An Update on Massive Binaries in Cygnus OB2

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The Cygnus OB2 Association contains one of the largest collections of massive stars in the Galaxy. Since 1999 we have been conducting a radial velocity monitoring program on >140 Cyg OB2 stars in order to determine:

• The binary frequency among massive stars
• The distribution of mass ratios, \( q = m_1/m_2 \), where \( p(q) \propto q^\alpha \)
• The distribution of semi-major axes, \( p(\log a) \propto (\log a)^\beta \)
• The incidence of “runaway” stars

Our goal is to provide basic data to inform theories of the formation of massive stars and the formation of energetic events such as some classes of supernova and gamma ray bursts that arise from massive binary progenitors.

Figure 1 shows the Cyg OB2 association and the locations of presently known massive binaries. Preliminary results of the survey were presented in Kiminki, Kobulnicky, et al. (2007), Kobulnicky & Fryer (2007) and Kiminki, McSwain, & Kobulnicky (2008). These works suggested that

1) The binary frequency is high, in the range 70-100%.
2) The index, \( \alpha \), describing the distribution of mass ratios is near zero, i.e., a flat distribution of mass ratios.
3) The index, \( \beta \), describing the distribution of separations is approximately flat in log space, i.e., the “Opik’s Law” distribution.
4) Among 17 massive binaries, we found only one “twin” system with \( q \approx 1 \)
5) We have found no “runaways”

Figures 2-5 illustrate some of our most recent discoveries. Table 1 summarizes the 17 massive binaries now known in Cygnus OB2—the most known in any cluster or association. Ten of the systems are from our work, and we anticipate many more SB1 and perhaps more SB2 systems over the next few years.

Table 1 – A summary of massive binaries in Cyg OB2 with orbital solutions. The 17 systems represent the most of any single cluster or association. Ten of the systems are from our work, and we anticipate many more SB1 and perhaps more SB2 systems over the next few years.

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