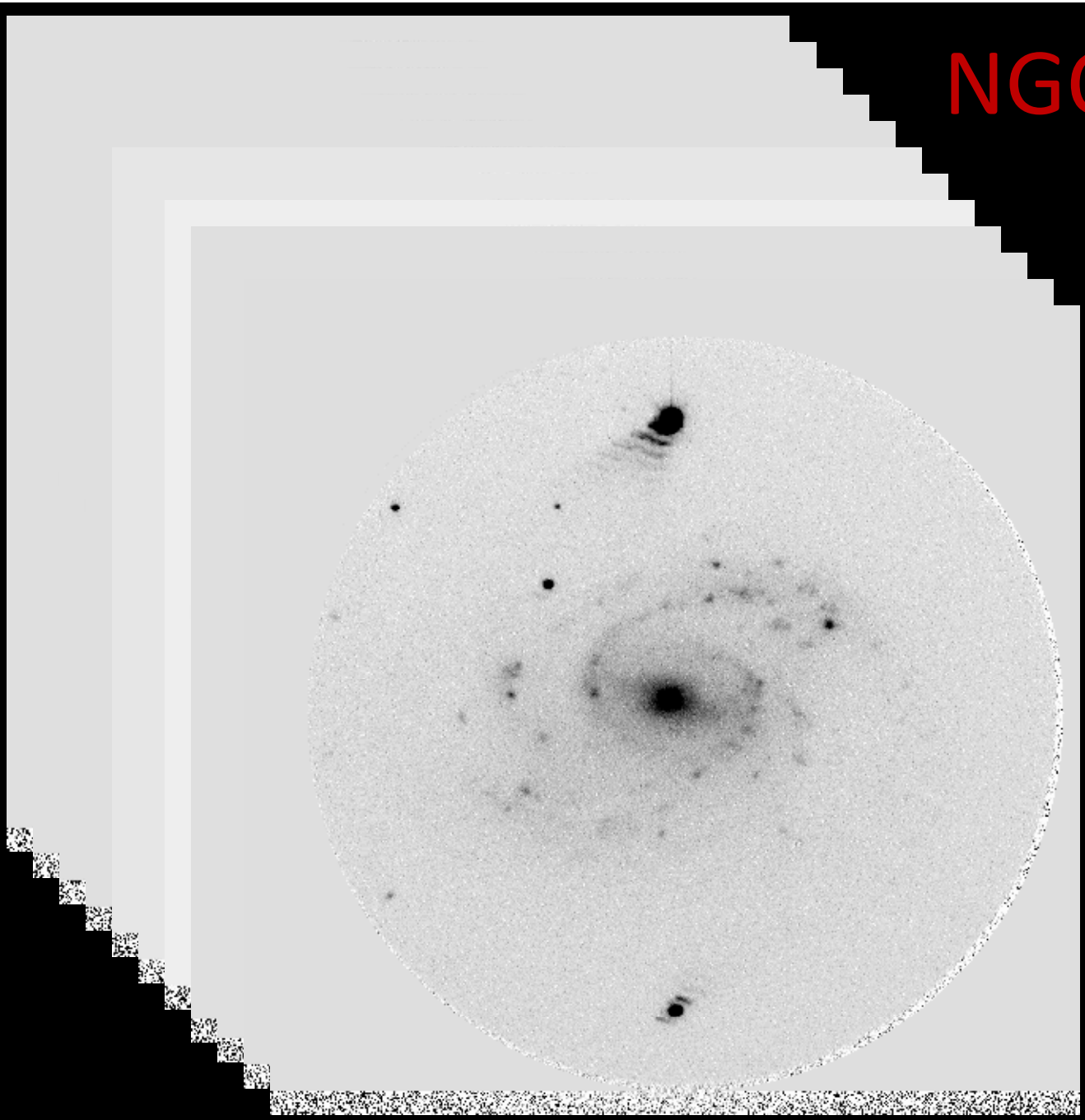
Imaging spectropolarimetry

Emission Line Example: NGC 1832

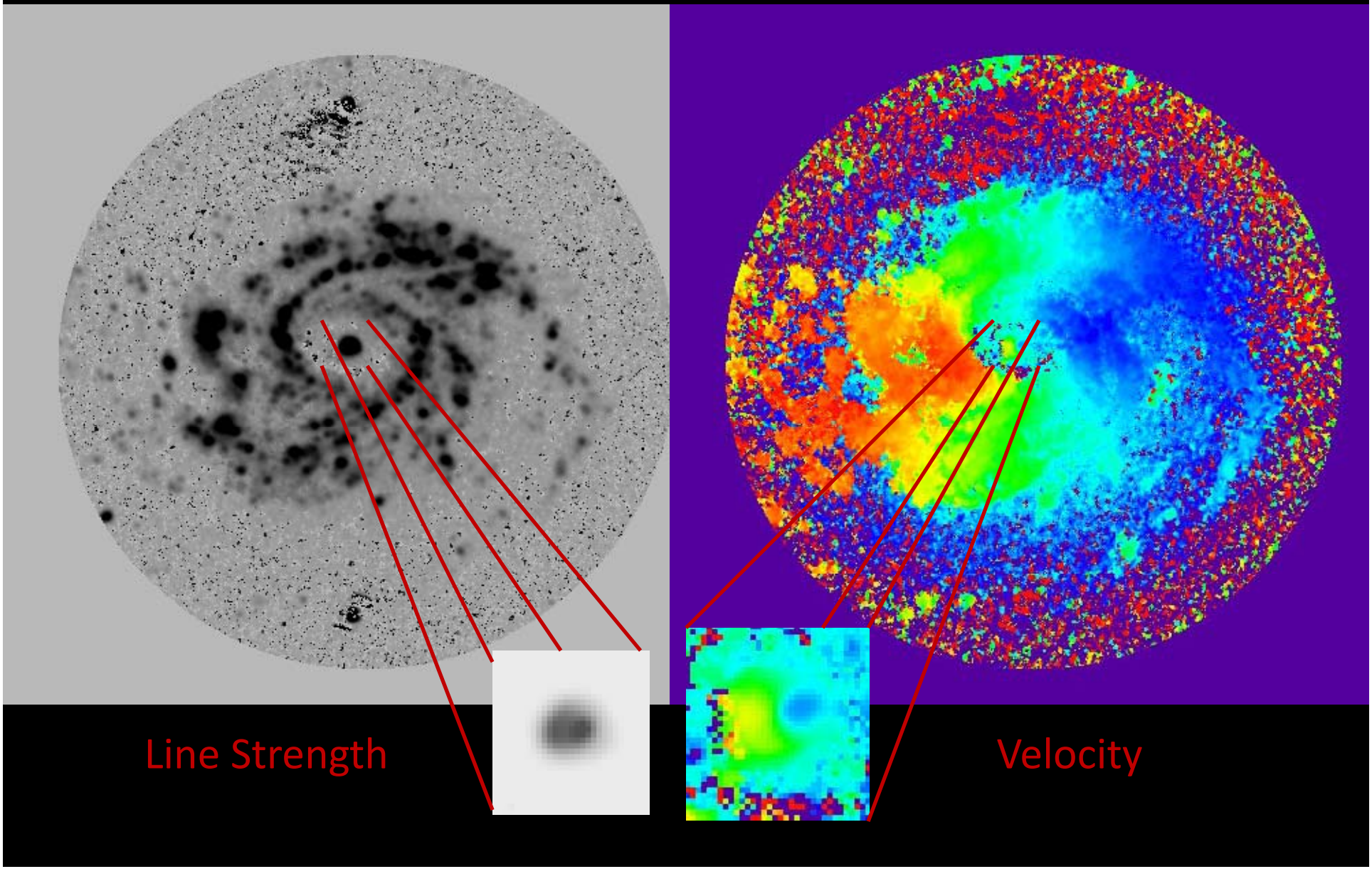




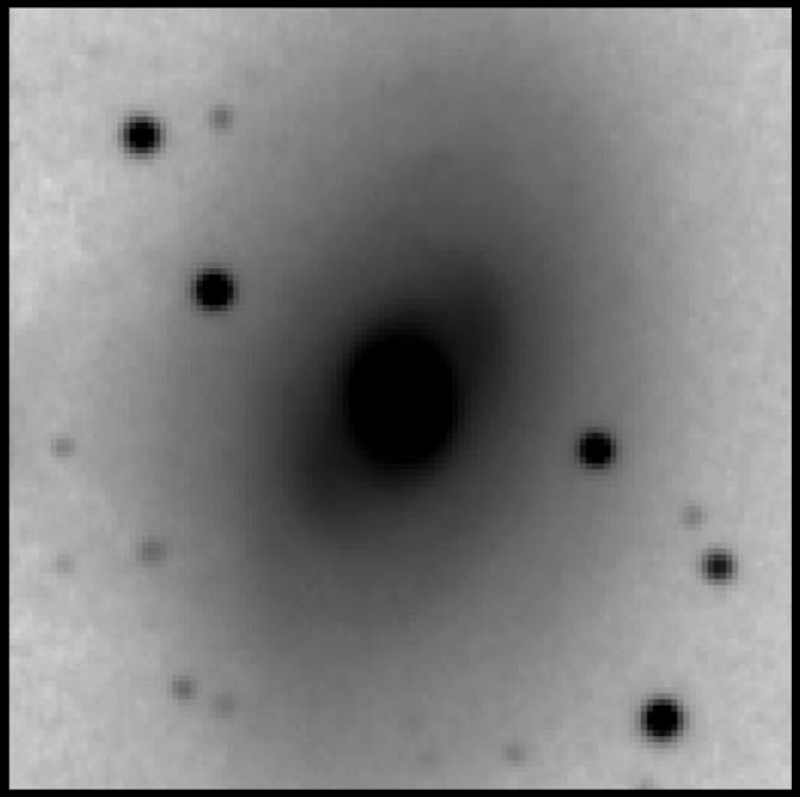
NGC 1832

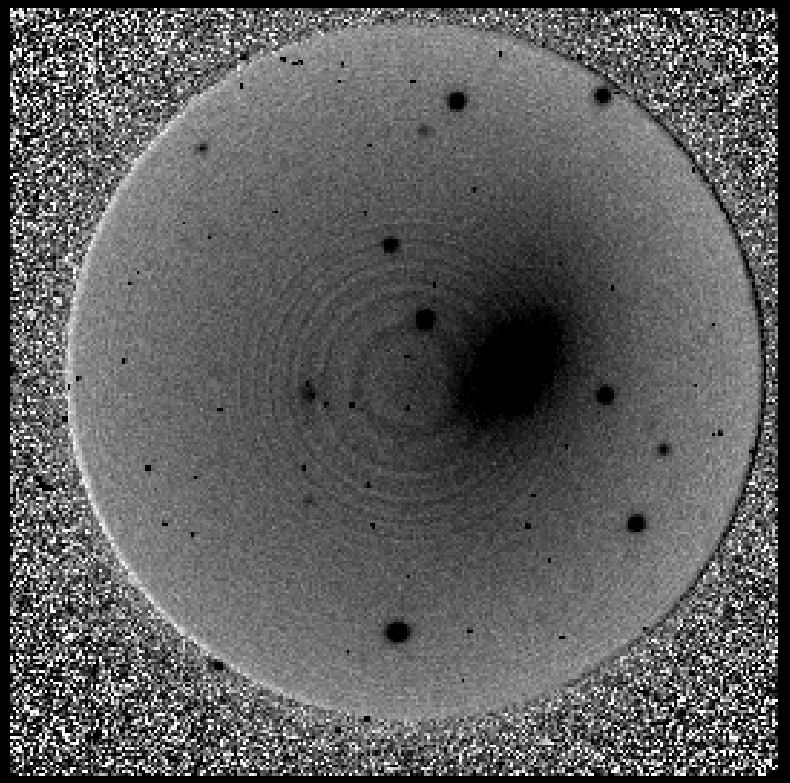


NGC 1832 Fits



Absorption Line Example: NGC 7079





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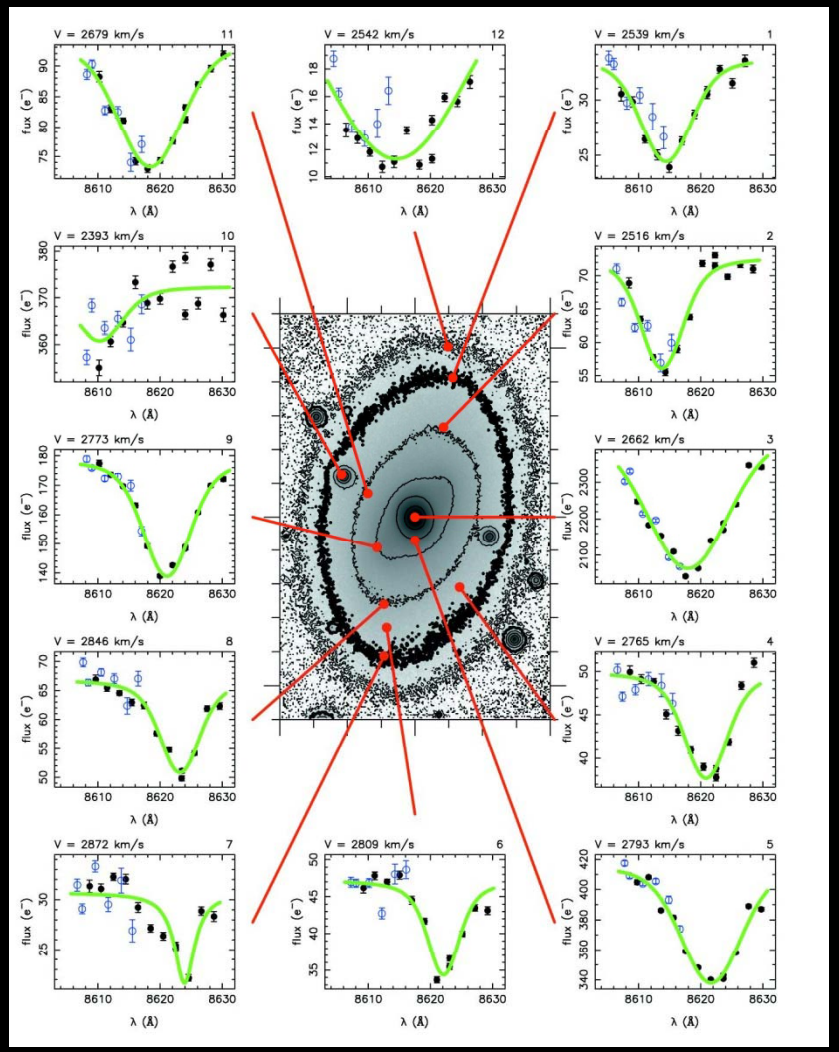
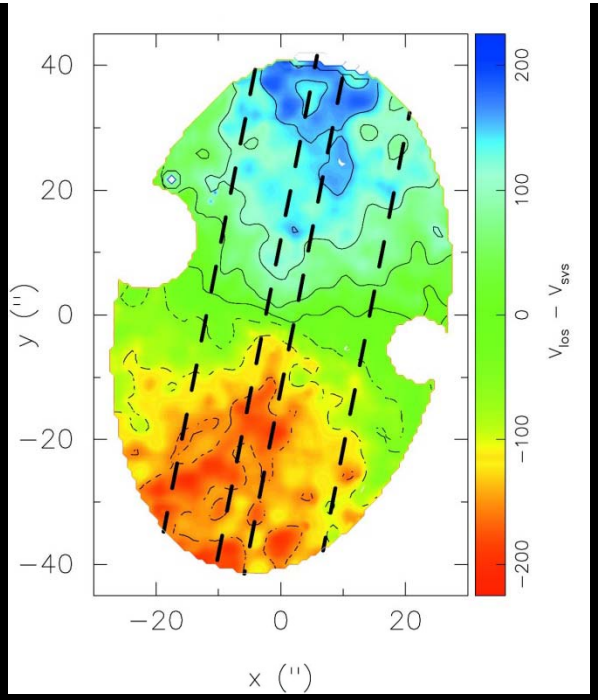
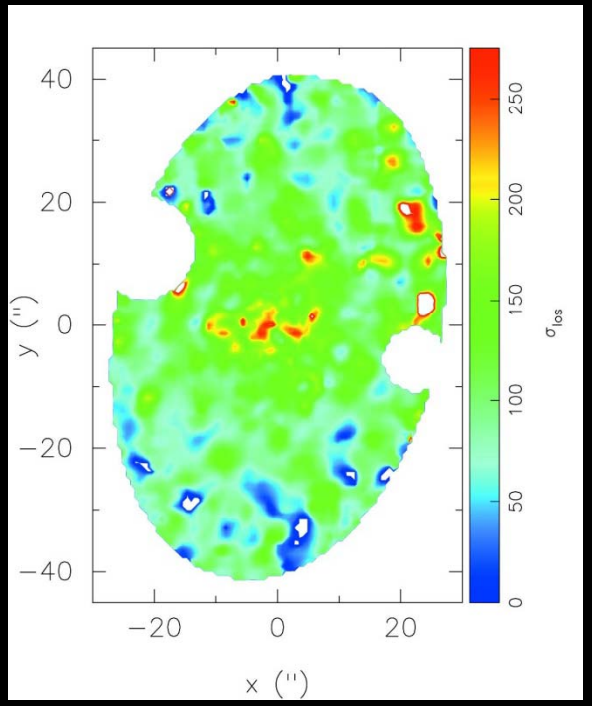


Velocity



Dispersion



System Design

Piezo-actuated servo controlled etalon

150 mm aperture

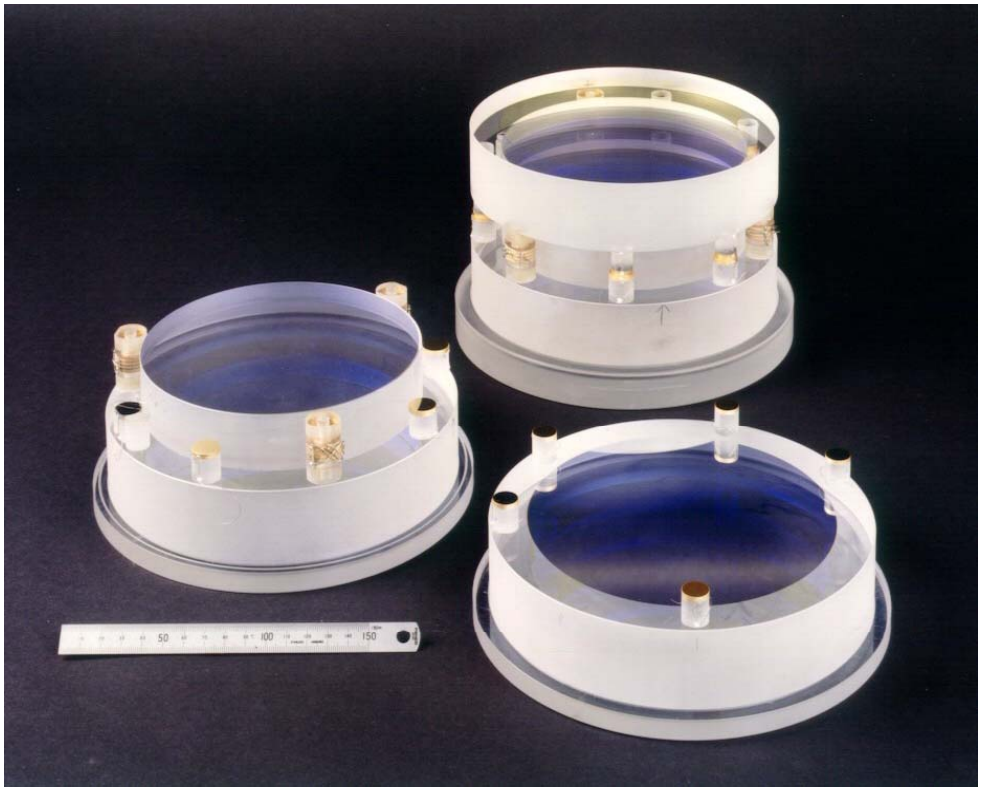
Gap: 42 μ

Reflectivity: 95%

Flatness: 12.5 nm

($\lambda/100$ at 1.25 μ)

Coating Defect: 50 nm



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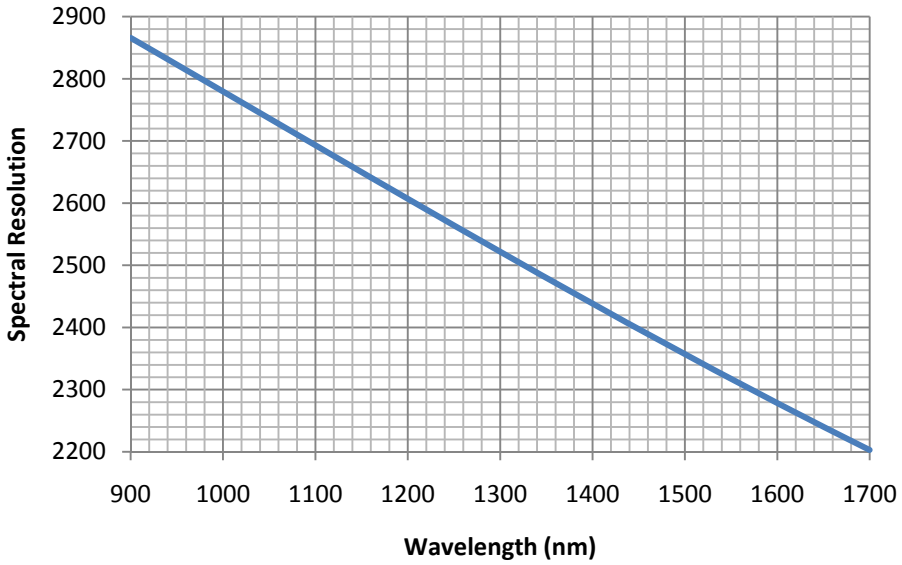
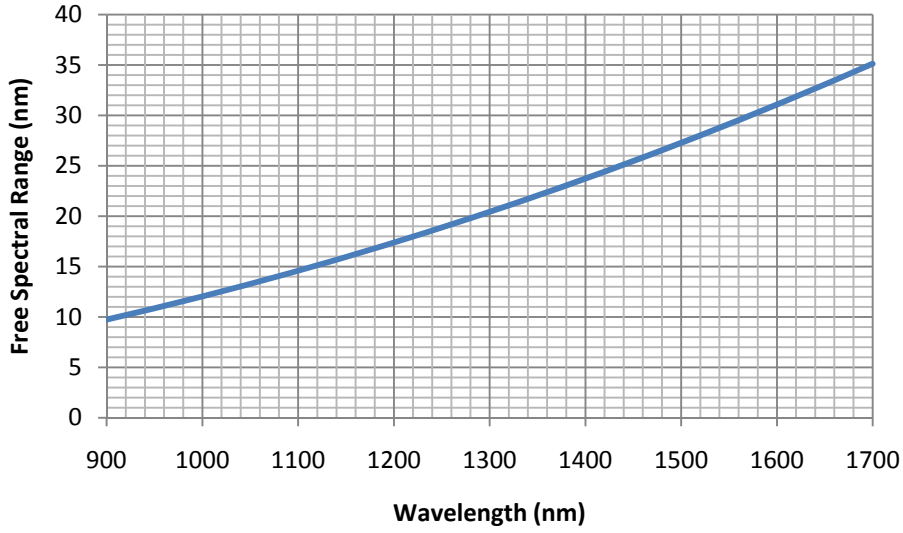




System Design

Wavelength Gradient:

$$\lambda\,(r) = \lambda_0 \cos\,(r / F_{cam})$$

4.2 nm @ 1.25 μ

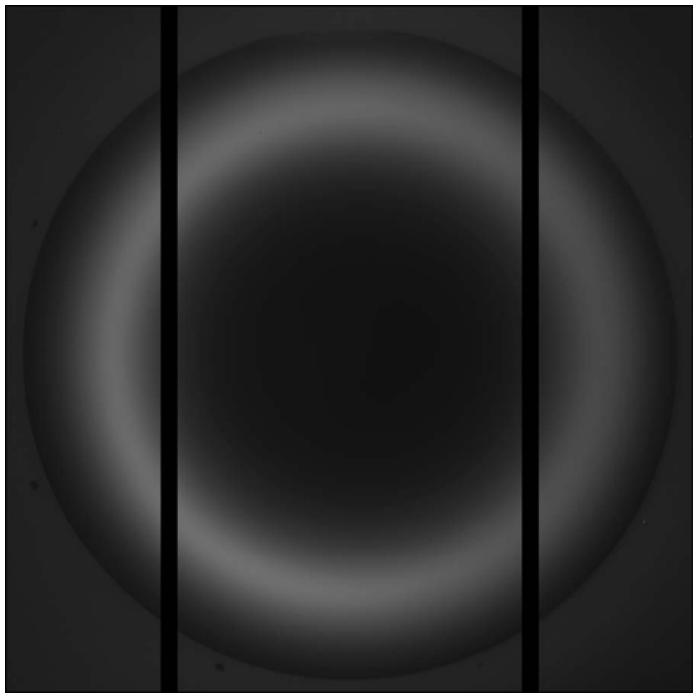
1000 km/s

8.3 x FWHM

Tip/tilt stability requirement:

5 x 10^{-4} rad = 1.7’

(for < FWHM / 10 @ r_{max})



Risks

Cooling: -40 C

- possible loss of piezo & capacitor optical contacts
- plate distortion
- mitigation: test apparatus for thermal cycling
  vendor experience with etalons to 77 K

Coatings

- visible etalons: effective gap change, defect amplification
- mitigation: extensive design simulation and review
  deposition modification for uniformity