

## DISCOVERY OF A LOW SURFACE BRIGHTNESS GALAXY IN THE NGC2655 FIELD

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### INTRODUCTION

We report the discovery of a low surface brightness galaxy (LSB Galaxy) candidate at  $(\alpha, \delta) = (8^{\text{h}}50^{\text{m}}23^{\text{s}}.3, 78^{\circ}28'58''.0)$  (J2000) with projected separation  $22'14''.4$  from NGC2655. In addition to evidence and confirmation of its detection, we explore data via The Guide Star Catalog, Version 2.3.2 (Lasker *et al.* 2008) in support of its apparent presentation.

### DETECTION & CONFIRMATION

The LSB Galaxy was first identified in our  $14h$  full-color integration of a field within the NGC2655 Group (Tully 1988) as acquired from 203mm Newtonian optics at  $f/3.9$  between 2016 October 23 and 2017 March 02. As depicted in Figure 1, both a compressed linear representation and non-linear process of the luminance component ( $23 \times 1200s$ ) reveal an object with diffuse morphology centered at  $(\alpha, \delta) = (8^{\text{h}}50^{\text{m}}23^{\text{s}}.3, 78^{\circ}28'58''.0)$  (J2000) with peak signal at  $(\alpha, \delta) = (8^{\text{h}}50^{\text{m}}25^{\text{s}}.9, 78^{\circ}28'51''.8)$  (J2000). In support of this observation and with analog-digital-units (ADU) in the range  $[0,1]$ , we establish Gaussian noise of the source data at  $\sigma_k = 3.15e-4$  ADU and a mean background reference level of  $3.04e-3$  ADU. A  $7 \times 7$  pixel ( $9''.68 \times 9''.68$ ) sample at the center of the LSB Galaxy produces a mean signal level of  $4.62e-3$  ADU, more than  $5\sigma_k$  greater than the background level. Further, a single-pixel ( $1''.38 \times 1''.38$ ) sample at the peak region is found at  $6.64e-3$  ADU, more than  $6\sigma_k$  greater than that of the center of the LSB Galaxy. While this peak signal is later corroborated in our review of data in The Guide Star Catalog, Version 2.3.2 (Lasker *et al.* 2008), its relationship to the diffuse area is considered here in apparent presentation only.

Presentation of the LSB Galaxy is confirmed in two additional data sets. Our confirmation luminance integration ( $6 \times 600s$ ) was acquired with 0.3m Ritchey-Chrétien optics at  $f/8$  on 2017 March 16, where a non-linear process reveals the LSB Galaxy (Figure 1). The Pan-STARRS1 Surveys (Chambers *et al.* 2016) were analyzed for additional confirmation. A FITS-cutout<sup>1</sup> was obtained from the Pan-STARRS1 database (Flewelling *et al.* 2016) as imaged with the  $i_{\text{PS1}}$  filter with mean wavelength  $7545\text{\AA}$  (Tonry *et al.* 2012). A non-linear process of this data again reveals the LSB Galaxy with comparative presentation.

### APPARENT PRESENTATION

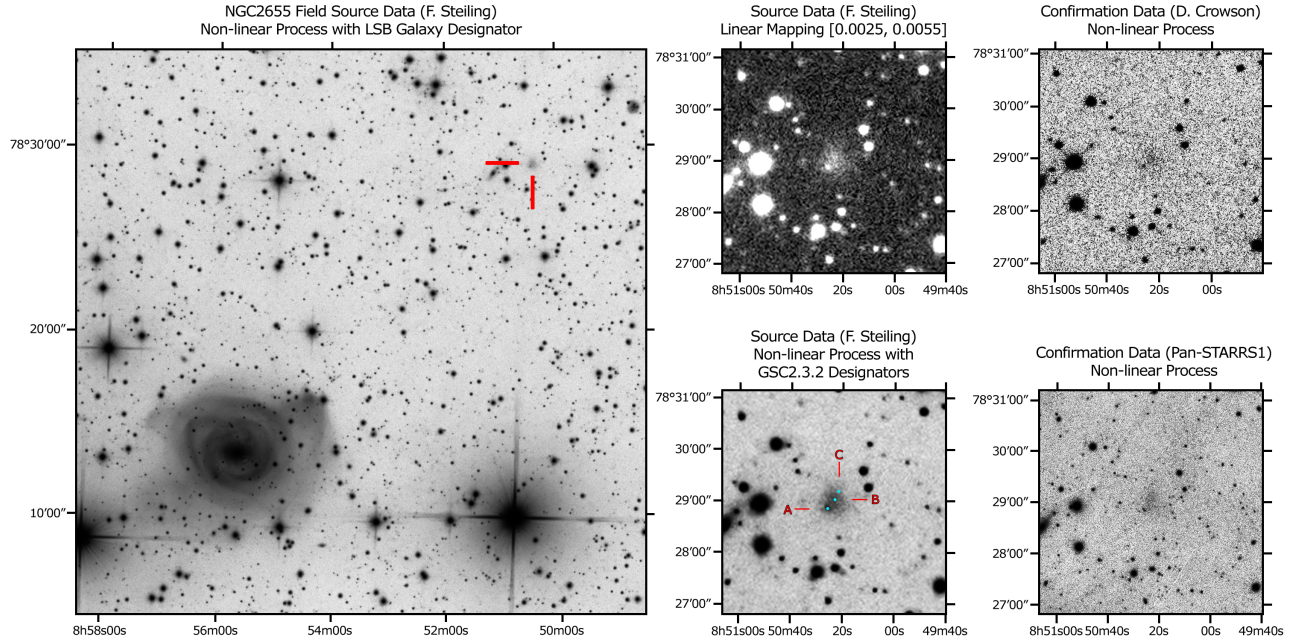
The apparent size of the LSB Galaxy is conservatively estimated from the source data at  $24''.9 \times 27''.7$  by identifying right ascension and declination boundaries for which a 5-pixel mean ADU exceeds the background level by  $3\sigma_k$ . We calculate a projected separation between the LSB Galaxy and NGC2655 of  $22'14''.4$ , where NGC2655 is found at  $(\alpha, \delta) = (8^{\text{h}}55^{\text{m}}37^{\text{s}}.731, 78^{\circ}13'23''.10)$  (J2000) (Skrutskie *et al.* 2006). As interactions of NGC2655 with other galaxies have been identified by Sparke *et al.* (2008), the LSB Galaxy's proximity to NGC2655 is of possible related interest.

In consideration of the LSB Galaxy's presentation with a diffuse body and concentrated peak region, we identify three records in The Guide Star Catalog, Version 2.3.2 (Lasker *et al.* 2008) across the LSB Galaxy (Figure 1), each of which reports magnitude data in the POSS-II IIIaJ+GG385 ( $B_j$ ) photographic band (Reid *et al.* 1991). Object N7B0004771<sup>2</sup> presides near the peak of the LSB Galaxy at 21.44 mag  $B_j$ . Object N7B0004791<sup>3</sup> is identified near the center of the

<sup>1</sup> Pan-STARRS1 stack 2606.067 i (Chambers *et al.* 2016)

<sup>2</sup> N7B0004771 entry via Vizier (Ochsenbein *et al.* 2000)

<sup>3</sup> N7B0004791 entry via Vizier (Ochsenbein *et al.* 2000)



**Figure 1.** The LSB Galaxy is revealed by the source data (Frederick Steiling) in a field with NGC2655, and both cropped linear and non-linear processes of the source data present diffuse galactic morphology. Confirmation data (Dan Crowson) and a FITS-cutout from the Pan-STARRS1 Surveys (Chambers *et al.* 2016) reveal similar LSB Galaxy presentations. Records N7B0004771 (A), N7B0004791 (B), and N7B0004813 (C) from The Guide Star Catalog, Version 2.3.2 (GSC2.3.2) (Lasker *et al.* 2008) are annotated in the non-linear process of the source data in support of the LSB Galaxy’s presentation. All images are rotated to a North-up orientation.

LSB Galaxy at 21.89 mag  $B_j$ . Object N7B0004813<sup>4</sup> is found opposite the peak signal at 22.11 mag  $B_j$ . These data support the source analysis that the LSB Galaxy presents with peak signal near  $(\alpha, \delta) = (8^{\text{h}}50^{\text{m}}25^{\text{s}}.9, 78^{\circ}28'51''.8)$  (J2000).

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*Software:* Aladin (Bonnarel *et al.* 2000), Astropy (Astropy Collaboration *et al.* 2013), VizieR Catalogue Access Tool (Ochsenbein *et al.* 2000)

<sup>4</sup> N7B0004813 entry via VizieR (Ochsenbein *et al.* 2000)

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