



# MIDI and AMBER from the user's point of view

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## Abstract

This article introduces the two instruments MIDI and AMBER of the VLTI, for which observing proposals can be submitted. The instruments are described from a user's point of view without going very deep into their technical details. Emphasis is put on practical considerations that may be useful for the preparation of observations in the various stages including the first consideration of scientific ideas, the preparation of observing proposals, and the preparation of the actual observations after observing time has been granted. © 2007 Elsevier B.V. All rights reserved.

*Keywords:* Instrumentation: interferometers; Techniques: interferometric; Telescopes; MIDI; AMBER

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## Contents

1. Introduction . . . . .	640
1.1. Scientific results from MIDI and AMBER . . . . .	640
2. Description of MIDI and AMBER . . . . .	641
2.1. Number of beams and imaging capabilities . . . . .	641
2.1.1. MIDI . . . . .	641
2.1.2. AMBER . . . . .	642
2.2. Wavelength ranges and dispersion . . . . .	642
2.2.1. MIDI . . . . .	642
2.2.2. AMBER . . . . .	642
2.3. Optical set-ups and method of beam combination . . . . .	642
2.3.1. Incoming light beams . . . . .	642
2.3.2. MIDI . . . . .	643
2.3.3. AMBER . . . . .	643
3. Preparation tools for MIDI and AMBER . . . . .	644
4. Observing with the VLTI . . . . .	645
4.1. Calibration of the interferometric transfer function . . . . .	646
4.2. Sequences of observations . . . . .	647
4.3. Scheduling of VLTI observations . . . . .	648
4.4. Precision of coordinates and sky accessibility . . . . .	648
5. An overview on past and present VLTI observing periods . . . . .	648
6. Summary . . . . .	649
Acknowledgement . . . . .	649
References . . . . .	649

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## 1. Introduction

In this book chapter, we introduce and discuss the two instruments MIDI and AMBER, which are currently offered for observations with the VLT Interferometer. The principles of interferometry as well as the VLTI facility are described in the previous chapters of this book, and these aspects are not repeated here. The present chapter is focused on the preparation of observations, with respect to both the initial development and formulation of the scientific idea (phase 1 proposal preparation), and the definition of the exact observational material and parameters after observing time has been obtained (phase 2 proposal preparation). The process of reducing and modeling the data obtained with MIDI and AMBER is discussed in detail in the following chapters of this book, and these aspects are not a part of the present chapter.

The ESO Very Large Telescope Interferometer (VLTI), located on Cerro Paranal in northern Chile (La Silla Paranal Observatory), is the first optical interferometer that is operated as a general-user facility and that can be used by the whole astronomical community. The telescopes of this facility include the four fixed 8 m diameter VLT Unit Telescopes (UTs) spanning ground baselines between 47 m and 130 m, and four 1.8 m diameter Auxiliary Telescopes (ATs), which can be moved over an array of 30 stations with baselines between 8 m and 200 m. A fringe tracker (FINITO) and a dual-feed facility (PRIMA) for astrometry and phase referenced imaging will extend the capabilities of the interferometer. The details of the facility including the status of the fringe tracker FINITO and the dual-feed facility PRIMA are described by Schöller (chapter 3.1 in this book).

The VLTI includes at present two scientific instruments, the mid-infrared (8–13  $\mu\text{m}$ ) instrument MIDI (Leinert et al., 2003) combining two light beams at a time and the near-infrared (J, H, K bands) instrument AMBER (Petrov et al., 2003) combining three beams at a time. MIDI offers spectral resolutions of 30 and 230; AMBER of 30, 1500, and 12000. Both instruments are at present unique among interferometric facilities in their combination of spectral ranges and spectral resolutions. The science operations schemes of MIDI and AMBER are fully integrated into the well established operations scheme of all VLT instruments at Paranal Observatory from the initial preparation of observing proposals to the delivery of the data. In particular, the same kind and level of service and support is offered to users of the VLTI instruments MIDI and AMBER as to users of any instrument at the single UTs at Paranal Observatory.

The instrument MIDI has been offered for regular scientific observations since April 2004 (ESO period P73), and AMBER for observations since October 2005 (ESO period P76). Both instruments can now be used with the UTs as well as with the ATs. The regular VLTI observing periods were preceded by commissioning and shared-risk science opera-

tions using the K-band instrument VINCI (cf. Kervella, chapter 6.1 of this book), as well as by early science observations in the framework of the MIDI and AMBER science demonstration programs. The data resulting from these early observations are publicly available.<sup>1</sup>

All information that is needed to prepare observations with MIDI and AMBER, including preparation tools, is available at the standard ESO webpages as for any other scientific instrument at Paranal.<sup>2</sup> These documentations are regularly updated and it is important to carefully consult the latest versions of these documents for the preparation of actual observations. The present article is by no means intended to represent an alternative to these documents, and details would inevitably be outdated for upcoming observing periods.

Earlier overviews on the technical status of the VLTI and the instruments MIDI and AMBER include, for instance, those by Glindemann et al. (2003), Morel et al. (2004), Rantakyö et al. (2006). Earlier overviews on the operations scheme of the VLTI include, for instance, Wittkowski et al. (2004, 2005).

### 1.1. Scientific results from MIDI and AMBER

The range of astrophysical topics that can be addressed by the instruments MIDI and AMBER can be estimated by studying the results that have so far been obtained using optical/infrared interferometry in general and using MIDI and AMBER in particular.

General scientific results based on interferometry were reviewed, for instance, by Quirrenbach (2001), Baldwin and Hanniff (2002), Monnier (2003). The OLBIN newsletter<sup>3</sup> is regularly updated and provides a list of all publications related to optical interferometry.

Overviews on early results from the VLTI were presented, for instance, by Richichi and Paresce (2003) and Wittkowski et al. (2005). More recent scientific results from MIDI and AMBER are exemplarily presented by several authors in chapter 6 of this book. The ESO telescope bibliography,<sup>4</sup> maintained by the ESO library, contains refereed publications directly using ESO data. This database is regularly updated and provides an easy interface to search, for example, for refereed publications based on MIDI or AMBER data. At time of writing this article (January, 2007), it contains a number of 19 refereed publications that are based on MIDI data. Refereed publications based on AMBER data are not available as of this date, but several articles based on AMBER data are currently in press and will soon appear in this database.

<sup>1</sup> [http://www.eso.org/projects/vlti/instru/vinci/vinci\\_data\\_sets.html](http://www.eso.org/projects/vlti/instru/vinci/vinci_data_sets.html), [http://www.eso.org/projects/vlti/instru/midi/midi\\_data\\_sets.html](http://www.eso.org/projects/vlti/instru/midi/midi_data_sets.html), [http://www.eso.org/projects/vlti/instru/amber/amber\\_data\\_sets.html](http://www.eso.org/projects/vlti/instru/amber/amber_data_sets.html).

<sup>2</sup> <http://www.eso.org/observing>, <http://www.eso.org/instruments>.

<sup>3</sup> [olbin.jpl.nasa.gov](http://olbin.jpl.nasa.gov).

<sup>4</sup> <http://archive.eso.org/wdb/wdb/eso/publications/form>.

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