

The First Optical Spectra of Wolf-Rayet Stars in M101 Revealed with Gemini/GMOS

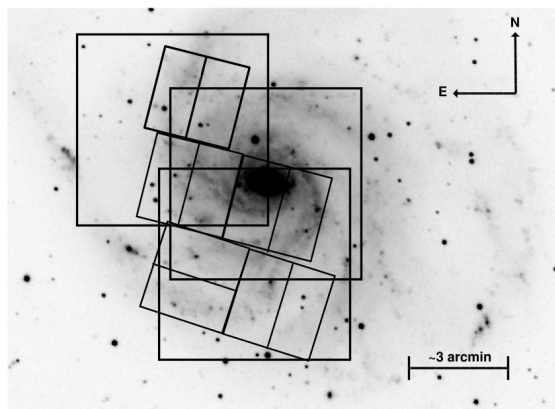
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ABSTRACT

- M101のDeep narrow-band imaging with Gemini/GMOS
- 10のHeII emission source内に15個のWR星を同定 (4 WN & 11 WC) .
→ WC/WN比がMWより大きい.
- 結構な確率でHII region内にあるか、associateしている.

1. INTRODUCTION

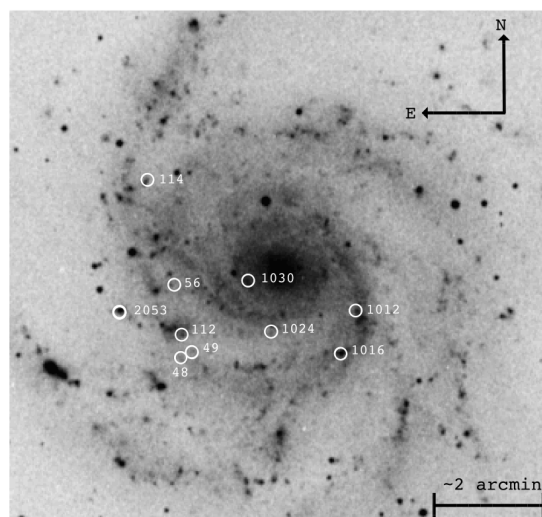
- M101
 - 6.4 Mpc
 - iconic spiral galaxy
 - face-on : extinctionが一定 (0.25-1 mag)
- SFR $\sim 3.3 M_{\odot}/\text{yr}$
 - MW $\sim 2 M_{\odot}/\text{yr}$, 1900 WRs
 - 3000 WRs
- strong metallicity gradient (super-solar metallicity)
 - 恒星大気モデルから、N(WR)/N(O), N(WN)/N(WC)の評価が可能.



▲図1 : KPNO Schmidt image (16.5' x 12')
大四角 : GMOS pointing
小四角 : WFC3 pointing

2. OBSERVATIONS

- HST/WFC3
 - 2.7 x 2.7 arcmin
 - F469N filter (He II 4684Å)
 - 18 fields
 - WR candidateのpick-up
 - 1.24pc/pix @6.4Mpc = 0.04 arcsec/pix @WFC3
 - 25 WR & 71 RSG candidates
- GMOS pre-imaging
 - 5 x 5 arcmin
 - spatial resolution ~ 1.1 arcsec
- GMOS spectroscopy
 - 7 MOS mask positions
 - spectral resolution $\sim 15\text{\AA}$



▲図2 : ○ : confirmed WR

4. RESULTS

- Nebular Analysis

- extinction \leftarrow Balmer line ratio (H_{α}/H_{β}): $E(B-V) = 0.42 \pm 0.07$ mag.
- metallicity : $\log(O/H)+12 = 8.66 \pm 0.24$ dex

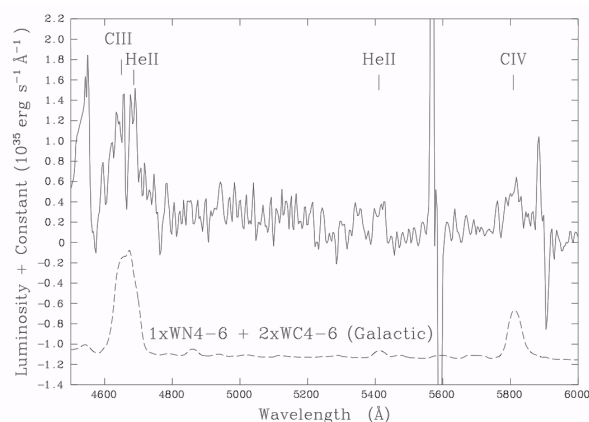
- Stellar Analysis

- Imaging (photometry) \rightarrow Spectroscopy
- WN : HeII 4686, WC : CIII 4650, CIV 5808, WO : OIV 3811-34
- WN in sub-solar metallicity region \leftrightarrow WC in metal-rich region
- stellar evolutionary theoryに矛盾しない
(metal-richな環境
→ strong stellar wind
→ enhance stripping outer layer)

- Synthetic Magnitudes

- Non Detections

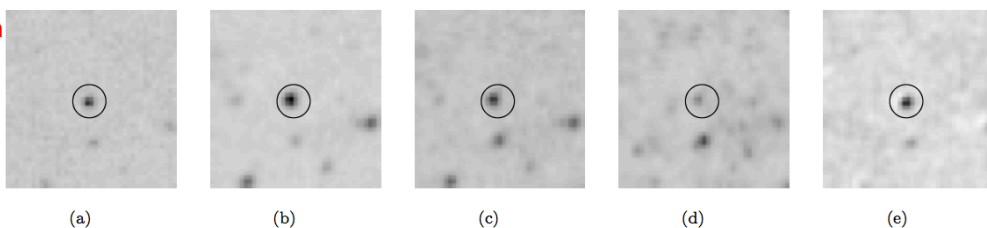
- total 208 WR candidates in 7 MOS mask designs
- No WR : $m_{F435W} > 23.64$ mag.



▲図3 : Spectrum of #56

5. WR Stars in HII Regions

- 70% : in HII region
- 10% : associated with HII region
- 20% : not associated



▶図B10 : Images of #56

Figure B10. Source # 56 in F469N, F435W, F555W, F814W and continuum subtracted F469N filters, respectively