Crimean Astrophysical Observatory

Results of photopolarimetric observations of UX Ori at a uniquely deep minimum

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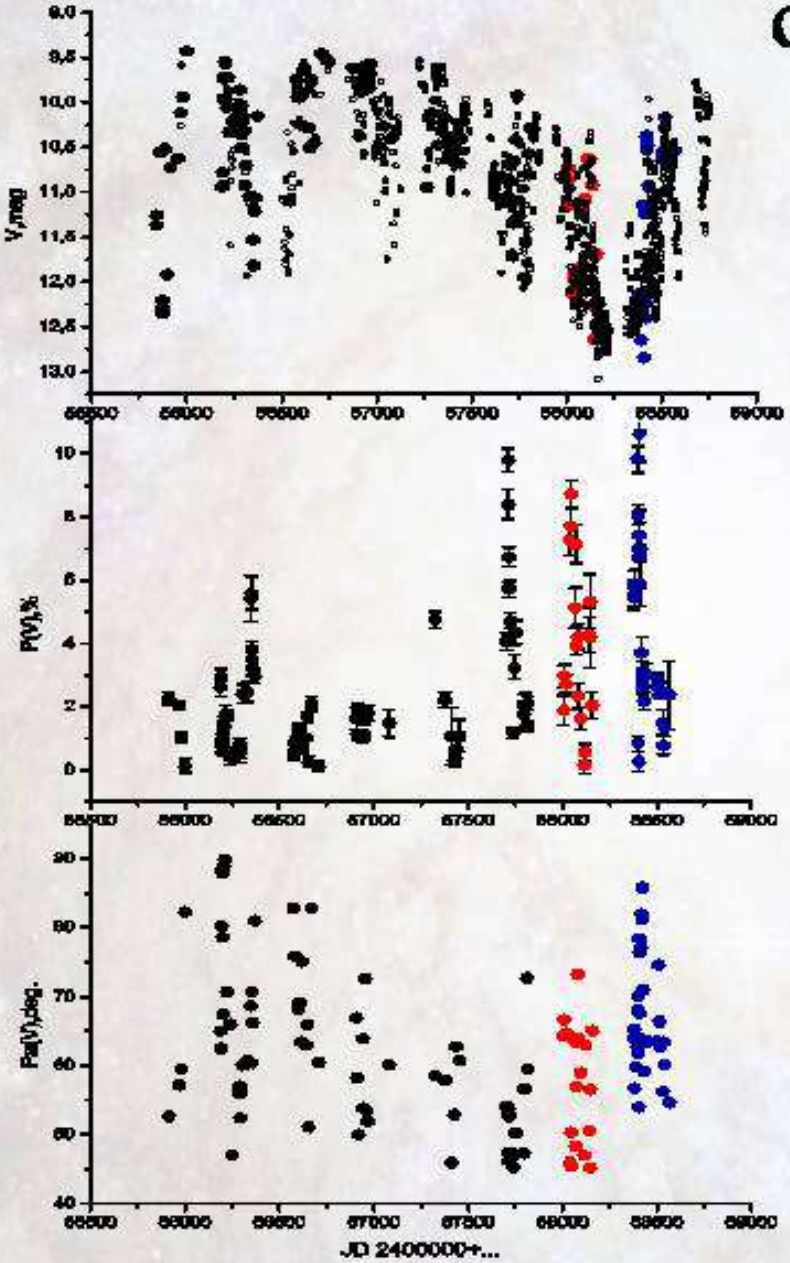
Nauchniy, 2019

Variation of the parameters V, P and Pa as a function of time



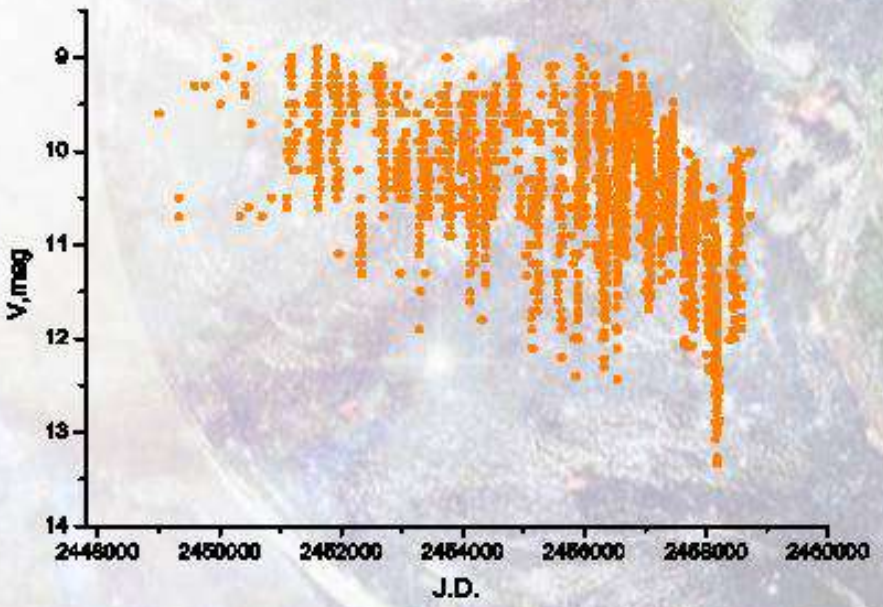
the **black** dotes–CrAO data

the whole **black** dotes–ASAS–SN data

the red dotes–CrAO data at the first season of observation of uniquely minimum

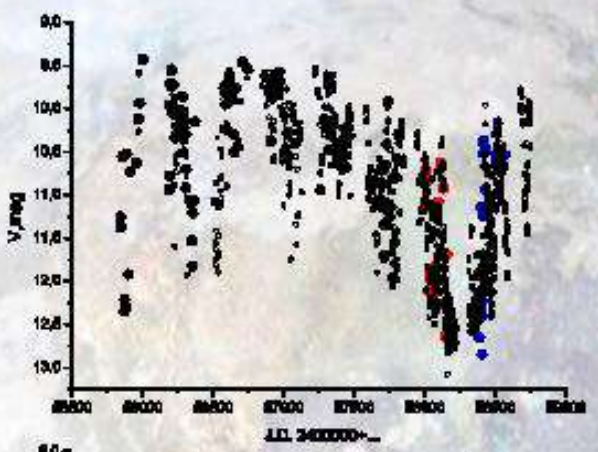
the blue dotes–CrAO data at the second season of observation of uniquely minimum

UX Ori light curve (AAVSO data)

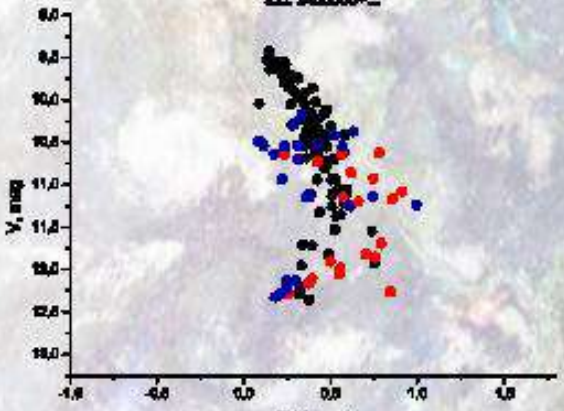


The long minimum of UX Ori observed in 2018–2019 had some characteristics typical for this prototypic UXOR

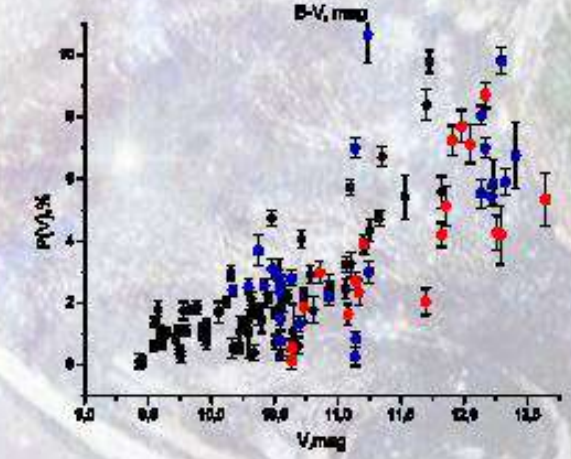
1. Irregular variations consisting of day-scale deep minima overlapping with year-scale variations of average brightness



2. Usual pattern of color variations with initial reddening and then bluing below certain brightness level

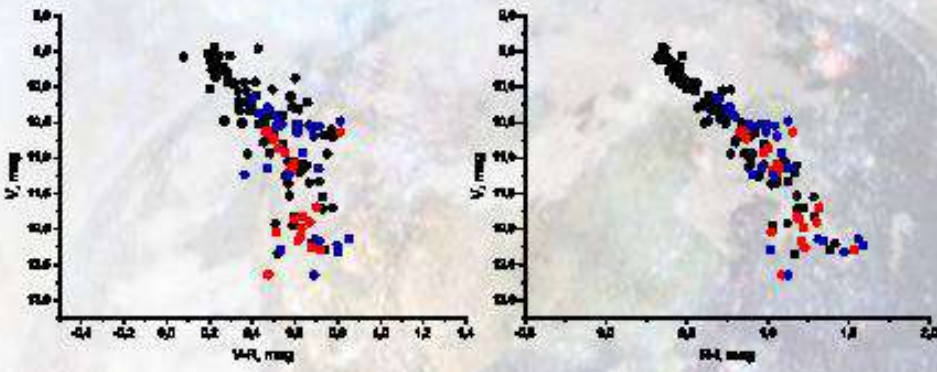


3. Some degree of polarization–brightness correlation

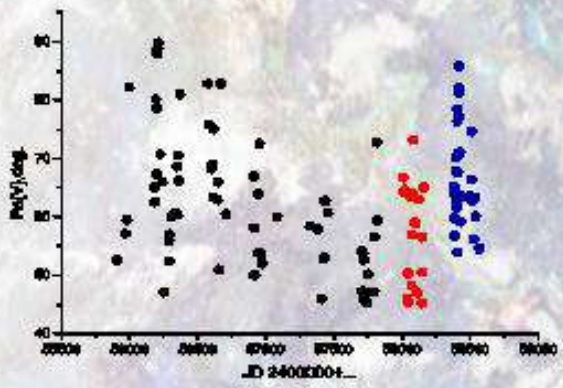


Some characteristics that a less usual and are not easily explained by the simple "variable absorption + constant disk scattering" model

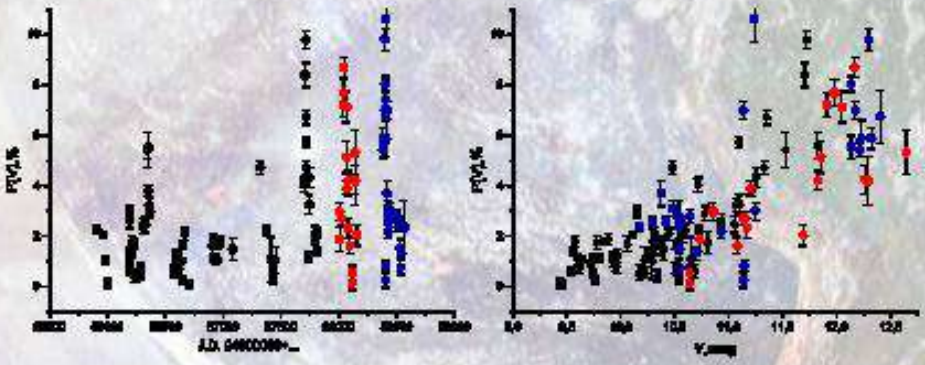
1. Very high degree of polarization (>10%), observed even in the red (R, I) bands, where even in the deepest minima color indexes indicate that non–scattered light still dominates in observed flux.



2.Highly variable Position Angle of polarization



3.Polarization–brightness correlation is far from perfect when one compares data of several years observational seasons or even inside some seasons (note scatter of blue dots at 11.2 mag.)



Interpritation

Position angle variations may be caused by the addition of constant component (usually interstellar) of polarization to the variable component with constant PA. But in such cases PA is unambiguously determined by polarization degree (fig. 1).

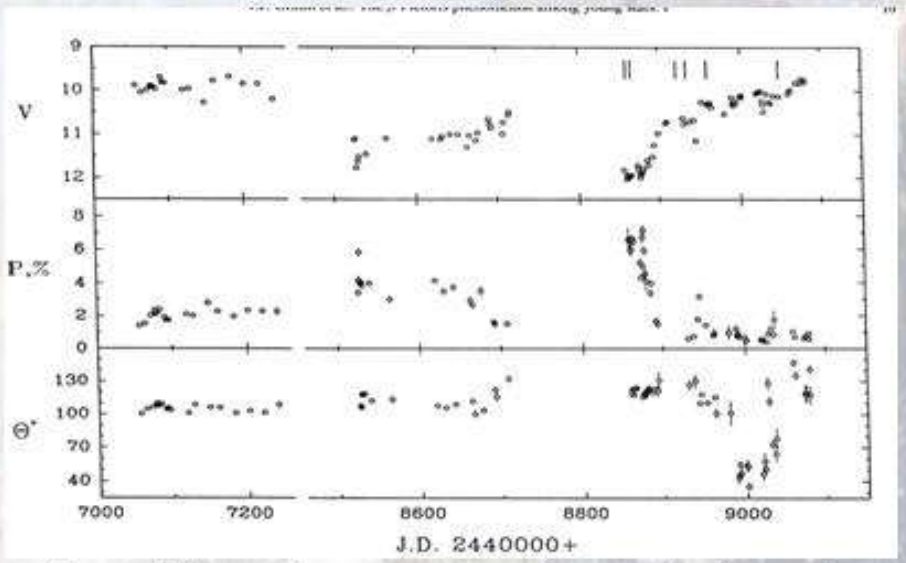


Fig.1 Grinin et. al Astronomy and Astrophysics, Vol. 292, p. 165–174 (1994)

This is not the case for our data as may be seen on fig.2 and fig.3.

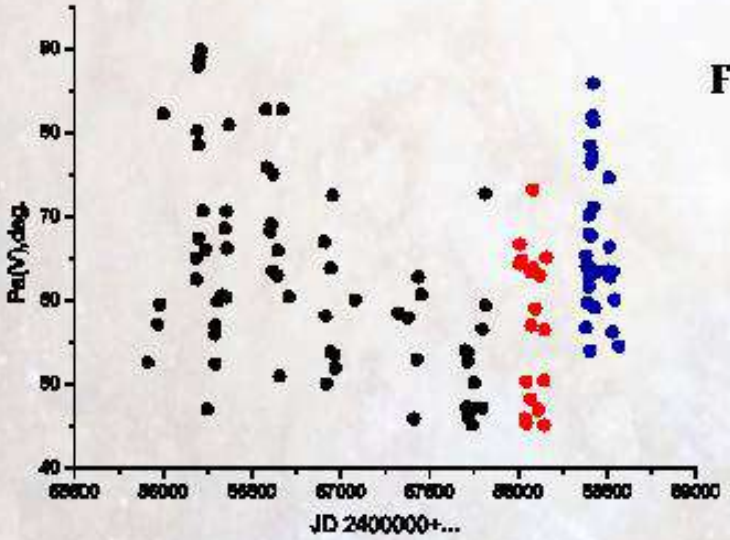


Fig.2

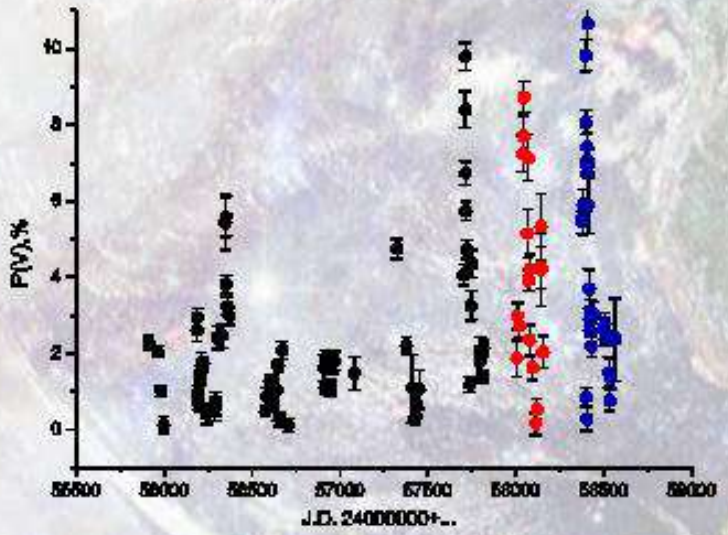


Fig.3

Interpritation

Examining Stokes parameters representation of our data (fig.4), there is no predominant orientation of polarization vector for the whole dataset, and even inside some seasons (red dots). Thus, the variations of position angle with about 45 deg. range are intrinsic and reflect changing geometry of polarization–inducing mechanism. If the mechanism is scattering, gradual change of PA during 3 years of the minimum may be interpreted as gradual changes of scattering geometry due to azimuthally motion of some large–scale dust structure, which caused the long minimum.

But this interpretation does not explain wide variation of polarization parameters on shorter timescale, which also are weakly correlated with brightness variations (fig.5). The alternative interpretation is dichroic absorption by aligned dust grains with varying direction of alignment.

Fig.4

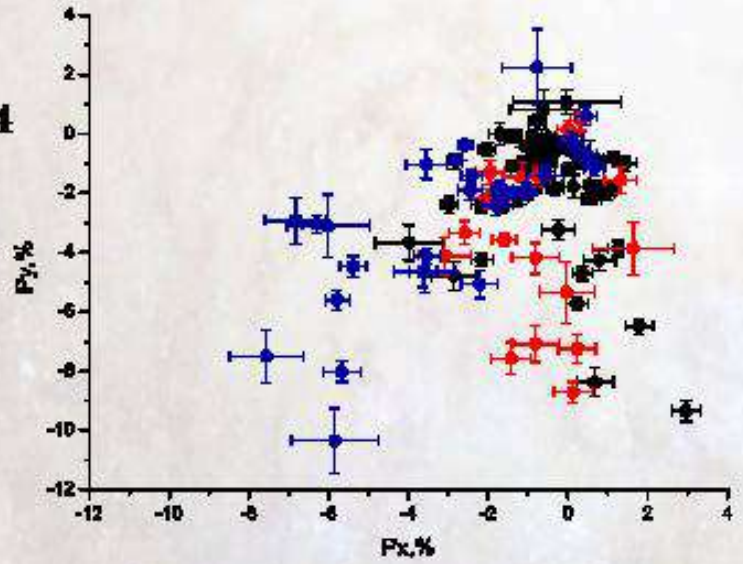
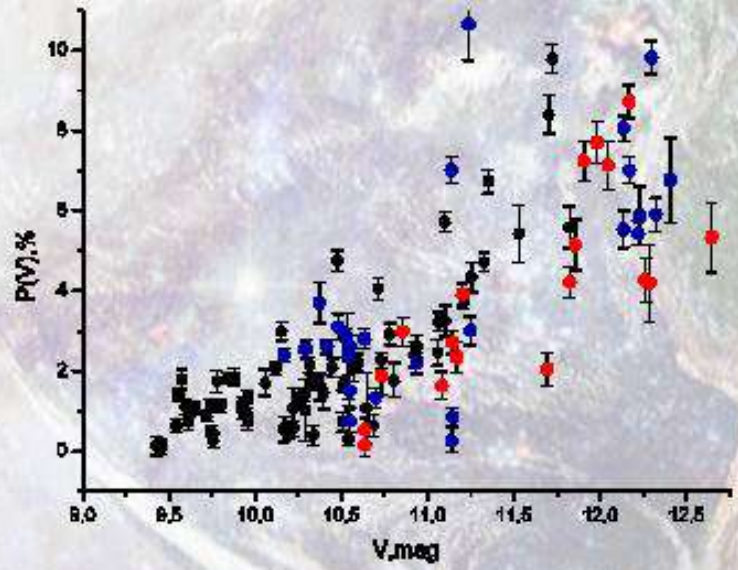


Fig.5



THANKS FOR ATTENTION