The Flaring Corona of UX Arietis

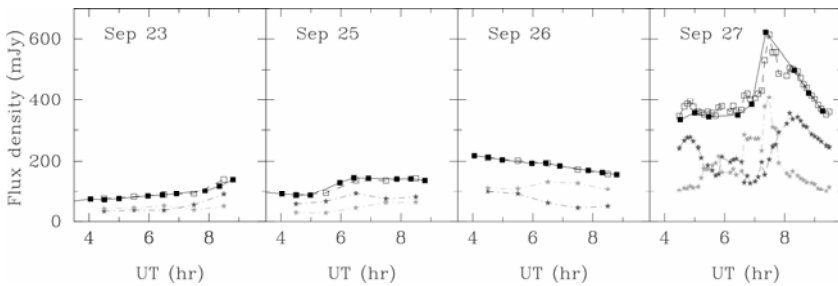## Eduardo Ros & Maria Massi

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Single-dish measurements – Effelsberg

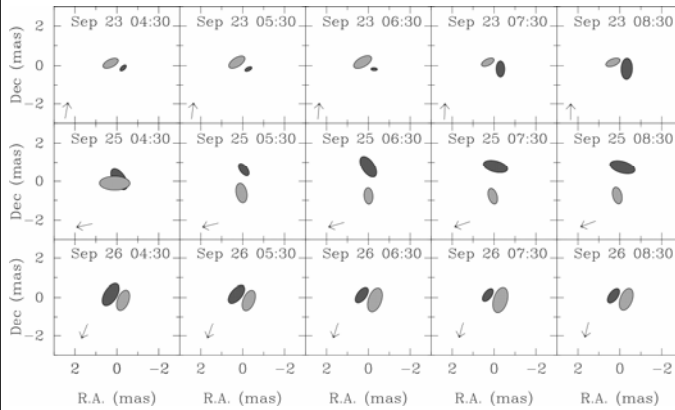

Flux densities during the four observing runs. Filled boxes represent the single-dish Effelsberg measurements (J. Neidhöfer, priv.comm.). Empty boxes show the total flux densities obtained from model fitting the visibility data with the a priori calibration from the observing logs (valid within a 5%). Stars denote flux densities for the two model fit components (A in dark grey, B in light grey).
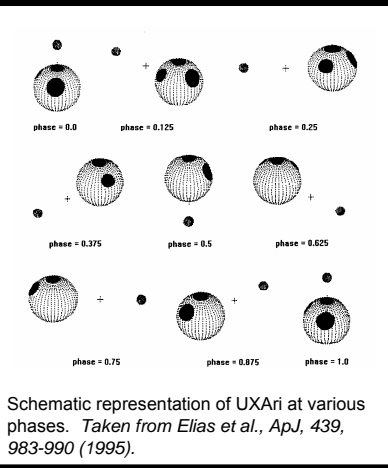
Overview: RSCVn stars are binary systems characterized by intense coronal activity at X-rays, UV, and radio wavelengths. One of the most active sources at radio wavelengths is the system UX Arietis. Here we present the results of four Very Long Baseline Array runs distributed in time to cover the rotational period of 6.44 days. More than the usual (core plus halo) model, the data are well fitted by two Gaussian components. In the first three days the sizes of the two components do not change much from hour to hour but an evident change occur in their relative position and orientation from day to day. The origin of this evolution can be explained by geometrical factors (i.e., star rotation). The fourth day a large flare occurred and dramatic changes in the sizes of the Gaussian components are seen.

Schematic representation of UXAri at various phases. *Taken from Elias et al., ApJ, 439, 983-990 (1995).*

VLBA Model Fitting

September 23rd-26th

Relative positions and sizes for the elliptical Gaussians which model the visibilities of UXAri at epochs 23, 25, and 26 September 2001. We used **1-hr bins** to perform the model fitting. The axis ratio was kept fix at 0.5. We solved for the flux density, position, major axis, and position angle of the major axis. The A component is shown with dark gray tones, the B with light gray. The arrows at the bottom, left represent the P.A. from the optical phase (a phase of 0 implies the K0 IV star to the south, and between the G5V star and the observer).

Observation log

| Exp.	Date	Array	UT Range	Phase
BM140B	Sep 23 2001	VLBA+EB	03:30-09:30	0.46-0.49
BM140C	Sep 25 2001	VLBA+EB		0.78-0.81
BM140E*	Sep 26 2001	VLBA+EB		0.93-0.97
BM140D	Sep 27 2001	VLBA+EB		0.10-0.13

*Observation initially scheduled on Sep 21, but shifted due to scheduling problems in Effelsberg.

A summary

1st day <φ>=0.5: The spotted hemisphere is eclipsed by the K0 IV star itself – The optical spots are not visible but for those at high latitudes (inclination 60º)

2nd day <φ>=0.8: the distance between components is maximized, the K0 IV star is to the SW of the GV5.

3rd day <φ>=0.9: the K0 IV star is in the foreground

4th day <φ>=0.1: The big flare – Observations reveal dramatic changes in flux and size of the model fit components.

September 27th

Relative positions and sizes for the elliptical Gaussians which model the visibilities of UX Ari at the last observing epoch, **scan by scan**. The procedure was similar to the three previous days, but the binning was restricted to each VLBA scan.
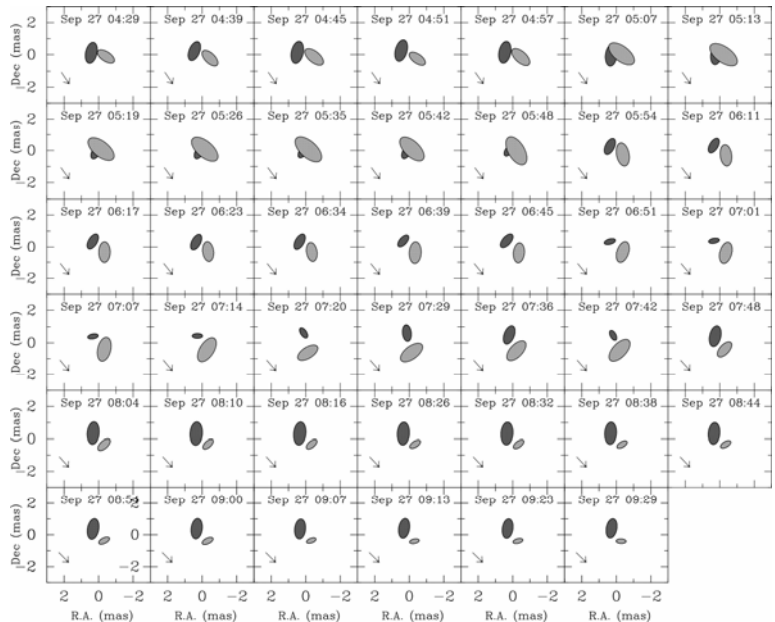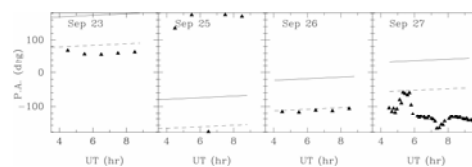

Separation A-B with time
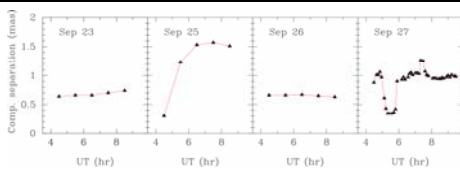
Position angle A-B with time

Position angles of component B with respect to component A. The solid line represents the P.A. (phase φ=360º) of the K0 IV star w.r.t. the G5V. The dashed line is the perpendicular to this one (φ=360º-90º).

X-Y Positions

Relative positions in the sky from component B with respect to component A for the four observing epochs (squares: 23 Sep; triangles: 25 Sep; diamonds: 26 Sep; stars: 27 Sep).