

Critical Differences and Clues in Eta Car's 2009 Event

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We monitored Eta Carinae with {it HST/} WFPC2 and {it Gemini/} GMOS throughout the 2009 spectroscopic event, which was expected to differ from its predecessor in 2003. Here we report major observed differences between events, and their implications. Some of these results were quite unexpected. (1) The UV brightness minimum was much deeper in 2009. This suggests that physical conditions in the early stages of an event depend on different parameters than the ``normal" inter-event wind. Extra mass ejection from the primary star is one possible cause. (2) The expected ion{He}{2} λ 4687 brightness maximum was followed several weeks later by another. We explain why this fact, and the timing of the λ 4687 maxima, strongly support a ``shock breakup" hypothesis for X-ray and λ 4687 behavior as proposed 5--10 years ago. (3) We observed a polar view of the star via light reflected by dust in the Homunculus nebula. Surprisingly, at that location the variations of emission-line brightness and Doppler velocities closely resembled a direct view of the star; which should not have been true for any phenomena related to the orbit. This result casts very serious doubt on all the proposed velocity interpretations that depend on the secondary star's orbital motion. (4) Latitude-dependent variations of ion{H}{1}, ion{He}{1} and ion{Fe}{2} features reveal aspects of wind behavior during the event. In addition, we discuss implications of the observations for several crucial unsolved problems.

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