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Two New Massive Binary Stars in the Magellanic Clouds

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Abstract. The discovery and preliminary spectroscopic orbits of two early O type binaries in very young open clusters in the Magellanic Clouds is reported. The binaries are NGC 346–1 in the Small Magellanic Cloud, and HDE 270145 in NGC 2122 in the Large Magellanic Cloud.

1. Introduction and Observations

Searching and analyzing binaries among the massive stars in a galaxy is important for several reasons. Most importantly, because several open clusters contain stars with observed luminosities indicating masses higher than 120 $M_{\odot}$ when compared with stellar evolutionary models. However, no O type star in a binary system is known to be more massive than 50 $M_{\odot}$.

Searches and studies of massive spectroscopic binaries are lacking for our nearest neighbour galaxies, the Magellanic Clouds. Therefore we have started an on–going program aiming to find and analyze spectroscopic binaries among the brightest and earliest O type members in open clusters of the Magellanic Clouds. Here I present the discovery and preliminary spectroscopic orbits of two early O type binaries in very young open clusters of the Magellanic Clouds.

Blue digital spectral images were obtained at two different Observatories, namely at Cerro Tololo Inter-American Observatory (CTIO) in Chile, and Complejo Astronómico El Leoncito (CASLEO)[1] in San Juan, Argentina. The observations at CTIO were performed with the two-dimensional photon-counting detector (2DF) and Cassegrain spectrograph attached to the 1m telescope. The observations at CASLEO were obtained with the Cassegrain and REOSC sepctrographs with CCD detectors attached to the 2.15m telescope.

All spectral images have been processed with IRAF routines at La Plata Observatory, Argentina.

[1]Operated under agreement between CONICET, SeCyT, and the Universities of La Plata, Córdoba and San Juan, Argentina

2. Results

Confirming an old saying among astronomers, that the *brightest star in each open cluster is (at least) a binary*, the present study of radial velocities of early O type stars in young open clusters in the Magellanic Clouds discloses two new spectroscopic binaries, namely: the brightest star (No. 1 in Walborn 1978) in the core of NGC 346, the ionizing cluster of the largest H II region in the Small Magellanic Cloud, and the most luminous star (HDE 270145 = LH117–43) in the open cluster NGC 2122 in the Large Magellanic Cloud.

The spectral type of NGC 346–1 was determined by Walborn & Blades (1986) as O4 III(f), and as O5.5 If by Massey, Parker & Garmany (1989). In a previous radial velocity study of NGC 346 cluster members (Niemela, Marraco & Cabanne 1986) NGC 346–1 was suspected to be a binary with a period longer than 15 days. Combining these previous data with values from new spectra, confirms that the radial velocity of NGC 346–1 is variable. A period search algorithm applied to all data produces as the best period 127.4 days. In this period the radial velocities describe an elliptic binary orbit. However, with the present data set other periods are also possible.

The H II region NGC 2122 in the Large Magellanic Cloud contains an open cluster (LH 117) with many O type stars, (Garmany & Walborn 1987; Massey et al. 1989). Spectra of 3 stars classified as O3–4 in this cluster were obtained at CASLEO in 1999. The brightest of these, HDE 270145 = LH 117–43, was discovered to have variable radial velocity. A period search algorithm found the most probable period to be 6.7 days, in which the radial velocities of HDE 270145 describe an elliptic orbit. The spectrum of this star has been classified as O4:III(f) by Conti, Garmany & Massey (1986). However, the present spectra show an O6-7 If type spectrum, rather different from the previous classification.

Preliminary orbital elements for both binaries are listed in Table 1.

Table 1. Preliminary Orbital Elements for NGC 346-1 and HDE 270145

Star	Period [days]	Spectral type	e	K [km s^{-1}]	V_0 [km s^{-1}]	F(M) [$M_\odot$]
NGC 346-1	127.4	O4f+O:	0.4	57	157	1.8
HDE 270145	6.70	O6-7If+O:	0.4	110	212	0.7

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