

Obscured Supernovae in Starburst Galaxies

Seppo Mattila¹, Peter Meikle², Robert Greimel³, and Petri Väisänen⁴

¹Queen's University Belfast, Belfast, UK, email: s.mattila@qub.ac.uk

²Imperial College London, London, UK

³Isaac Newton Group of Telescopes, La Palma, Spain

⁴South African Astronomical Observatory, Cape Town, South Africa

1. Introduction

About one core-collapse supernova (CCSN) is expected to explode every 5-10 years in the nuclear regions of M 82 and other nearby starburst galaxies. In luminous infrared galaxies (LIRGs) such as the interacting system Arp 299 (NGC 3690 + IC 0694) at least one CCSN can be expected every year. Due to the high dust extinction most of these SNe have remained undetected. Here we show results from two near-IR searches we have recently carried out to detect obscured SNe in nearby starburst galaxies and LIRGs.

2. Near-IR SN Searches

We used the William Herschel Telescope (WHT) to monitor the 40 most IR luminous nearby (within 45 Mpc) starburst galaxies in the northern hemisphere in the Ks band between 2001 and 2005. This yielded the discoveries of two obscured SNe ($A_V \sim 4$) both within the nuclear (central kpc) regions of their host galaxies, SN 2005U (Mattila *et al.* 2005a) in Arp 299 and SN 2005V (Mattila *et al.* 2005b) in NGC 2146. In addition, optical searches discovered two more SNe during our search period: an obscured ($A_V \sim 5$) SN 2004am within the nuclear regions of M 82 and an unobscured SN 2004gt outside the nuclear regions of NGC 4038/9 both of which were also observed by us. The extinctions towards the detected SNe are significantly lower than expected (see Mattila & Meikle 2001) although our search was sensitive to nuclear (central kpc) SNe with $A_V \sim 20$. The lack of detections of SNe with very high A_V could be explained by their strong concentration towards the nuclei of our targets as has been recently shown for Arp 220 by deep VLBI observations (Lonsdale *et al.* 2006).

To test if adaptive optics (AO) could be used for detecting highly obscured SNe within the innermost nuclear regions of LIRGs we carried out a pilot SN search using the Naos Conica (NACO) AO system on the Very Large Telescope (VLT). We obtained pairs of Ks band images with a successful AO correction for a sample of 10 nearby LIRGs. Image subtraction techniques yielded the discovery of an apparent SN at 500 pc from the nucleus of one of our targets, IRAS 18293-3413. The SN was confirmed in Ks band NACO follow-up images obtained within 2 weeks from the discovery. From the discovery magnitude we estimate a likely lower limit of $A_V \sim 4$ for this SN.

References

- Lonsdale, C.J., Diamond, P.J., Thrall, H., Smith, H.E., & Lonsdale, C.J. 2006, *ApJ* 647, 185.
Mattila, S., & Meikle, W. P. S. 2001, *MNRAS* 324, 325.
Mattila, S., Greimel, R., Gerardy, C., & Meikle, W. P. S. 2005a, *IAU Circ* 8473.
Mattila, S., Greimel, R., Gerardy, C., & Meikle, W. P. S. 2005b, *IAU Circ* 8474.