New precision V & R light curves of the eclipsing binaries V1033 Her and V1044 Her have been obtained using the 41-cm telescope at the Eastern University Observatory equipped with an SBIG ST-10XME CCD.

V1033 Her (SSC 2066:1210, P = 0.2981 days, m = 11.2) has only one published unfiltered light curve (Blattler and Diethelm 2001a) with significant scatter in the data. The system was observed seven nights from 15 Jun - 20 Jul 2005, accumulating approximately 540 observations in both V and R. All published times of minimum light were analyzed resulting in the refinement of the star’s ephemerides to 2452056.41435 + 0.2989025(11)E. Since monitoring began in 1999 the period of the system has been constant. The light curves show distinctly that the system is totally eclipsing. Analysis using Wilson-Devinney (1971; 1992) differential corrections (DC) indicates that this binary is W-type (the larger, more massive star is the cooler component), has a mass ratio of 0.287, a small temperature difference between the stars of 374 K, and a fillout of 0.294. The complete list of parameters is given in a table below.

V1044 Her (SSC 2071:837, P = 0.2406 days, m = 12.5) is a partially eclipsing overcontact system of very short period and relatively deep eclipses of 0.6 mag in R. The previously published unfiltered light curve given by Blattler and Diethelm (2001b) has too much scatter for reliable analysis. V1044 Her was observed on eleven nights from 5 Jun - 10 Jul 2005, accumulating more than 800 observations in both V and R. All published times of minimum light were analyzed resulting in the refinement of the star’s ephemerides to 2452055.5004(3) + 0.2404028(7)E. Since monitoring began in 2001 the period of the system has been constant.

Determining a unique mass ratio from partially eclipsing light curves is nearly impossible. Even with a fairly deeply eclipsing system like V1044 Her, the range of possible mass ratios is extensive. This is shown in the ‘Q-method’ graph below which plots mass ratio versus the sum of the squares of the residuals as determined from Wilson-Devinney differential corrections (DC). Each dot represents a different mass ratio which was held constant while varying other parameters (inclination, i, omega, L) in order to achieve a best fit (the infamous ‘q-method’). In each case the DC program converged to a robust solution where the suggested parameter corrections were usually smaller than their formal probable errors. The result of this clearly demonstrates that the mass ratio is indeterminate from the light curves. Essentially any mass ratio from 0.55 to 1.00 gives nearly the same fit. Interestingly, although most of the parameters cannot be uniquely determined, the inclination and temperature difference between the two stars hardly varied at all within this mass ratio range. So the inclination of the system (i = 41°) and the temperature difference (ΔT = 200 K) are fairly well determined.

To show how close the solutions actually are, we plot the “best” fit (mass ratio = q = 0.55 which by definition is an A-type overcontact system, not to be expected from such a short period binary) as well as a “typical” mass ratio of (q = 1.35) which is far more likely for a W-type solution of this very short period system. The resulting light curves from the two solutions are virtually indistinguishable to the eye. Obviously the final solution to this overcontact binary must await a spectroscopic study and radial velocity solution in order to uniquely determine the mass ratio as well as absolute parameters.

V1033 Her with inner and outer Lagrangian surfaces

V1044 Her with outer Lagrangian surfaces