our 25 timing measurements, a total of 83 times of minimum light spanning about 66 yr were used for a period study. It was found that the orbital period of GX Aur has varied due to two periodic oscillations superposed on an upward-opening parabolic variation. The long-term period increase rate is deduced as $+9.636\times10^{-10}$ d yr^{-1}, which can be produced as a mass transfer from the secondary star to the primary at a rate of 3.136×10^{-6} $M_\odot$ yr^{-1}, among the largest rates for contact systems. The periods and semi-amplitudes of the two periodic variations are about P_3 = 8.7 yr and P_4 = 21.2 yr, and K_3 = 0.011 d and K_4 = 0.017 d, respectively. The most reasonable explanation for both cycles is a pair of light-travel-time effects driven by the possible existence of an unseen third and fourth components with projected masses of M_3 = 0.91 $M_\odot$ and M_4 = 1.09 $M_\odot$ in eccentric orbits of e_3 = 0.13 and e_4 = 0.73. Because no third light was detected in the light curve synthesis, each circumbinary object could be a compact star or a binary itself.

[구 ST-04] Apsidal motions of 90 eccentric binary systems in the Small Magellanic Cloud

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We examined thousands of light curves of stars brighter than 18.0 mag in I band and less than mean magnitude error of 0.1 mag in V band from the OGLE-III eclipsing binary catalogue, and found 90 new binary systems exhibiting apsidal motion. In this study, the samples of apsidal motion stars in the SMC were increased by 250 percent than previously known. In order to determine the period of the apsidal motion for the binaries, we analysed in detail both light curves and eclipse timings using the MACHO and OGLE photometric database obtained for about 20 yrs. For the eclipse timing diagrams of the systems, new times of minimum light were derived from the full light curve combined at intervals of one yr from the survey data. The binaries presented in this paper have apsidal motion periods in the range of 12-918 yrs. An additional short-term oscillation was detected in five systems (OGLE-SMC-ECL-1634, 1947, 3035, 4946, and 5382), which most likely arise from the existence of a third body orbiting each eclipsing binary. All of the selected systems can be used for the statistical study of the interior structure of the stars in the SMC through their apsidal motions due to the homogeneous data and consistent analysis methods.

[구 ST-05] Wolf-Rayet star evolution with clumpy envelope structure.

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It is well known that theoretical models of Wolf-Rayet stars are not consistent with observational data in terms of temperature and stellar radius. Recent study in analytical and numerical simulations show the importance of density inhomogeneity in stellar envelope. Using 1-dimensional numerical simulations, we study how such clumpiness arisen over convective surface of Wolf-Rayet stars affect their evolutionary path. Starting from pure helium star models, we constructed 21 different initial conditions by varying stellar mass, metallicity, and the clumpiness of the sub-surface convection zone. We run the simulations until the oxygen-burning is reached and find that the influence of the clumpiness is sensitive to the initial metallicity. Our models with high metallicity including the effect of the density inhomogeneity can roughly explain the observed properties of Wolf-Rayet stars such as stellar radius and temperature. By contrast, despite a considerable amount of density inhomogeneity is given, low metallicity models could not fully explain observations. To understand the inconsistency in low metallicity models, detailed study with improved model is required, taking account of the error range of the observations.

[구 ST-06] Infrared-Visible Photometric Analyses of Core-collapse Supernovae and Supernova Dust Formation

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We present multiband photometric analyses of