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Poster Abstracts (Session 1)

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Comparison of Selected Methods of Radial Velocity Measurement

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The measurements of the radial velocity (RV) of spectral lines is a fundamental task of spectral analysis. Most of the current astronomical software packages use in addition to cross-correlation, fitting of line profiles with Gaussian, Lorentzian or Voigt functions. One of the less known and used method is a comparison of the direct and reverse images of the line profiles, so called "method of mirroring". It is successfully used in the SPEFO program developed at Astronomical Institute of the Academy of Sciences of the Czech Republic. Lately, it was implemented in the Virtual Observatory (VO) enabled package SPLAT-VO. Because of its simplicity and intuitivity, this method can still find application in the modern analysis of broad noisy and misshapen line profiles.
In this contribution we tried for an objective comparison of the accuracies of these methods. We show comparison of these methods on different types of lines and discuss their advancements and disadvantages.

Double Stars Speckle Interferometry with the 3.5 m Telescope at Calar Alto (Almeria, Spain)

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The first results of speckle interferometry carried out with the 3.5-m telescope of the C.A.H.A. (Almeria, Spain) during a run in July, 2005 are presented. Forty nine stars with separations between 0.058 and 2.1 arcsec were observed under good seeing conditions. On the basis of these observations three improved orbits are presented. The Time Allocation Committee's report with its high scientific qualification to our proposal is included. It confirms the relevance of binary and multiple star research in modern astronomy and the great significance of large telescopes in this kind of studies as well.

GL 569B: A Brown Dwarf Triple?

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GL 569 is a multiple system comprised of GL 569 A, a M2.5V star (Henry & Kirkpatrick, ApJ 359, L29, 1990) of mass $M = 0.35 \pm 0.03\ M_{\odot}$ (Gorlova *et al.*, ApJ 593, 1074, 2003) at distance 9.81 ± 0.16 pc, and GL 569 B, thought to be a binary brown dwarf with period $\sim$ 876 days (Zapatero Osorio *et al.*, ApJ 615, 958, 2004). We began a study of GL 569 B in 2002 because the astrometric orbit is well determined and Ba and Bb are bright enough to be observed at high spectral resolution in the near-IR. Thus, GL 569 B is well suited for the fusion of visual and spectroscopic binary techniques to measure the mass of its components.
Here we describe the evidence that GL 569 B is actually a hierachical triple with components of roughly equal mass, $\sim 0.040 M_{\odot}$. Details, and evidence that at age about 100 Myr, the system is younger than had been reported earlier, are presented in Simon *et al.* (ApJ, 644, 1183, 2006).

Interferometric Investigations of Eclipsing Binaries as a Key to an Improved Distance Scale

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Binary and multiple systems constitute one of the main tools to obtain fundamental stellar parameters, such as masses, radii, effective temperatures and distances. One especially fortunate, and at the same time rare, occurrence is that of double-lined eclipsing binaries with well-detached components. In this special case, it is possible to obtain a full solution of all orbital and stellar parameters, with the exception of the effective temperature of one star, which is normally estimated from spectral type, reddening-corrected photometric colors, or derived from atmospheric analysis of the spectrum. Long-baseline interferometry at facilities such as the ESO VLTI is beginning to have the capability to measure directly the angular separation and the angular diameter of some selected eclipsing binary systems, and we have proposed such observations with the AMBER instrument.
In particular, we aim at deriving directly the effective temperature of at least one of the components in each binary system by iterative convergence of the orbital solution and of the interferometric measurements, thereby avoiding any assumptions or required external calibration in the global solution through the Wilson-Devinney method. We will also obtain an independent check of the results of this latter method for what concerns the distance to the systems.This represents a first step towards a global calibration of eclipsing binaries as distance indicators. Our results will also contribute to the effective temperature scale for hot stars.The extension of this approach to a wider sample of eclipsing binaries could provide an independent method to assess the distance to the LMC.

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Introduction to the 30 m Ring Interferometric Telescope

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For the demands of astronomical limitation observations, such as exploring extra-terrestrial planets or black hole accretion disks and jets in the near-infrared and optical wave band, extremely large telescopes (optical and infrared) have become the principal ground-based astronomical instrumentation. With the maturation of interferometric imaging theory, the borderline between new generation ground-based extremely large telescopes and interferometric arrays for aperture synthesis imaging is becoming increasingly blurred, and the differences in their technical methods and characteristics are also gradually disappearing. Based on the research results of interferometric imaging in Yunnan Observatory, we bring forward a new concept ground-based extremely large telescope — the 30m Ring Interferometric Telescope (30mRIT). It has the direct imaging ability and resolution of a single aperture telescope, and it also can image with high resolution like the aperture synthesis imaging mode. The 30m RIT has a ring spherical primary mirror with 90 segmented mirrors, the width of the ring is 1 meter and the F/D ratio is about 0.8. This report also introduces some high resolution astronomical observe results by a one-meter ring which is 1 m in diameter and 100 mm in width. The 30mRIT project is remarkably different from the conventional ground-base ELT and its pivotal techniques have received the support of CAS and China NSF.

V379 Cep: A Quadruple System of Two Binaries

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Based on several published photometric and spectroscopic studies, V379 Cep (HR 7940) was identified as a 99.76-day eclipsing binary composed of two unusually-low-mass B type stars with projected rotational velocities of 15 and 55 km/s. Our investigation of new series of spectra and UBV observations from several observatories shows that the object is actually a quadruple system: the two observed sets of spectral lines belong to two primaries of two different binaries. The narrower lines belong to component Aa with a 99.76-day orbital period, while the broader ones belong to component Ba with a 159.3-day period. Both binaries revolve around a common centre of gravity with a period of about 6200 days; this motion is measurable via the change of the systemic velocities of both binaries.
Our result resolves the problem of anomalous masses. It is probable that the masses of all four bodies are quite normal for somewhat evolved stars. However, the ultimate test must come from interferometric resolution of the AB pair of binaries; it might be expected that the separation can reach about 40 mas. There is a very good chance that continuing systematic observations will permit accurate determination of all four individual masses.

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Spitzer Observations of the Eclipsing Binary GU Bootes

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We present a carefully controlled set of Spitzer MIPS time series observations of the newly discovered low-mass eclipsing binary star GU Bootes. These observations serve to characterize the MIPS-24 observing techniques of the spacecraft, precisely establishing the photometric repeatability of this instrument at the sub-percent level. The long wavelength characterization of this object's light curve allows for improved characterization of the primary and secondary component linear radii, in addition to other aspects of their surface morphology.

Tomography of the X-Ray Binary Cyg X-1 Based on High-Resolution Optical Spectroscopy

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We used optical spectra with resolution R=13000 obtained in the course of Cyg X-1 spectral monitoring over 2003-2004, carried out with the echelle spectrometer of the 2-m telescope of Peak Terskol Observatory (3100 m, Caucasus). The sequence of line profile variations with orbital phases is clearly pronounced. The Doppler images were reconstructed by an improved Doppler tomography method developed by Agafonov (2004) (radioastronomical approach) on the base of HeII λ4686Å profiles of 2003 ("soft" X-ray state) and 2004 ("hard" X-ray state). The main features of the reconstruction are: deconvolution in the image space with the introduction of the synthesized beam (equivalent summarized transfer function) and the removal of the distortions on the summarized image (after back projecting) caused by the sidelobes of this beam using the CLEAN algorithm. The method is developed specially for a small number of irregularly distributed observations.
The Doppler images and Roche lobe model allowed putting a limitation on the black hole to supergiant mass ratio $1/4 \leqslant M_X/M_O \leqslant 1/3$.
The emission may come from the accretion disk outer regions heated by the hot supergiant emission, from the "hot line" discussed by Kuznetsov *et al.* (2001), or/and from the accretion stream (focused stellar wind).
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The Orbit and Properties of the Spectroscopic-Eclipsing-Interferometric Triple System ξ Tauri

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ξ Tauri is a triple-lined spectroscopic binary consisting of a bright, broad-lined, main sequence B star in orbit about a close pair of sharp-lined A stars. We have used radial velocities measured from more than 100 years of spectrograms from the Lick, Perkins and David Dunlap Observatories to derive the spectroscopic orbital elements for this system. The ratio of the orbital periods, 145.1317 ± 0.0040 d to 7.1466440 ± 0.0000049 d is among the smallest known for triple systems. The inner orbit is circular, while the outer orbit has a modest eccentricity, $e = 0.149$. Photometric observations obtained during the HIPPARCOS mission show that ξ Tauri is an eclipsing binary with eclipses that are at least 0.1 mag deep. Based on the steepness of the ingress to primary eclipse,we believe that the eclipses of the inner pair are total, but additional photometry is required to prove this. In any event, the orbital inclination of the inner pair must be very close to 90°. If we assume this is correct, then the masses of the inner pair are 2.21 ± 0.02 and 2.12 ± 0.02 $M_\odot$. When this is combined with the results of the outer orbit, we find that the inclination of this orbit is either $63° \pm 4°$ degrees or $116° \pm 4°$. This yields a primary mass of 3.12 ± 0.16 $M_\odot$. This system has also been observed as an interferometric binary by a number of groups, but as yet, no one has published an orbital solution. Both the depth of eclipses and the strengths of the A-star lines are inconsistent with some of the interferometric estimates of the magnitude difference between the B star and the close pair of A stars. We will present a combined solution for the astrometric and spectroscopic data and comment of the stability of the system.

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