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Physical parameters and dynamical properties of the multiple system ι UMa (ADS 7114)

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Abstract

We analyze the physical parameters, orbital elements, and dynamic stability of the multiple system ι UMa (HD 76644 = ADS 7114). We have used the positions from the WDS catalog and our own observations on the 6-m telescope of the Special Astrophysical Observatory of the Russian Academy of Sciences and the 1.5-m Russian-Turkish Telescope (Antalya, Turkey). We have obtained more precise orbital parameters of the subsystems, and spectral types, absolute magnitudes, and masses of the components. The primary has $Sp = F0\ V\text{-}IV$, $M = 1.7 \pm 0.1M_{\odot}$, $T_{\text{eff}} = 7260 \pm 70\ \text{K}$, and $\log g = 4.30 \pm 0.07$. The companion in the close Aa subsystem is most likely a white dwarf with a mass of approximately $1.0 \pm 0.3M_{\odot}$. The spectral types and masses of the components in the BC subsystem are $M3V$, $M4V$ and $0.35 \pm 0.05M_{\odot}$, $0.30 \pm 0.05M_{\odot}$, respectively. The total mass is $3.4 \pm 0.4M_{\odot}$. The Aa subsystem probably has an orbital period of $4470\ \text{d} = 12.2\ \text{y}$ and an eccentricity of approximately 0.6. The outer subsystem seems to have a period of approximately 2084 yrs and an eccentricity of approximately 0.9. We have carried out simulations using the stability criteria and shown that for all possible variations in the component parameters, the multiple system is unstable on a time scale of less than 10^6 years with a probability exceeding 0.98. Possible reasons for this instability are discussed. © 2012 Pleiades Publishing, Ltd.

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