

Dynamical investigations of the multiple stars

Kiyaeva O., Zhuchkov R.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2017 O. V. Kiyaeva and R. Y. Zhuchkov Two multiple stars — the quadruple star Bootis (ADS 9173) and the triple star T Tauri were investigated. The visual double star Bootis was studied on the basis of the Pulkovo 26-inch refractor observations 1982-2013. An invisible satellite of the component A was discovered due to long-term uniform series of observations. Its orbital period is 20.2 years. The known invisible satellite of the component B with near 5 years period was confirmed due to high precision CCD observations. The astrometric orbits of the both components were calculated. The orbits of inner and outer pairs of the pre-main sequence binary T Tauri were calculated on the basis of high precision observations by the VLT and on the Keck II Telescope. This weakly hierarchical triple system is stable with probability more than 70%.

<http://dx.doi.org/10.1515/astro-2017-0019>

Keywords

Bootis, Individual, Multiple stars, T Tauri

References

- [1] Aarseth, S. J., Sverre, J. 2003 Gravitational N-Body Simulations, In Gravitational N-Body Simulations, ISBN 0521432723, Cambridge, UK: Cambridge University Press, pp. 430.
- [2] Bakos, G.A. 1986, *Astron J.*, 91(6), 1416-1417.
- [3] Dyck, H.M., Simon, T., Zuckerman, B. 1982, *Astrophys. J.*, 255, 103-106.
- [4] Izmailov, I. S., Khovrichева, M. L., Khovrichев, M. Yu., Kiyaeva, O. V., Khrutskaya, E. V., Romanenko, L. G. et al. 2010, *Astron. Lett.*, 36, 349-354.
- [5] Izmailov, I. S., Roshchina, E. A., Kiselev, A. A., Kiseleva, T. P., Kalinichenko, O. A., Bykov, O. P. et al. 2016, *Astron. Lett.*, 42, 41-54.
- [6] Izmailov, I. S. and Roshchina, E. A. 2016, *Astrophys. Bull.*, 71, 225-231; <http://izmccd.puldb.ru/vds.htm>.
- [7] Kiselev, A. A., Kiyaeva, O. V. 1980, *Sov. Astron.*, 24, 708-716.
- [8] Kiselev, A. A., Kiyaeva, O. V., Izmailov, I. S., Romanenko, L. G., Kalinichenko, O. A., Vasil'kova, O. O. et al. 2014, *Astron. Rep.*, 58(2), 78-97.
- [9] Kiyaeva, O.V. 1982, *Izv. Glavn. Astron. Observ. Pulkovo*, 199, 13-18.
- [10] Kiyaeva O. V. 1983, *Sov. Astron.*, 27, 701-706.
- [11] Kiyaeva, O.V. 2006, *Astron. Lett.*, 32(12), 836-844.
- [12] Kiyaeva, O.V., Gorynya, N.A. 2015, *Astronomy Letters*, 41(8), 417-424.
- [13] Kiyaeva, O.V., Romanenko L.G., Zhuchkov R.Ya. 2017, *Astronomy Letters*, 43(5), 316-331.
- [14] Koehler, R., Ratska, T.M., Herbst, T. and Kasper, M. 2008, *Astron. and Astrophys.*, 482(3), 929-938.
- [15] Koehler, R., Kasper, M., Herbst, T., Ratska, T., Bertrang G. H.-M. 2016, *Astron. Astrophys.*, 587, 35-42.

- [16] Koresko C.D. 2000, *Astrophys.J.*, 531(2), 147-149.
- [17] Loinard, L., Torres, R.M., Mioduszewski, A.J., Rodriguez, L.F., Gonzalez-Lopezlira, R.A., Lachaume, R. et al. 2007, *Astrophys. J.*, 671(1), 546-554.
- [18] Mason, B.D., Wycoff, G.L., Hartkopf, W.I., The Washington Visual Double Star Catalogue (Washington: US Naval Observatory, <http://ad.usno.navy.mil/wds/wds.html>, 2016).
- [19] Orlov V.V. and Zhuchkov R. Ya. 2005, *Astron. Rep.*, 49(3), 201-216.
- [20] Schaefer, G.H., Prato, L., Simon, M., Patience J. 2014, *Astron.J.*, 147(6), 157-178.
- [21] Tokovinin, A.A. 1997, *Astron. & Astrophys. Suppl.*, 124, 75-84.
- [22] Valtonen, M., Myllari, A., Orlov, V. and Rubinov, A. 2008 The Problem of Three Stars: Stability Limit. In *Dynamical Evolution of Dense Stellar Systems*, IAU Symp. No. 246, Cambridge Univ. Press, Cambridge, 209-217.
- [23] Van Leeuwen, F. 2007, *Astron. & Astrophys.*, 474(2), 653-664.
- [24] Zhuchkov R. Ya. and Orlov V. V. 2005, *Astron. Rep.*, 49(4), 274-283.
- [25] Zhuchkov R. Ya., Kiyaveva O.V., Orlov V.V. 2010, *Astron. Rep.*, 54(1), 38-47.