AMBER+FINITO+UT Science Demonstration Proposal

The origin of radio flares in the RS CVn star UX Arietis

Investigators	Institute	EMAIL
Christian Hummel	ESO	chummel@eso.org
Nicholas Elias II	LSW Heidelberg	

Abstract:

We propose to use AMBER to resolve the double-lined binary UX Arietis for the first time in the NIR in order to unambiguously identify the source of the radio flares. In September 1995, a VLBA campaign of UX Arietis observed a series of strong radio flares from the system, resolving multiple radio components on milliarcsecond scales. More recent high-resolution radio observations also modeled the quiescent emission using two components which changed relative position on a daily timescale. A model was proposed linking the radio components to the stellar binary components. We fit an orbit to the radio data and propose to verify it by one or two images obtained from the AMBER data. Detailed modeling of the radio sources requires an unambiguous understanding of the stellar alignment in the system, i.e. the positioning of the magnetic fields and energetic electron sources with respect to the stellar surfaces.

Scientific Case:

One of the causes of stellar activity is rapid rotation which drives internal dynamos thus resulting in large and quasi-stable spot groups (Elias et al. 1995; Duemmler & Aarum 2001), quiescent radio emission and strong flaring (Beasley and Güdel 2000), and extreme chromospheric and coronal emission (Gu et al. 2002; Franciosini et al. 2001). Spin-up due to tidal interaction in close binaries produces just such a class of active binaries, the RS CVn stars, which have orbital periods between one and 14 days.

UX Ari (BD+28d532, HD 21242) is a very important member of this class, consisting of an early K subgiant and a G dwarf. It is among the most dynamic, it is very bright ($V \approx 6.5$), and it has a relatively short orbital period ($\approx$ 6.44d). The K star is the active component, exhibiting strong H+K emission and photometric variability due to large photospheric spot groups. Strong Hα emission arises from the chromosphere of the K star.

A flaring scenario was proposed in which the main site of the energy release was on the more active subgiant (close to the mid-latitude spot groups, Elias et al. 1995), while the magnetic field of the dwarf star acted as a passive magnetic foot print, bright in microwaves because the field is enhanced there (Beasley et al., in prep.). The energetic electrons fill the magnetized volume between the stars on a short time scale (1 min.). The two radio components were associated with the two stars rather than two lobes on either side of the K subgiant.

Calibration strategy:

We require good absolute calibration, and therefore propose to observe a CAL-SCI-CAL sequence.

Targets and number of visibility measurements

Target	**RA**	**DEC**	**V** mag	**H** mag	**K** mag	**Size** (mas)	**Vis.**	**Mode**	**# of** Vis.
HD 21242	03 26 35.39	+28 42 54.31	6.5	4.1	4.0	1.0	0.9/0.8/0.7	LR-JHK	2

Time Justification:

One or two calibrated observation are sufficient. With a good absolute calibration and good data quality in the JHK bands, images can be made.