Abstract

We report the discovery of a new supernova remnant (SNR) candidate in the narrow-band [Fe II] 1.64μm line imaging survey UWIFE (UKIRT Wide-field Infrared Survey for Fe). UWIFE covers the first quadrant of the Galactic plane (γ < 1° 62, b < 1° 5), and, by visual inspection, we have found 390 extended ionized Fe objects (IFOs) in the survey area. Most of IFOs are associated with SNRs, young stellar objects, HII regions, and planetary nebulae; about 12% of IFOs are not associated with any known astronomical objects, and the SNR candidate, IFO J183740, J1837+0041 (hereafter IFO J183740) is one of these.

IFO J183740 is a 6° long, faint, arc-like filament with small-scale irregular structures. It appears to be a portion of a circular loop, but the rest of the loop is not seen in [Fe II] emission. It is found to coincide with a well-defined radio continuum arc. The radio arc has a complicated morphology, and IFO J183740 coincides with the bright inner part of the radio arc. Hydrogen recombination lines have been detected toward the radio arc from low-resolution surveys, so it has been known as an HII region (G23.8+0.2). But the inside of this radio arc is filled with soft X-rays, white, just outside the arc to the north, there is hard X-ray nebula harboring a young pulsar. Therefore, the nature of this arc-like structure seen in radio and [Fe II] emission is uncertain.

We present the results of follow-up spectroscopic study of IFO J183740 using IGRINS (Immersion Grating Infrared Spectrograph) which is high spectral resolution (R~40,000) spectrograph covering H and K-bands, simultaneously. We have found that the [Fe II] filaments are spatially and kinematically distinct from the HII filaments. The intensity ratios of [Fe II] to Brγ lines suggest that the HII filaments are photoionized while the [Fe II] filaments are shock-ionized, which make the spectral SNR candidate origin for IFO J183740. We discuss the association of IFO J183740 with other sources in the region.

UIRKT Wide-field Infrared Survey for Fe+ (Lee et al. 2014)

Unbiased imaging survey using narrow-band filter with central wavelength of 1.644μm, covers the 4th Galactic quadrant (γ < 1° 62, b < 1° 5).

Extended Ionic Fe Object (IFO) catalog (Kim et al. in preparation)

- Identify all diffuse IFO in the survey area using continuum-subtracted emission line image
- ~900 diffuse IFOs are identified
- IFO J183740 is a shell-like IFO located near HII region G23.8+0.2
- [Fe II] flux ~ 2.49 x 10^-14 W/m²

Faint radio ring which surrounds diffuse X-ray emission is suggestive of SNR / molecular cloud system.

Radio structure

1. Very faint, large scale radio shell
   - ~301'-36 pc with d = 6.5 kpc
2. Bright, small radio arc coincide with [Fe II]
   - ~6'-11 pc, known as HII region G23.8+0.2, which makes the spectral measurement of the faint ring (difficult)

X-ray diffuse emission & pulsar

- X-ray counterpart of gamma-ray source 3EG J1837-0610 is detected (Sakamoto & Kawai 2003)
  - X-ray diffuse emission & pulsar detection
  - Millimeter-wave molecular emission rotation line observation suggests pulsar & molecular cloud system.

- X-ray pulsar AX J1837-0610 is studied in detail (Lin+2008)
  - Coincident with PWN candidate in the study of Sakamoto & Kawai 2003.
  - Candidate period of pulsar is 0.17 s with characteristic age of 1700 yr.
  - Faint radio ring which surrounds diffuse X-ray emission is suggestive of SNR / molecular cloud system.

Infrared structure

- Faint shell which coincides with [Fe II] & molecular cloud is observed.

Figure 1: Observation coverage of UWIFE survey.

References

(6) Alberto et al. 2003, The nature of unidentified Galactic high-energy gamma ray sources: Proceedings of the workshop held at Tottori University, Puebla, Mexico, 9-10 October 2003
(7) Yu+2010, SPIE, 7735L, SMY

A Supernova Remnant Candidate in the UWIFE Survey

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