I IL1 Diffusion and magnetic field effects on stellar surfaces

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Chemically peculiar stars form ideal astrophysical laboratories for furnishing a wide range of theoretical and observational aspects of our knowledge of physical processes in stars. Improvements in the quality of observational data and refinement of modelling methods led to an emergence of the new branch of stellar astrophysics which is focused on reconstruction and understanding the origin of three-dimensional structures in the envelopes of peculiar stars. In this contribution I present an overview of recent results of detailed self-consistent modelling of chemical, magnetic and pulsation velocity field structures in the atmospheres of peculiar A stars. New Doppler imaging analyses of magnetic field and chemical inhomogeneities reveal unexpected complexity of the surface formations and suggest an important role of non-magnetic phenomena in shaping the geometry of chemical spots. Consideration of the line shapes observed at very high spectral resolution and simultaneous interpretation of the pulsational variability of different chemical species have made it possible to probe radial dependence of chemical abundances and pulsation characteristics of cool Ap stars. An extension of the Doppler mapping technique to the reconstruction of the structure of non-radial stellar oscillations delivers a solution of the long-standing problem of the pulsational geometry of roAp stars and helps to elucidate the interrelation between pulsations, magnetic field and stellar rotation.