

Periodic Dust Formation around WR 140; Dust Properties Examined by the Multi-Epoch Mid-Infrared SED Analyses

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Massive stars are expected to play an important role in predominately supplying metal elements and dust particles into the interstellar space in the early universe due to their short lifetime in the main sequence. The amount of newly formed dust in the ejecta of a supernova obtained from the observational results, however, remains only in a range of 10^{-3} - $10^{-5}M_{\text{sun}}$, which is much smaller than the amount of dust needed for a SN to form to account for the dust content in the early universe. Recent observations of dust-forming type-Ib supernova 2006jc made with AKARI and Spitzer have shown that the newly-formed dust in the SN ejecta is also only in the range of 10^{-4} - $10^{-5}M_{\text{sun}}$ (Sakon et al. 2009; Mattila et al. 2008), but they recognize the presence of pre-existing circumstellar dust possibly formed in the mass loss wind associated with the events prior to the SN explosion. Recent studies reveal that many of the Wolf-Rayet stars form in binary system and that around 10% of WR stars may form carbon-rich dust in their wind-wind collision zone whenever the secondary passes by the periastron point of the primary. Therefore, whether or not such WR binary systems should have made significant contribution toward supplying dust particles in the early universe has to be verified from the observational point of view. In this presentation, we present the results of the multi-epoch Mid-Infrared observations of a long period ($P=7.93$ years; Williams 2011) colliding-wind Wolf-Rayet binary system WR140 with Subaru/COMICS. The observations have been carried out over 3 years since after the last periastron event in 2009. The properties of dust in the expanding concentric arc structures (see Fig. 1) formed during the 2001 and 2009 periastron events are examined based on the mid-infrared SED analyses.

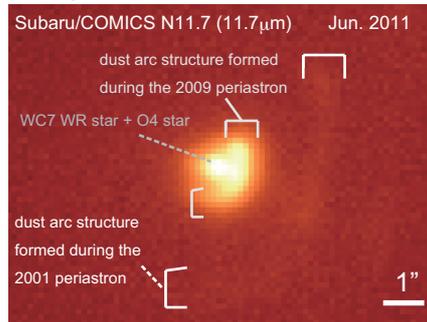


Figure 1: Subaru/COMICS N11.7 band image of WR140 on June 2011 (orbital phased =0.3)

References

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- [2] I. Sakon, et al. 2009, ApJ, 692, 546
- [3] P. Williams, 2011, BSRSL, 80, 595