

Three-dimensional mapping of chemical spots in the magnetic Ap star theta Aur

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Atomic diffusion in quiescent atmospheres of magnetic Ap stars leads to formation of inhomogeneous vertical and horizontal distribution of chemical elements. The presence of these chemical structures is responsible for spectroscopic peculiarities, unusual atmospheric properties, and rotational variability of Ap stars. Until now surface abundance spots and vertical chemical stratification were studied in different stars, as separate, unrelated phenomena. We combined, for the first time, Doppler imaging analysis of the horizontal chemical non-uniformities with constraints on vertical chemical gradients in our study of the Ap star theta Aur. Here we report the first 3-D map of chemical structures in the atmosphere of this Ap star, providing a new insight into the complex physics of interaction between chemical transport processes and magnetic field.