THE MUSICOS NETWORK FOR MULTI-SITE CONTINUOUS SPECTROSCOPY

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ABSTRACT The MUSICOS international project (MUlti-SIt e CO
tinuous Spectroscopy) is presented. Two world-wide MUSICOS in
ternational campaigns were organised in 1989 and 1992, involving Hawaii,
Kitt Peak, La Silla, Canarias, OHP, Catania, AAT and Xinglong obser
vatories, as well as radio telescopes and the IUE satellite. These pro
vided new results on non radial pulsations of Be and δ Scuti stars, circumstellar
variability of Herbig Ae/Be stars, Doppler imaging of surface structures
and dynamics of exceptional white-light flares on the RS CVn systems.

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THE MUSICOS PROJECT

Several stellar science programmes (such as asteroseismology, stellar rotational modulation, surface structures, Doppler imaging, variable winds, coordinated multi-frequency observations with space satellites) require continuous spectroscopic and photometric coverage during several days. Valuable continuous observations can be obtained from multi-site networks of ground-based observatories equipped with identical instruments, before future facilities from the earth’s poles, interplanetary probes, dedicated satellites or the lunar base become operational.

MUSICOS is an international project started in 1988 which aims at developing a multi-site network of high resolution spectrographs (Catala & Foing 1988), supported, so far, from European, American and Asian scientists. The goal of MUSICOS is first to help the coordination of observations from existing instruments at different sites. In a second phase, in 1990-1991, a cross echelle fiber-fed spectrometer was designed and developed (Baudrand & Boehm 1992). Tests were performed in the laboratory and at the 2m Bernard Lyot telescope at Pic du Midi. This spectrograph was also transported during the MUSICOS 92 campaign to the 2.2m University of Hawaii telescope. In a third phase, this instrument is proposed for duplication to different foreign collaborators, thus allowing multi-site campaigns with identical instruments, with unprecedented continuity and homogeneity.

THE MUSICOS DEC. 1989 OBSERVING CAMPAIGN

For this first world-wide MUSICOS campaign at the end of 1989, three programs requiring multi-site spectroscopic observations were selected:

- 1) Short-period spectroscopic variations in Be stars
- 2) Corotating stream structures in the winds of PMS Herbig Ae stars
- 3) Doppler Imaging and flare monitoring of RSCVn-type active stars

Initially, the sites and telescopes to be involved in this campaign, were the following: Mauna Kea 2.2m UH, 3.6m CFHT, Kitt Peak MacMath, La Silla 1.4m CAT, France 1.5m OHP, Crimea 2.6m Shajn, China 2.16m Xinglong. After the general announcement sent by J. Butler through the Multi wavelength IAU Working group, and also an IAU circular for our multi-site continuous spectroscopy campaign from 8 to 17 Dec 1989 (MUSICOS 89 campaign), we received large observing support (ground based spectroscopic or photometric, or satellite observations) and finally 17 telescopes, including IUE, were pointed towards our targets. In addition to resident spectrographs at OHP, Crimea, CFH, ESO, Lick, MacMath, we used the two existing versions of the ISIS fiber-fed spectrograph in mono-order mode (one of them used until 1988 at OHP), specially transported for the MUSICOS campaign on the 2.2m University of Hawaii telescope and on the 2.16m newly installed telescope at the Chinese Xinglong station.

The first results from the MUSICOS 89 campaign have been presented in the 2nd MUSICOS workshop (Catala & Foing 1990) and in Catala et al. (1993). Results concerning Surface structures and Flares on HR1099 are published in
Foing et al. (1990, 1994). Two exceptional white-light flares were detected by photometric and spectroscopic instruments. Typical rise times of 60-90mn, remarkable spectral signatures in the Hα profile, and longer decay time scales were reported. Equivalent colours, temperature excesses, projected areas (0.55 and 0.89 solar disc areas), radiative and kinetic energy budgets were derived for the two flares (Foing et al. 1994).

PRELIMINARY RESULTS FROM THE MUSICOS DEC. 92 CAMPAIGN
The second world-wide MUSICOS campaign took place in December 1992, and was focused on three scientific programmes:

- 1) Search for nonradial pulsations in the δ Scuti star θ² Tau
- 2) Streams in the Chromosphere and Wind of the Herbig Ae star AB Aur
- 3) Surface Imaging of active structures for the RS CVn system HR1099

Nine sites and telescopes were involved in this campaign: University of Hawaii 2.2 m (Hawaii), Kitt Peak MacMath 1.5m (Arizona), Black Moshannon Observatory 1.6m (Pennsylvania), William Herschell 4.2m (Canarias), OHP 1.52m (France), Vainu Bappu Observatory 1m (India), Xinglong 2.16m (China), Anglo-Australian 4m (Australia), IUE (Space): 24 shifts ESA/NASA. In addition a world-wide multi-wavelength campaign from UV to radio was organised for HR1099, during and around the MUSICOS 1992 campaign. The prototype MUSICOS spectrograph was transported and installed on the University of Hawaii 2.2m telescope for this campaign, and gave very satisfactory results. The campaign was very successful and produced a vast amount of data, still be analysed by the topic leaders and their collaborators. Preliminary results were presented at the 3rd MUSICOS workshop at ESTEC in May 1993.

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