ABSTRACTS of TALKS

In the order of the Program

(as at 24-Oct-2011)

ABSTRACT

Pierre Léna
Université Paris Diderot (FR)

The birth of the VLTI

abstract missing

ABSTRACT

Oskar von der Lühe
Kiepenheuer-Institut, Freiburg (DE)

The true history of the VLTI

abstract missing

ABSTRACT

Wesley Traub
Jet Propulsion Laborabory (US)

History of interferometry in the US and recent developments

abstract missing

ABSTRACT

Andrea Isella
Caltech (US)

Disks around young stars: Invited Review

abstract missing

ABSTRACT

Rachel Akeson
Caltech (US)

The disks inner regions: Interferometry review talk

abstract missing

ABSTRACT

Willy Benz
Universität Bern (CH)

Formation of planetary systems: Challenges for interferometry

The theory of formation of planetary systems is not yet capable of explaining all the observations. This talk will point out where observations could provide further guidance in order to improve our understanding of some of the key processes at play.

ABSTRACT

Bram Acke
Instituut voor Sterrenkunde, Leuven (BE)

Dust evolution in disks: the impact of mid-infrared interferometry

abstract missing

ABSTRACT

Florentin Millour
Observatoire de la Côte d'Azur, Nice (FR)

Spectro-interferometry of disks and winds with VLTI

abstract missing

ABSTRACT

Myriam Benisty
Max-Planck-Institut für Astronomie, Heidelberg (DE)

Unveiling the structure of pre-transitional disks

Circumstellar disks are the birthplaces of planets. Several processes are known to be acting on the disks, and over time, material dissipates. In this talk, I will present recent interferometric studies of pre-transitional disks, thought to be at an intermediate stage in the disk evolution between a gas-rich and a gas-poor phase. In addition to the SED, the data obtained with the VLTI instruments PIONIER (H-band), AMBER (H+K bands) and MIDI (N band) allowed us to constrain the morphology of the inner and outer disks in a few objects, while hydrodynamical simulations enabled to study the gap formation in their disks.

ABSTRACT

Gerd Weigelt
Max-Planck-Institut für Radioastromie, Bonn (DE)

VLTI/AMBER spectro-interferometry of the young Herbig Be star MWC 297 with a spectral resolution of 12000: studies of its disk and disk wind

Infrared spectro-interferometric observations are able to probe the nature of the accretion process and the launching of jets and winds. We studied the continuum disk and Brackett Gamma emitting region of MWC 297 with high spatial and spectral resolution and compared our observations with disk-wind models (Weigelt et al. 2011, Astron. & Astrophys. 527, A103). The high spectral resolution mode of AMBER allowed us to study the AU-scale environment of MWC 297 in ~10 different spectral channels across the Brackett Gamma emission line. The interferograms have a high SNR since the fringe tracker FINITO permitted long exposure times of 8 sec per frame. The measured continuum visibilities confirm previous results that the continuum-emitting region of MWC 297 is remarkably compact. We derived a continuum ring-fit radius of ~2.2 mas (~0.56 AU), which is ~5.4 times smaller than the 3 AU dust sublimation radius expected for silicate grains (in the absence of radiation-shielding material). The strongly wavelength-dependent and asymmetric Brackett Gamma emitting region is more extended (~2.7 times) than the continuum-emitting region. At the center of the Brackett Gamma line, we derived a Gaussian fit radius of ~6.3 mas HWHM (~1.6 AU). To interpret the observations, we employed a magneto-centrifugally driven disk-wind model consisting of an accretion disk, which emits the observed continuum radiation, and a disk wind, which emits the Brackett Gamma line. The observations (i.e., K-band spectrum, visibilities, differential phases, and closure phases) were compared with the calculated wavelength-dependent model intensity distributions and Brackett Gamma line profiles. The closest fitting model predicts a continuum-emitting disk with an inner radius of ~0.3 AU, a disk wind ejection region with an inner radius of ~0.5 AU (~17.5 stellar radii), and an inclination angle of ~20 degrees (i.e., almost pole-on). We show that the K-band flux, visibilities, and remarkably strong phases can be explained by our disk wind model. New 2011 observations confirm the small predicted inclination angle of ~20 degrees.

ABSTRACT

Jose-Carlos Guirado
Universidad de Valencia (ES)

The size of ABDorA from VLTI/AMBER interferometry

The pre-main sequence (PMS) star ABDorA is the main component of the quadruple system AB Doradus. The precise determination of the mass and photometry of the close companion to ABDorA, ABDorC, has provided an important benchmark for calibration of theoretical evolutionary models of low-mass stars. The limiting factor to the precision of this calibration is the age of the system. We present VLTI/AMBER observations of ABDorA which provide a direct measurement of the size of this star, 0.96±0.06 Rsun. The latter estimate, combined with other fundamental parameters also measured for this star, allows a precise test of PMS evolutionary models using both H-R diagrams and mass-radius relationships. We have found that our radius measurement is larger than that predicted by the models, which we interpret as an evidence of the oversizing produced by the strong magnetic activity of AB Dor A. Considering, at least partially, this magnetic effect, theoretical isochrones have been used to derive constraints to the age of AB Dor A, favouring an age about 40-50 Myr for this system.

ABSTRACT

Francois MENARD
IPAG - Observatoire de Grenoble (FR)

First Results from the PIONIER survey of Southern T Tauri Stars

T Tauri stars are solar-like pre-main sequence objects. They are surrounded by a disk of gas and dust where planets are thought to form. The inner part of these protoplanetary disks, visible by NIR interferometry, are of particular importance because they feed the accretion onto the star and the density is large enough for planets to form. Unfortunately, the targets are faint and only a handful of them could be observed previously in NIR with the KECK and CHARA 2-telescope interferometers. The visiting instrument PIONIER is now sensitive enough to observe them with 4 ESO/VLTI telescopes and with excellent precision allowing for good visibility and closure phase measurements. PARAGRAPH Our survey programme is scheduled to span 4 semesters. The results after 2 semesters are spectacular. The 6 simultaneous baseline measurements (and 3 closure phases) allow for good modeling of the disks to be performed. In this contribution I will present the data for several sources and discuss the general results. They include that (1) the closure phases are usually null, or very small; (2) there is a clear and unambiguous signature of starlight scattering in the visibility curves. This is an important result because the contribution of scattering was usually overlooked in previous studies. Interestingly, these measurements confirm an earlier prediction by our group. The implications of these results will be discussed for the star formation process (accretion onto the forming star), and in the context of planet forming scenarios (properties of the disks where planets form).

ABSTRACT

Olja Panić
ESO-Garching

Structure and variability of the planet-forming regions in the disc around HD100546 revealed using VLTI/MIDI

I will discuss the advantages and challenges of the modelling of mid-infrared interferometric observations of circumstellar discs. In particular, I present ESO Very Large Telescope Interferometer observations of a bright Herbig Be disc, HD100546, in N-band on six baselines spanning 14 to 40 meters. Many signs suggest that this disc hosts one or more planets, namely a gas and dust gap, spiral structure seen in scattered light imaging, Hale-Bopp-like mineralogy. Following an overview of this uniquely well-studied disc, I focus on our mid-infrared interferometric VLTI/MIDI observations which directly probe the disc brightness distribution in the regions from 0.2 to about 20AU where the putative planets may open gaps and cause resonant clumping of disc material. Our data show the presence of disc material both close to the dust sublimation radius (consistent with prior VLTI/AMBER data) and beyond the outer edge of the disc gap, located at about 13~AU (also revealed with VLT/CRIRES and NACO instruments). We detect up to 50% variability in the correlated interferometric fluxes, and their shapes, measured on identical 40m baselines one year apart. This variability can be explained either by changes in the thickness and location of the inner rim, changes in the dust properties at the rim, or by disc asymmetry in the inner few AU. The observed flux changes are too subtle to be detected with a single UT telescope (a few percent of the total disc flux), stressing the need for interferometric monitoring. I present both our results obtained using a simple geometric modelling approach, and results we obtain with the state-of-the-art radiative transfer code MCMax.

ABSTRACT

Willem-Jan de Wit
ESO-Chile

MIDI's view of Massive Young Stellar Objects

High-angular resolution observations are of key importance to massive star formation if we are to understand how young massive stars accrete mass. Testing numerical predictions of accreting massive stars requires observations at milli-arcsecond angular resolution. We present an overview of the results to date in massive star formation using IR interferometry. All results are nearly exclusively obtained using the Very Large Telescope Interferometer. These results involve the near_IR instrument AMBER and the mid-IR instrument MIDI. We will present the observational results and elaborate on the physical interpretation using radiative transfer modelling. The overview is based on the recent VLTI-MIDI papers by de Wit et al. (2008, 2010, 2011). The results will be confronted with and compared to new unpublished results of other MYSOs obtained by our and other groups.

ABSTRACT

Thorsten Ratzka
Universitäts-Sternwarte München (DE)

MIDI's View of Discs around Low-Mass Young Stellar Objects and their

Young low-mass stars are surrounded by circumstellar discs that transport angular momentum, serve as reservoir from which the central stars accrete gas and dust, and are the sites where planets form. Conventional imaging cannot resolve the structure of these discs. With the unprecedented spatial resolution offered by MIDI and the sensitivity of the N-band to warm circumstellar material, this limitation was overcome and detailed investigations became possible. Moreover, the wavelength range between 8 and 13 micron is perfectly suited to study the dust composition and grain growth (a prerequisite for planet formation) within the discs. We will present our characterisation of several discs around T Tauri stars during the last eight years. Among the studied objects is TW Hya with its gap potentially formed by a planet. Of special interest in our studies are binaries and multiple systems, e.g., GV Tau and T Tau. The discs in these two prominent systems are misaligned and suggest a highly dynamic formation process of the objects. The large potential of MIDI and its successors for future studies of the discs around low-mass stars will also be briefly discussed

ABSTRACT

Olivier Absil
Université de Liège (BE)

Detecting faint companions with PIONIER

One of the main goals of the PIONIER visitor instrument at VLTI is to search for faint companions around relatively bright stars. In this talk, we present a general method to search for companions in PIONIER data, with a particular emphasis on the exploitation of closure phases. Our search method is illustrated on a few exemples, including the detection of companions at the ~1% contrast level, and non-detections showing upper limits of a few 0.1% on the contrast of any companion within the interferometric field-of-view. In particular, we demonstrate that the small near-infrared excesses previously reported around several main-sequence stars with precision near-infrared interferometry is not related to the presence of low-mass companions around the target stars. The current limitations of PIONIER are shortly discussed, and we derive some general guidelines on how to best use an interferometric array for faint companion detection. Finally, we discuss how the dynamic range and angular resolution provided by of PIONIER can serve various scientific goals, ranging from low-mass companions around main sequence stars to massive binaries. We show that PIONIER could detect objects at the brown dwarf / planet boundary for young low-mass stars residing in nearby associations.

ABSTRACT

Fabien Malbet
IPAG - Observatoire de Grenoble (FR)

Star-disk interplay in the resolved emission of Herbig-Haro object: the case of MWC158 observed with the VLTI

(F. Malbet, J. Kluska, J.-P. Berger, B. Lazareff, F. Menard, C. Pinte, J.-B. Le Bouquin, R. Millan-Gabet, W. Traub, M. Benisty) Emission from young stars originates mainly from two sources: the star and its nearby circumstellar environment whose continuum contribution is dominated by the thermal emission from optically thick material (dust and gas). The peak of emission of the star of effective temperature between 4000K and 10000K lies in the visible domain whereas the excess emission due to the disk dominates at wavelengths long-ward 2 microns. The H band which corresponds to wavelengths between 1.5-18 microns is of special interest since the major contributor to the total flux swings over from the star to the disk from 1.5 to 1.8 microns. Neglected so far, this effect is of tremendous importance to interpret interferometric visibilities in this band because the spatial structures of the star and the disk are very different scales. The main effect on broad band interferometric observations is to overestimate disk visibilities and therefore to underestimate disk spatial scales. We have obtained H-band measurements with the VLTI visitor instrument PIONIER on MWC158 whose spectral dispersion can be entirely interpreted by the star-disk effect. We have developed a method to subtract the stellar contribution in order to get the right disk visibilities. We compare reconstructed images before and after the subtraction. The method is also applied on AMBER data obtained in H-band where the visibility dispersion was wrongly interpreted. The case of MWC158 is a nice example of the interplay between different region of emission and shows that broad-band visibilities should be used with great care. The talk will be pedagogical with a step-by-step presentation of the issue and discussion of the consequences.

ABSTRACT

Jason Aufdenberg
Embry-Riddle Aeronautical University (US)

Fundamental parameters of stellar physics: Invited Review

abstract missing

ABSTRACT

Pierre Kervella
Observatoire de Paris, LESIA (FR)

Interferometric constraints on the fundamental parameters of stars

Long baseline interferometry can now measure the angular diameter of nearby stars with sub-percent accuracy, creating a novel and powerful constraint for stellar models. This observing technique has also been applied extensively to the study of tight multiple star systems, resulting in high accuracy distances, masses, and other physical parameters. I will present a few examples of recent interferometric observations that resulted in significant improvements of our knowledge of the fundamental parameters of nearby stars, often in combination with other techniques (e.g. asteroseismology). Finally, I will briefly summarize the potential of the future GRAVITY instrument of the VLTI for the determination of fundamental stellar parameters.

ABSTRACT

Antoine Mérand
ESO-Chile

10 years of interferometric observations of Cepheids

More than 100 years after Cepheids were recognized as distance indicators, these pulsating stars remain the cornerstone of many distance related problems, among which the determination of the Hubble Constant. Optical interferometry has provided unique insights to the calibration of the Period-Luminosity relation (the Leavitt law): by resolving directly the changing angular diameter, the parallax of pulsation method can be applied with a unique accuracy. I will present the major results that have been obtained in the last decade using optical interferometry: direct pulsation measurement; distance scale calibration; projection-factor determination; measurement of infrared excess due to circum-stellar environments etc. I will also present an ongoing study using AMBER in its highest spectral resolution, in particular the attempt to model the projected velocity spatially and spectroscopically resolved in metallic lines.

ABSTRACT

Andrea Chiavassa
Institute of Astronomy and Astrophysics, Brussels (BE)

Imaging stellar surfaces with VLTI and 3D radiative hydrodynamics simulations

Interferometric imaging provides an innovative way of addressing the detailed studies of variability, dynamics and stellar parameters determination of stars. Three-dimensional radiative hydrodynamics simulations of stars from solar mass to red supergiant stars are essential to a proper quantitative analysis of interferometric observations. I will present how these simulations have been (and will be) crucial to prepare and interpret the interferometric observations in the last years with the important result of the first spectro-images of a massive evolved star with VLTI/AMBER (Chiavassa, Lacour, Millour et al., A&A, 511, id.A51).

ABSTRACT

Keiichi Ohnaka
Max-Planck-Institut für Radioastromie, Bonn (DE)

1-D imaging of the dynamical, inhomogeneous atmosphere of the red supergiant Betelgeuse in the CO first overtone lines with VLTI/AMBER

We present high-spatial and high-spectral resolution observations of the red supergiant Betelgeuse in the CO first overtone lines near 2.3 micron with VLTI/AMBER. For the first time, we have reconstructed 1-D images in the individual CO lines with an angular resolution of 9.8 mas and a spectral resolution of 6000 by applying the self-calibration technique to restore the Fourier phase from the differential phase measurements. This marks the highest spatial resolution achieved for Betelgeuse so far. The reconstructed 1-D images reveal that the star appears different in the blue and red wing of the individual CO lines. In the blue wing, the star shows a pronounced, asymmetric extended component up to 1.3 stellar radii, while such a component does not appear in the red wing. This can be explained by a model, in which the CO gas clump roughly half as large as the star is moving downward with < 10 km/s, while the gas in the remaining region is infalling much faster with 20-30 km/s. Comparison between the CO line data taken in 2008 and 2009 shows a significant time variation in the dynamics of the outer atmosphere. However, the 1-D images in the continuum show only a slight deviation from a limb-darkened disk with an angular diameter of 42.5 mas. Moreover, the continuum data taken in 2008 and 2009 reveal no or only marginal time variations, much smaller than the maximum variation predicted by the current 3-D convection simulations.

ABSTRACT

Jose Groh
Max-Planck-Institut für Radioastromie, Bonn (DE)

Resolving the wind of the most massive stars in the Galaxy with VLTI/AMBER

The most massive stars are ridiculously luminous, which causes them to lose mass via a powerful stellar wind. Mass loss plays a fundamental role in massive star evolution, and many of our shortcomings in understanding how massive stars evolve and die are directly related to our limited knowledge of mass loss in these stars. VLTI/AMBER provides the unique capability to directly resolve the stellar wind of the most massive stars in the Galaxy, peering into the inner 5 mas wind region at high spectral resolution. I will present our recent findings from a mini-survey of 11 of the most massive stars in the Galaxy, thought to be in the short, unstable Luminous Blue Variable (LBV) stage. The interferometric visibilities and phases were analyzed with the radiative transfer code CMFGEN. I will discuss how our analysis of the interferometric observations provide unique constraints on the mass loss process and stellar rotation in massive stars.

ABSTRACT

Thomas Preibisch
Universitäts-Sternwarte München (DE)

The multiplicity of young OB stars revealed by interferometry

The detection and appropriate characterization of multiple stellar systems is a key step in advancing our understanding of the star and cluster formation process. Binaries also offer unique opportunities to directly determine fundamental stellar parameters such as the stellar mass. In this talk, I will present results of our interferometric studies of the multiplicity of the massive OB stars in the Orion Nebula Cluster. The range of separations accessible to the VLTI/AMBER (~ 2-100 mas) is very well suited to close the gap between the existing searches for spectroscopic companions on the one side, and speckle / adaptive optics observations and conventional imaging for wider systems on the other side. Our observations yield a comprehensive picture of the multiplicity of a coherent sample of massive stars, which is essential for testing different star formation models and provide crucial constraints for theoretical models of the mass- and environmental-dependence of stellar multiplicity.

ABSTRACT

Stanislav Stefl
ESO-Chile

Zooming in on circumstellar matter around B stars with the AMBER high-resolution mode

(S. Stefl, J.-B. LeBouquin, T. Rivinius, D. Baade, A. Carciofi)
The presentation offers an overview of the AMBER-enabled progress achieved in the physical understanding of circumstellar structures in selected types of B-type stars:
i) Through detailed dynamical and radiative-transfer modeling, the spectro-interferometric resolution of the decretion disk around the Be star zeta Tau could provide the most detailed proof to date of one-armed density waves in such structures. Additional higher-order features, possibly pertaining to the direction to the plane of the disk, were found.
ii) The Be star 48 Lib is a similar case but with an extremely extended disk.
iii) In the 11-year period Be binary delta Sco, the dynamical interaction of the companion with the disk during the periastron passage was detected. A first comparison to numerical simulations was made.
iv) In these and several other classical Be stars, the increased spectral resolution revealed much more complex structure in visibility and phase profiles than commonly seen at lower spectral resolution. It provides a strong hint at additional components (probably polar outflows) in addition to the central star and a rotationally supported disk. The simultaneous observation of the Br-gamma line emission at spectroscopically boosted angular resolution and the H and K continuum enables advanced modeling at additional qualitative granularity.
v) For the first time ever, the co-rotating magnetosphere of a He-rich B star with kGauss magnetic field was resolved.

ABSTRACT

Armando Domiciano de Souza
Observatoire de la Côte d'Azur, Nice (FR)

Angular diameter of rotating stars from differential phases

We investigate how to use VLTI/AMBER differential phases to measure physical parameters of a rotating star: angular diameter, position angle of rotation axis, rotation velocity. These parameters seems to be constrained, via a physical model, even for partially resolved objects, because the precision on differential phases is usually significantly higher than the precision on the visibility amplitude. We show an application to the fast rotator Achernar, observed with VLTI/AMBER HR mode on the Brackett gamma line

ABSTRACT

Thomas Rivinius
ESO-Chile

The interferometric signature of the rapidly corotating magnetosphere of HR5907

I report on interferometric AMBER/VLTI observations of the magnetic B2Vn star HR5907 to detect the spectrally dispersed phase signature of the co-rotating magnetically-bound plasma. We obtained the first ever successful interferometric observation of magnetically bound material. Unfortunately, the position angle and extension of the elongated structure could not be fully constrained interferometrically, as the object is faint and observing conditions were not optimal, but polarimetry suggests the observed baselines were quite perpendicular to the circumstellar structure.

ABSTRACT

Hugh Wheelwright
Max-Planck-Institut für Radioastromie, Bonn (DE)

VLTI/AMBER observations of the binary B[e] supergiant HD 327083

HD 327083 is classified as a supergiant B[e] star. In addition, the star is the primary of a close binary system. It is not clear whether the B[e] behavior of HD 327083 is related to its binarity or its evolutionary state. We addressed this issue by studying its circumstellar environment with high spatial resolution. To this end, we observed HD 327083 with the VLTI and AMBER in the medium resolution K-band setting. The observations spatially resolve the source of the NIR continuum and that of the observed Br gamma and CO emission. The continuum visibilities can be reproduced with a binary model, which substantiates the detection of a companion via radial velocity variations. We also spatially resolve the circumstellar material surrounding the primary for the first time, and find it is concentrated in an elongated structure reminiscent of a bipolar outflow. The data demonstrate that the binary HD 327083 appears noticeably different to single sgB[e] stars where the standard dual outflow scenario applies. This raises the possibility that the mass loss of HD 327083 is related to its binary nature.

ABSTRACT

Olivier Chesneau
Observatoire de la Côte d'Azur, Nice (FR)

The early observations of novae: the optical interferometry enters into the scene

A classical nova eruption results from a thermonuclear runaway (TNR) on the surface of a white dwarf (WD) which is accreting material from a companion star in a close binary system. Optical Interferometry offers the opportunity to investigate the temporal evolution the ejecta during the very first days of the event. PARAGRAPH After a few historical attempts of observations of novae using optical interferometers, the outburst of the famous recurrent nova RS Oph, observed by many optical interferometers, witnessed the maturity of the technique. PARAGRAPH A unique campaign was then performed with the AMBER and MIDI instruments of the VLTI to observe the slow nova V1280 Sco that formed a copious amount of dust. This VLTI campaign was followed by a campaign using the NACO, SINFONI and VISIR instruments. PARAGRAPH The outburst of the recurrent nova T Pyx that occurred in April 2011, a long overdue event awaited for 45yr, was also an event that attracted the interest of many amateur and professional astronomers. The event was first caught after 2.9d by the CHARA interferometer and its instrument CLASSIC, followed then by VLTI observations with AMBER and the new visitor instrument PIONIER. These heterogeneous observation provided very complementary information that depicted a striking fastly-formed bipolar shell viewed nearly pole-on. PARAGRAPH The VLTI represents a breakthrough in terms of sensitivity, wavelength coverage and spectral resolving power. The second generation of VLTI recombiners will bring the imaging capabilities necessary to study rapidly the shape of the fast evolving ejecta.

ABSTRACT

Rene Oudmaijer
University of Leeds (UK)

The evolved massive star IRC+ 10420 with VLTI/AMBER: multi-epoch, multi-baselines and FINITO

IRC +10420 is one of the few massive stars within the rapid transitory phase from the cool Red Supergiant to the hot Wolf-Rayet star or LBV phase. We present AMBER/VLTI data of the object, and present the first AMBER observations of this objects employing the FINITO fringe tracker, extending the wavelengths coverage to the Na I doublet at 2.2 micron. The data are complemented with X-Shooter data which provide a higher spectral resolution view of the spectrum. The largest UV-coverage of IRC +10420 to date (12 baselines) allows us to assess the applicability of a relatively sophisticated geometrical model. We find that the ionized wind is a polar wind, and could well be in the shape of an hour-glass at milli-arcsecond scales. Na I is found interior to the bulk of the wind recombination region. The presence of this line emission (a measurement only possible thanks to FINITO) within the ionized region suggests the presence of a dense pseudo-photosphere. The fact that many Yellow hypergiants exhibit the same line emission may well hint at the presence of a "Yellow Wall" in the HR diagram, preventing them from evolving visibly to the blue.

ABSTRACT

Markus Wittkowski
ESO-Garching

VLTI/AMBER observations of Mira-variable AGB stars

Mass loss from asymptotic giant branch (AGB) stars is the most important driver for the evolution of evolved low to intermediate mass stars toward planetary nebulae. It is also one of the most important sources of the chemical enrichment of the interstellar medium. The mass-loss process originates in the extended atmospheres, whose structure is affected by stellar pulsations, and where molecular and dusty layers are formed. Optical interferometry resolves the extended atmospheres of AGB stars and thereby enables us to obtain measurements of the intensity profile across this region. We present recent VLTI/AMBER observations of Mira variable AGB stars that indicate an intensity profile consistent with predictions of the latest dynamic model atmospheres based on self-excited pulsation models. The AMBER data also indicate non-zero closure phases, which are indicative of deviations from point symmetry at all wavelengths, thus a complex non-spherical stratification of the extended atmosphere. We interpret these inhomogeneities as the result of pulsation- and shock-induced chaotic motion in the extended atmosphere.

ABSTRACT

Iva Karovicova
Max-Planck-Institut für Astronomie, Heidelberg (DE)

Interferometric monitoring of Evolved Stars

We present multi-epoch observations of the pulsating atmosphere and the circumstellar environment of a sample of four evolved stars, using the mid-infrared interferometric instrument MIDI at the VLTI. Our sample includes 4 oxygen-rich Mira variables: RR Aql, GX Mon, S Ori and R Cnc observed at many epochs. This unique and rich sample of interferometric data allow us to monitor the photometry and visibility spectra over their pulsation cycle(s). The data are compared to radiative transfer model describing the dust shell and dust-free dynamic model atmosphere series representing the central source. Additionally to the observations, we performed modeling simulations of intracycle and cycle-to-cycle photometry and visibility variations theoretically expected at mid-infrared wavelength. The obtained infrared observations allowed us to explore the characteristics of the molecular shells and the dust formation zone, and to study the connection between stellar pulsation and the dust condensation process. This study represents the first comparison between interferometric observations and a combination of a radiative transfer modeling with dynamic atmosphere models over an extended range of pulsation phases covering several cycles, and it is an important step for our understanding of the late stage of stellar evolution and the chemical evolution of galaxies

ABSTRACT

Nicolas Blind
IPAG - Observatoire de Grenoble (FR)

An incisive look at the symbiotic star SS Leporis - Milli-arcsecond imaging with PIONIER

SS Leporis is a symbiotic binary system constituted of an M giant and an A star. It presents the Algol paradox, indicating that mass transfer from the M giant occurred in this system and may still be ongoing. Using the VLTI instruments AMBER and PIONIER, we have studied the system at 8 different epochs, with an angular resolution of about 1 milli-arcsecond. PARAGRAPH With PIONIER we obtained the first resolved images of a symbiotic system. The images show the binary rotating from one epoch to the other and that the M giant is spatially resolved by our observations. From the parametric modeling, we obtained an astrometric orbit, which, combined with previous radial velocities, allowed to determine the mass of both components. Our new estimations of both the mass ratio and the M giant diameter showed that, contrary to previous claims, the M star is not over-filling its Roche lobe, and that the mass transfer most likely occurs through the accretion of an important part of the M giant wind. These observations also indicate that an accretion disc is likely to have formed around the A star. We estimate its apparent diameter is less than 1 mas, i.e. at the limit of detection with our data. The current data also present good hints of unmodeled material escaping the system.

ABSTRACT

Andrea Richichi
NARIT, Chiang Mai (TH)

Investigating the geometry and physics of evolved giant stars: TX Psc and other beasts

Cool giant stars in the late stages of their evolution have always represented a favorite target for high angular resolution observations. Being bright and extended they are relatively easy to observe by various methods. At the same time they represent a critical benchmark for theoretical models and hold many keys to our understanding of the complex physical processes that regulate the fate and death of stars like our Sun. However, such stars have complex geometries, are highly variable, and are often very extincted. As a result, modelling and in-depth understanding of the physical properties are often problematic. The combination of different techniques such as long-baseline interferometry and lunar occultations, each with their pros and cons, is especially effective. We report detailed novel results obtained at the VLT and the VLTI on a few infrared sources, highlighting in particular the complex geometry of the cool carbon star TX Psc observed over several years.

ABSTRACT

Marco Delbo
Observatoire de la Côte d'Azur (FR)

Interferometric Observations of Asteroids

I will present results of the first long-baseline interferometric observations of asteroids from the ground. In particular, I will describe the analysis of observations of asteroids that we have obtained with the MIDI instruments of the Very Large Telescope Interferometer (VLTI) of the European Southern Observatory.

I will also discuss some of the current limitations of this technique and how we hope to overcome them using the second-generation instruments of the VLTI. I will show how these latter technological advances in high spatial resolution astronomy will offer a unique opportunity to study the densities and internal structures of asteroids in unprecedented detail.

ABSTRACT

Alexis MATTER
Max-Planck-Institut für Radioastromie, Bonn (DE)

Determination of physical properties of Main-belt asteroids using infrared interferometry

We present the first applications of infrared interferometry to the determination of physical properties of several Main-belt asteroids. Thanks to the use of geometrical models and a more sophisticated thermophysical model, we mainly refined size measurements and derived surface thermal properties including thermal inertia and macroscopic roughness.

ABSTRACT

Martin Elvis
Harvard-Smithsonian Center for Astrophysics (US)

The Structure of Active Nuclei on Scales from 100mas to 100microarcsec

Quasars and Active Galactic Nuclei (AGNs) are the quintessential point sources - they are "quasi-stellar" after all. We have had to rely on timing and spectroscopy to tease out their structure. Thanks to observations across the electromagnetic spectrum we now have a good rough idea of the structures we are looking at. I will outline the Standard Model of AGNs and highlight its limitations, and sketch out how we think we can overcome these. In the end though, there is no substitute for an image. Optical and infrared interferometry is just getting to where it can already begin to address the outer regions of an AGN, and I will discuss how future, more capable interferometers could solve quasars.

ABSTRACT

Makoto Kishimoto
Max-Planck-Institut für Radioastromie, Bonn (DE)

Infrared nuclei of active galaxies as probed by interferometry: a review

Infrared long-baseline interferometers have extensively been used to explore the nuclei of active galaxies over the recent several years. I will briefly review the history, and then summarize the current status with an emphasis on our on-going Type 1 AGN investigation using both the near-IR and mid-IR interferometers.

ABSTRACT

Konrad Tristram
Max-Planck-Institut für Radioastromie, Bonn (DE)

The complexity of parsec-scaled dusty tori in AGN

A torus of molecular gas and dust is one of the key components of unified schemes of active galactic nuclei (AGN): it provides the material for accretion onto the supermassive black hole and is held responsible for the orientation-dependent obscuration of the central engine. PARAGRAPH I will present the results and current status of infrared interferometry of these dust distributions in AGN in the infrared. Our observations have shown that both the hot inner rim as well as the warm body of the torus scale with the square root of the luminosity of the AGN and we find that the warm dust in the body of the torus is located at about 30 times larger radii than the inner hot rim. The large scatter about the size-luminosity relation in the mid-infrared hints at significant differences between the tori in individual galaxies, questioning the current picture of the same dusty doughnut in all AGN. PARAGRAPH I will especially focus on the results for the Circinus galaxy, the closest Seyfert 2 galaxy. It is the object studied best by mid-infrared interferometry. Its nucleus is well resolved, so that a precise determination of the properties of the individual dust components and of the profile of the radial dust distribution can be obtained. The interferometry shows a relatively thin disk embedded in a geometrically thick and clumpy structure. [Note, that the exact content might shift depending on other speakers reporting on the MIDI AGN results.]

ABSTRACT

Leonard Burtscher
Max-Planck-Institut für Astronomie, Heidelberg (DE)

The MIDI AGN Large Programme: A statistical sample of resolved AGN tori

Interferometric observations with MIDI/VLTI in the mid-infrared made studies of the central dusty tori of Active Galactic Nuclei (AGNs) possible and proved their existence in a number of nearby galaxies. Both type 2 and type 1 galaxies showed "tori" whose general properties were comparable -- consistent with (but not proving) the "unifying model" for radio-quiet galaxies. However, the well resolved type 2 tori differ in their detailed properties and the highest resolution observations show signs for non-smooth structures, as expected both from theoretical arguments and from hydrodynamical simulations. It turned out that a more comprehensive approach was needed to overcome the differences in individual galaxies and be able to draw statistical conclusions from the study of a large number of type 1 and type 2 galaxies. PARAGRAPH This statistical basis was set up as a VLTI/MIDI Large Programme that comprises 14 AGNs for which torus properties are being determined. The observations have now been completed [at the time of the workshop] and show resolved dust emission in almost all of the sources. They represent the largest sample of resolved AGN tori so far allowing to ask a number of questions, ranging from unification to the physics of accreting galactic nuclei. In the talk, both the scope and first results from the Large Programme will be presented.

ABSTRACT

Romain Petrov
Laboratoire H. Fizeau, Nice (FR)

VLTI/AMBER blind mode observations of the QSO 3C273's Broad Line Region

We report ‚Äúblind mode‚Äù observations of the QSO 3C273's Broad Line Region, with the VLTI and AMBER used in medium spectral resolution. This new observation mode and its associated specific data reduction procedure allow to accumulate information from many very low SNR ‚Äúblind‚Äù frames and hence to observe targets too faint for the fringe trackers or the standard procedures based on a detection of fringes in individual frames. The QSO 3C273 was observed with a resolution 1500 in the Paschen alpha emission line (red shifted in the K band), yielding constraints on the size and structure of its BLR. The gain with regard to previous medium resolution observation was of at least 2.5 magnitudes and this could be improved in the future, yielding new perspectives for science with the VLTI both for AGNs with the UTs and stellar physics with the ATs.

ABSTRACT

Francoise Delplancke-Stroebele
ESO-Garching

Setting the scene: the VLTI in 2016

abstract missing

ABSTRACT

Bernard Lazareff
IPAG - Observatoire de Grenoble (FR)

Scientific results from PIONIER

The Pionier instrument, installed and commissioned in Oct-Nov 2010, allows for the first time the coherent recombination of four VLTI beams. This talk will first present a brief outline of the salient characteristics of the instrument. The second part of the presentation will review the science projects that Pionier enabled: their goals and early scientific results from the first nine months of operation in several areas: circumstellar disks, stellar surfaces, bianry stars and stellar companions.

ABSTRACT

Damien Ségransan
Astronomical Observatory, University of Geneva (CH)

First results from PRIMA Astrometry

abstract missing

ABSTRACT

Frank Eisenhauer
Max-Planck-Institut für extraterrestrische Physik, Garching (DE)

Gravity

abstract missing

ABSTRACT

Bruno Lopez
Observatoire de la Côte d'Azur, Nice (FR)

MATISSE

abstract missing

ABSTRACT

Denis Mourard
Observatoire de la Côte d'Azur, Nice (FR)

Recent results from VEGA/CHARA and prospects for visible interferometry at VLTI

With very high angular resolution and high spectral resolution, the spectrograph VEGA installed on the CHARA array has started his harvest of scientific results. Fundamental parameters of stars, circumstellar environments are the main domains where VEGA is bringing unique results. I will describe the main results we recently obtained and will discuss the potential of implementing such a facility on the VLTI observatory in the future.

ABSTRACT

Jörg-Uwe Pott
Max-Planck-Institut für Astronomie, Heidelberg (DE)

(Multi-waveband) phase-referencing: first science and technical progress

I will review our work in the field of phase-referencing and fringe tracking to increase sensitivity, spectral resolution and precision of long baseline interferometers. A focus will be put on spectro-interferometric astrometry, and the science demonstration run of MIDI+PRIMA-FSU, upcoming in Sep 2011. Science cases and results presented comprise the observations of disks, AGN, and exo-planets.

ABSTRACT

Stefano Minardi
Friedrich Schiller Universität, Jena (DE)

Discrete Beam Combiners: exploring the potential of 3D photonics for interferometry

(Stefano Minardi, Lucas Labadie, Nadia Chakrova, Felix Dreisow, Stefan Nolte, Thomas Pertsch) We present a 3D photonic component prototype designed for the determination of coherence properties of astronomical targets in optical interferometry. The component is based on the properties of two dimensional arrays of evanescently coupled waveguides and has the potential of being scalable to arbitrary large arrays of telescopes. Simulations and first experimental results will be presented along with perspectives for the on-sky implementation of the prototype such as aperture masking and long baseline interferometry.

ABSTRACT

David Buscher
University of Cambridge, Cavendish Laboratory (UK)

Bias correction for high precision science

As the VLTI moves to fainter targets and higher-precision measurements, sources of error which had previously been ignored will become important. Typically the highest-precision observable in interferometry is the closure phase, measured via the bispectrum. The bispectrum is subject to bias due to detection noise, and this bias becomes more important as the light level decreases. We show that existing bias correction strategies are inadequate at a level which will cause problems for many proposed observing programmes and we present an improved method which can be applied across a wide range of interferometric observations.

ABSTRACT

Jeff Meisner
Sterrewacht Leiden (NL)

VINCI: The first interferometric instrument at the VLTI, its success story, and technical lessons learned

VINCI was the first interferometric instrument implemented at the VLTI, intended primarily as a test and alignment instrument, but which delivered scientific results far exceeding any initial expectations. A very brief overview of the instrument and its operational history is presented.

The talk will then concentrate on some technical issues affecting the instrument, both positive and negative, and some lessons that can be learned. These issues are illustrated in each case using results obtained from analysis of on-sky (and some technical) data sets.

The greatest attention is devoted to the single-mode fiber beam combiner (MONA) which is the heart of the instrument. This device was an improved version of the tried and tested design used in the previous FLUOR instrument. Its parameters fluctuated over time requiring frequent (and troublesome) adjustment in order to obtain a high interferometric efficiency. Polarization mismatch is believed to be mainly responsible for the fluctuating and sometimes poor interferometric efficiency, and this is a general concern in the case of single-mode (guided wave) optical systems accepting both polarizations.

Due to the essentially perfect spatial filtering obtained using single-mode fibers, atmospheric seeing (r_0) had practically no effect on the transfer function (calibration) of the instrument over a single night. Apparent fluctuations in the transfer function are caused in the data reduction stage or are due to changes in the atmospheric coherence time (tau_0) when using an insufficient detector frame rate. This realization can simplify the choice and use of calibrator observations in an instrument benefiting from full spatial filtering.

Due to the exceptionally high intrinsic precision of the measurements, the demonstrated error in raw visibilities (but also in calibrated visibilities) could often be shown to steadily decrease in proportion to the square root of the observing time, rather than reaching a plateau due to systematic error sources as is more often the case. Unfortunately such attainable levels of precision were seldom realized due to the finite duration of observations. A number of conservative approaches in the design of VINCI helped guard against failure of the hardware or data analysis, however these also reduced the observational efficiency of the instrument. For instance, the long scans used in normal observing modes meant that the instrument spent 90% of the time completely off-fringe, leading to this observing inefficiency.

The ultimate test of the instrument's precision can be inferred from fitting calibrated visibilities obtained to the UD visibility function and analyzing the residuals obtained. 155 stars were observed sufficiently to consider, some of which are rather dim or might not be properly fit using a UD visibility function. The better half of this set, 77

ABSTRACT

Leonardo Testi
ESO-Garching

High angular resolution science with ALMA

I will review the major science themes and capabilities of ALMA for high angular resolution astrophysics. I will discuss some examples of science projects that benefit from ALMA-VLTI synergy, today and tomorrow.

ABSTRACT

Markus Kissler-Patig
ESO-Garching

E-ELT meets VLTI

In this talk, we briefly explore the expected synergies between the E-ELT and the VLTI.

ABSTRACT

John Monnier
University of Michigan (US)

Science with interferometers in the era of ALMA, ELTs and space missions

abstract missing