N61a Diffraction-limited speckle interferometry of R CrB at maximum and minimum light

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We present the first speckle interferometric observation of R CrB, the prototype of a class of peculiar stars which undergo irregular declines in their visible light curves. The observations were carried out with the 6 m SAO telescope near maximum light ($V = 7$, 1996 Oct. 1) and at minimum light ($V = 10.61$, 1999 Sep. 28). A spatial resolution of 75 mas was achieved in the K-band. The dust shell around R CrB is partially resolved, and the visibility is approximately 0.8 at a spatial frequency of 10 cycles/arcsec. The two-dimensional power spectra obtained at both epochs do not show any significant deviation from the circular symmetry. The visibility function and spectral energy distribution obtained near maximum light can be simultaneously fitted quite well with a model consisting of the central star and an optically thin dust shell with density proportional to r^{-2}. The inner boundary of the shell is found to be 85 $R_\star$ (20 mas) with the temperature 800 K. However, the visibility observed at minimum light is indicative of an additional unresolved component. We propose that this may be attributed to a newly formed optically thick dust cloud, which is not yet large enough to be resolved. The visibility and spectral energy distribution are well reproduced with a model consisting of the central star, a dust cloud whose radius and temperature are 4 $R_\star$ and 1200 K, respectively, and an optically thin dust shell with an inner boundary of 120 $R_\star$ and a temperature of 700 K. The inferred cloud size is in favor of dust formation very close to the star, ~ 2 $R_\star$.