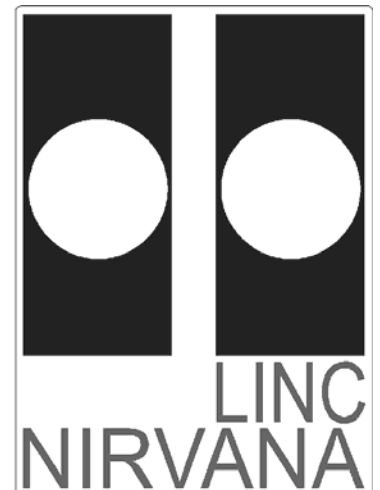


# LINC-NIRVANA

The **L**BT **I**nterferometric **C**amera and  
**N**ear-**I**nfra**R**ed / **V**isible **A**daptive  
**i**nterferometer for **A**stronomy

A collaborative project of the MPIA Heidelberg, INAF-Arcetri,  
Universität zu Köln, and MPIfR Bonn

<http://www.mpia.de/LINC>

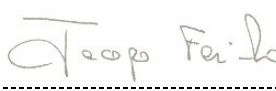


## LINC-NIRVANA

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### Handling and Shipping

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## 1 Scope

This document describes the handling and shipping of the LINC-NIRVANA instrument from unit level to the complete instrument in the integration facility in Europe and at the Large Binocular Telescope Observatory. It also outlines the concept for instrument shipping from the integration facility in Europe to the LBTO in the US.

Please see the document “LINC-NIRVANA Project Overview” (LN-MPIA-FDR-GEN-002) for an overview of the complete instrument.

## 2 Applicable documents

No.	Title	Number & Issue
AD1	LN-MPIA-FDR-AIT-005_APP_A.doc	CFRP Handling and Inspection Manual Issue A

## 3 Acronyms and abbreviations

FFTS	Fringe and Flexure Tracking System
GWS	Ground-Layer Wavefront Sensing System
HW	Hardware
LBT	Large Binocular Telescope
LBTO	Large Binocular Telescope Observatory
LINC-NIRVANA	LN
MPIA	Max-Planck-Institut fuer Astronomie Heidelberg, Germany
MHWS	Mid-High-Layer Wavefront Sensing System
PDR	Preliminary Design Review
SW	Software
TBD	To Be Defined/Determined
US	United States of America
CFRP	Carbon Fiber Reinforced Plastic
Units	
m	Meter
mm	Millimeter
kg	Kilogramm
V	Volt
Hz	Hertz

## 4 Handling Procedure for Instrument Assembly

### 4.1 Weight and dimensions of LINC-NIRVANA

Table 1 shows the weight of the LINC-NIRVANA instrument. The estimated complete mass is 7.100 kg, meaning that in the MPIA Montagehalle the complete instrument can't be lifted by the crane (limit 6.300 kg). We are within the crane limit without the electronic boxes. Lifting in the LBT dome is no problem.

All subunits have special lift points for the mounting of crane hooks. These positions are clearly marked. Lifting at not defined positions is not allowed. Only qualified crane operators at MPIA and in the LBT dome are allowed to handle the instrument and their subunits by crane.

Item	Qty	Mass [kg]	
		Single	Total
Cryostat	1	600,00	600,00
GWS	2	500,00	1.000,00
Deformable Mirror Unit	2	150,00	300,00
MHWS Sensor	2	200,00	400,00
Cover	1	300,00	300,00
Optical table	1	1.050,00	1.050,00
Substructure with base frame	1	950,00	950,00
Electronic cabinets	6	250,00	1.500,00
Lifting traverse	1	500,00	500,00
Miscellaneous	2	250,00	500,00
<b>Sum</b>			<b>7.100 ,00</b>

Table 1 Weight of the LN instrument (please note: 7.100,00 kg → 7,100.00 kg US standard)

Figure 1 shows a complete view of the assembled LINC-NIRVANA instrument. The optical table has outer dimensions of 4354 mm x 3584 mm. All fragile parts will be dismounted from the optical bench and packed separately.

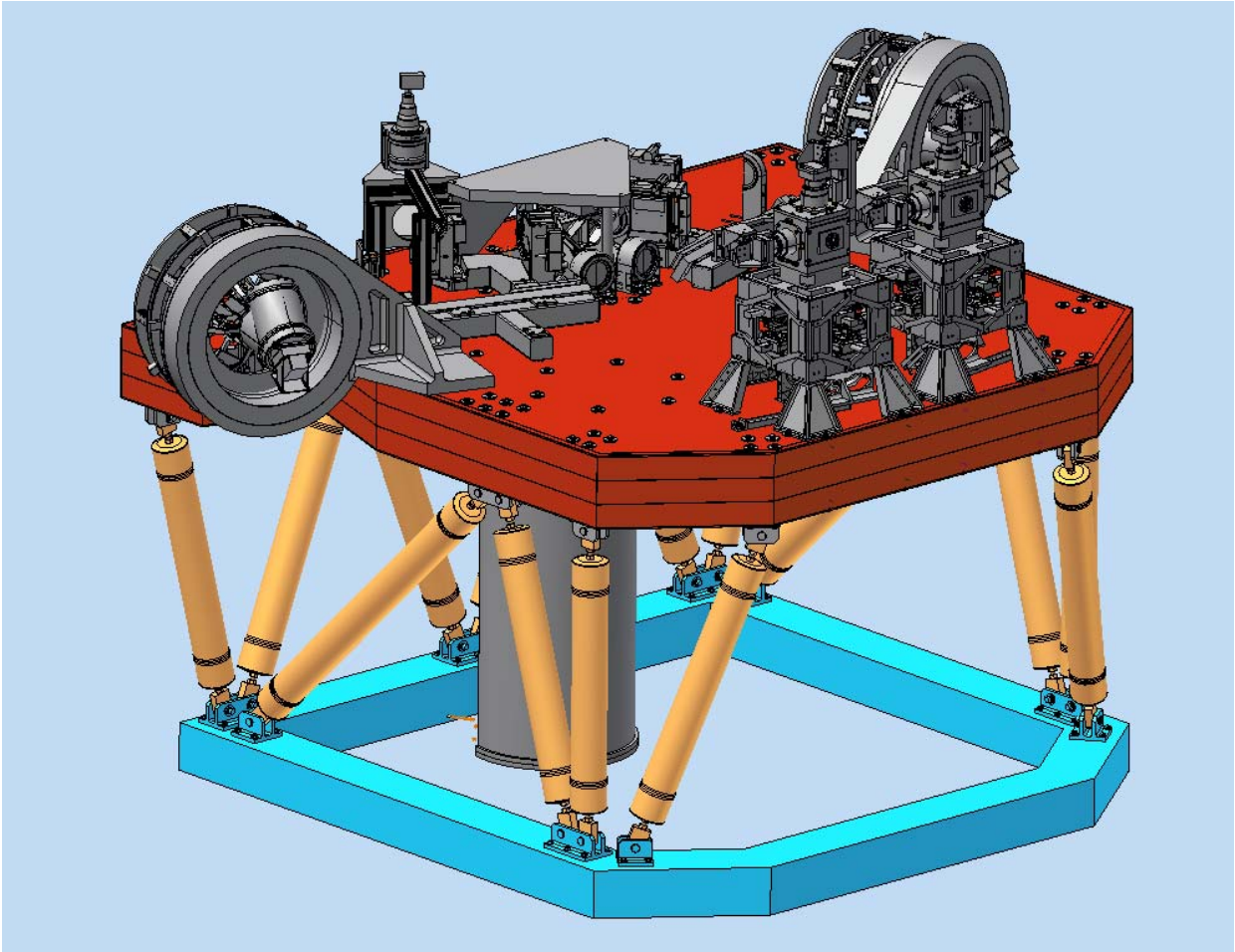


Figure 1 The complete assembled LINC-NIRVANA instrument

## 4.2 Handling Tools of Instrument Units

This section lists the tools for the handling of the various instrument units during instrument dis/assembly. Table 2 gives further information on the properties of the tools and on the provider.

<i>Instrument Unit</i>	<i>Handling Tool /Mounting Interface</i>	<i>Properties</i>	<i>Provider</i>
Bench&Support Structure (no electronic racks)	Crane	Load: 6300kg hook height: 5m	Montagehalle: MPIA Mt. Graham: LBTO
	Lifting traverse with lifting chains	Weight: 500kg (TBD) mounting interfaces to crane (traverse) and to bench (lifting chains)	MPIA
	Mounting connectors at bench and support structure		MPIA, INVENT

<i>Instrument Unit</i>	<i>Handling Tool /Mounting Interface</i>	<i>Properties</i>	<i>Provider</i>
	Mounting platform with handrails	Load: 700kg (8 persons) to be used by personnel for assembly work at the bench	MPIA
	LN moving telescope simulator	Rotates instrument 90° to simulate telescope movement mounting interface at base frame	MPIA
GWS	Crane	Load: 500kg (complete unit with bearing and mounting adapter)	Montagehalle: MPIA Mt. Graham: LBTO
	Lifting traverse with ropes	TBD	INAF Arcetri
	GWS mounting interface	TBD	INAF Arcetri
	Rotation, transport and storage device	Trolley for transport, storage and service	INAF Arcetri
MHWS	Crane	Load: 200kg	Montagehalle: MPIA Mt. Graham: LBTO
	MHWS interface for rope mounting	TBD	INAF Arcetri
	Storage palette	TBD	INAF Arcetri
Dewar	Trolley with lifting and rotation unit	Mounting of dewar at the optical bench, lab service	MPIA
	Cover for mounting hole in LBT floor	Safety	MPIA (TBD)
Electronic Cabinets	Crane	Weight (one cabinet): 250kg	Montagehalle: MPIA Mt. Graham: LBTO
Cooling unit	Crane	Weight: ~1500kg	Montagehalle: MPIA Mt. Graham: LBTO

<i>Instrument Unit</i>	<i>Handling Tool /Mounting Interface</i>	<i>Properties</i>	<i>Provider</i>
	Trolley	Standard low lift platform truck for a load of ~1500kg	Montagehalle: MPIA Mt. Graham: LBTO
Computer equipment	Trolley	TBD	Montagehalle: MPIA Mt. Graham: LBTO

**Table 2 Handling tools and mounting interfaces of instrument units**

### 4.3 Special properties of CFRP

The optical table, the substructure and other parts of LN are made from CFRP. Please see document LN-MPIA-FDR-AIT-005\_APP\_A.doc for more information about the special handling of CFRP.

## 5 Instrument Packing and Shipping

The instrument units will be shipped separately assembled. Packing is done by a professional packing company. Boxes for component delivery (bench, substructure, DM-unit ...) from different vendors can be used. Transport is organized and performed by a professional shipping company with experience in international transports. Road or road/train transport is foreseen within Europe. The packing containers stay with the respective unit and shall not be destroyed or returned. Responsible for packing and shipping is the consortium institute that provides the respective unit. It is assumed that unit transport in Europe will take a few days up to one week.

The items to be transported are detailed in Table 3 The items require TBD boxes. Note that weights are estimated, and include some contingency. Items TBD will be fitted with shock and level sensors, and provisions will be made for inspecting those sensors during transport.

<i>Nr</i>	<i>Outer dimensions (cm)</i>			<i>Net (kg)</i>	<i>Gross (kg)</i>	<i>Contents</i>
	<i>length</i>	<i>width</i>	<i>height</i>			
1						Optical table with mounted (TBD) warm optics
2						Beams for optical table substructure including telescope interface
3						Basic frame for substructure
4						Cryostat
5						GWS
6						DM-unit
7						MHWS
8						Tools
9						Misc.
						<b>Total</b>

**Table 3 List of items to be transport**

## 5.1 Transport definition

The transport shall be carried out "door-to-door", from the MPIA premises to the LBT Observatory. It is not yet decided if we will have an air or ship transport. This document currently describes air transport only.

## 5.2 Pick-up point

Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, GERMANY

LINC-NIRVANA Project Manager

M. Kürster, tel: +49 (0)6221 528 214, fax: 528 246

[kuerster@mpia.de](mailto:kuerster@mpia.de)

## 5.3 Final delivery point

LBT Observatory Mt. Graham

Total distance by road from delivery airport: 191 miles from Phoenix, 152 miles from Tucson

Joar Brynnel

LBT Observatory

Tel: +1 520-626-0431

[jbrynnel@as.arizona.edu](mailto:jbrynnel@as.arizona.edu)

## 5.4 Transport Specifications

The LINC-NIRVANA instrument is very fragile. Therefore boxes must be handled and transported with great care to avoid any shocks that may cause damage. During all phases of the handling and transport the following requirements must be fulfilled:

1. Static (<5Hz) acceleration shall be < 3 g in all directions.
2. Shocks shall be lower than 10g over 20 ms (50 Hz).
3. Boxes shall remain horizontal to within 20 degrees.
4. Boxes will not be exposed to direct sunlight for more than 3 hours continuously.
5. The contents of the boxes will remain inside the temperature range -5°C to +30°C.
6. Non condensing environment.

A number of boxes (TBD) will be fitted with shock and level sensors, and provisions will be made for inspecting those sensors during transport.

The goods shall be airfreighted, offloaded and put safely onto the ground and/or trucks provided by the transport agent for forwarding to Mt. Graham.

## 5.6 Schedule

The items to be transported shall be picked up at MPIA not earlier than TBD.

The items will be delivered to Mt. Graham not later than TBD.

## 5.7 Insurance

The insurance from the moment in which items are picked up in MPIA to the moment that they are delivered on the ground on Mt. Graham will be the responsibility of the shipping company. The total value of the parts to be shipped is TBD Euros. The insurance should be all risks. An option with complete responsibility of the insurance company shall be proposed (no uncovered parts), but other options with partial responsibility of the insurance company can also be evaluated.

## 5.8 Importation Liaison

Duty free importation of the Large Binocular Telescope into the United States, was approved by Congress in August 1996 and finally initialized through U. S. Customs in January 1998, according to the documentation submitted by Suarez International Inc., U.S. Customs Broker, on November 26, 1997.

Please note that Public Law 104-295 states the following:

*"In general. -- The Secretary of the Treasury is authorized and directed to admit free of duty ..... the large binocular components, parts, and equipment provided by the Arcetri Astrophysical Observatory and the Max Planck Institute for use by the Steward Observatory of the University of Arizona."*

Accordingly, each and every set of LBT documentation for hardware shipments that will be prepared for transportation to the United States should officially be routed through LBT Project manager at MPIA. In addition, it will be mandatory to incorporate the LBT Project Office/USA at the Steward Observatory of the University of Arizona into the consignee address for the Commercial Invoices and the Bills of Lading that will accompany each and every subset of hardware that will be coming into the United States.

### 5.8.1. US Customs Clearance

Documentation for the U.S. Customs clearance must be handled through:

Suarez International, Incorporated

U.S. Customs Brokers

Tucson, AZ 85732

USA

telephone: +1-520-573-8399

telefax: +1-520-573-8394

email: [ssuarez@flash.net](mailto:ssuarez@flash.net)

## 5.9 Further information on pickup and delivery sites

### 5.9.1 MPIA

The transport shall be done by truck.

MPIA is located on the Königstuhl in Heidelberg. A detailed description how to get there is given on the MPIA web-page <http://www.mpia.de> under "Institut/Adresse und Anfahrt" (in German) or "About the institute/ Visitor information" (in English), respectively.

Note that on the way from Heidelberg up to the Königstuhl (see Figure 2) there exist some narrow curves. When coming from the south-eastern direction it's easier to reach the Königstuhl via the B45 through Waldhilsbach (see Figure 3).

Part of the parking area directly opposite the entrance gate to the integration halls of the MPIA will be reserved for temporary truck maneuvering.

The crates will be stored in the integration hall of the MPIA which is the second hall of three. All the gates between the halls are 5,8 m in width and 4,7 m in height. The Experiment hall is accessible by truck.

The hall is equipped with a roof crane of loading capability of 6.3 tons and a hook height of 5m. For crane loading the load area of the truck should be open and accessible from above.

Second choice is to transport the boxes to the outside by MPIA equipment and to load the truck on the free space outside of the MPIA building.

### **5.9.2 From delivery airport to Mt. Graham**

1. The loading at the delivery airport and unloading in Mt. Graham shall be witnessed by a senior representative of the transport company and by LBT representatives.
2. All trucks **MUST** stop at the MGIO Base Camp (1480 W. Swift Trail) for permits before proceeding up the mountain.
3. The transport shall be done by air-damped truck. Two drivers shall be allocated on each truck required.
4. When necessary, crates can be stacked on top of each other. In this case, the weight of the crate on the top shall not exceed the weight of the lower one.
5. The maximum speed on highways shall not exceed 70 km/h (45 mph) On the last stretch of dirt road maximum speed will not exceed 30 km/h (20 mph) and the transport will be accompanied by an LBT representative.

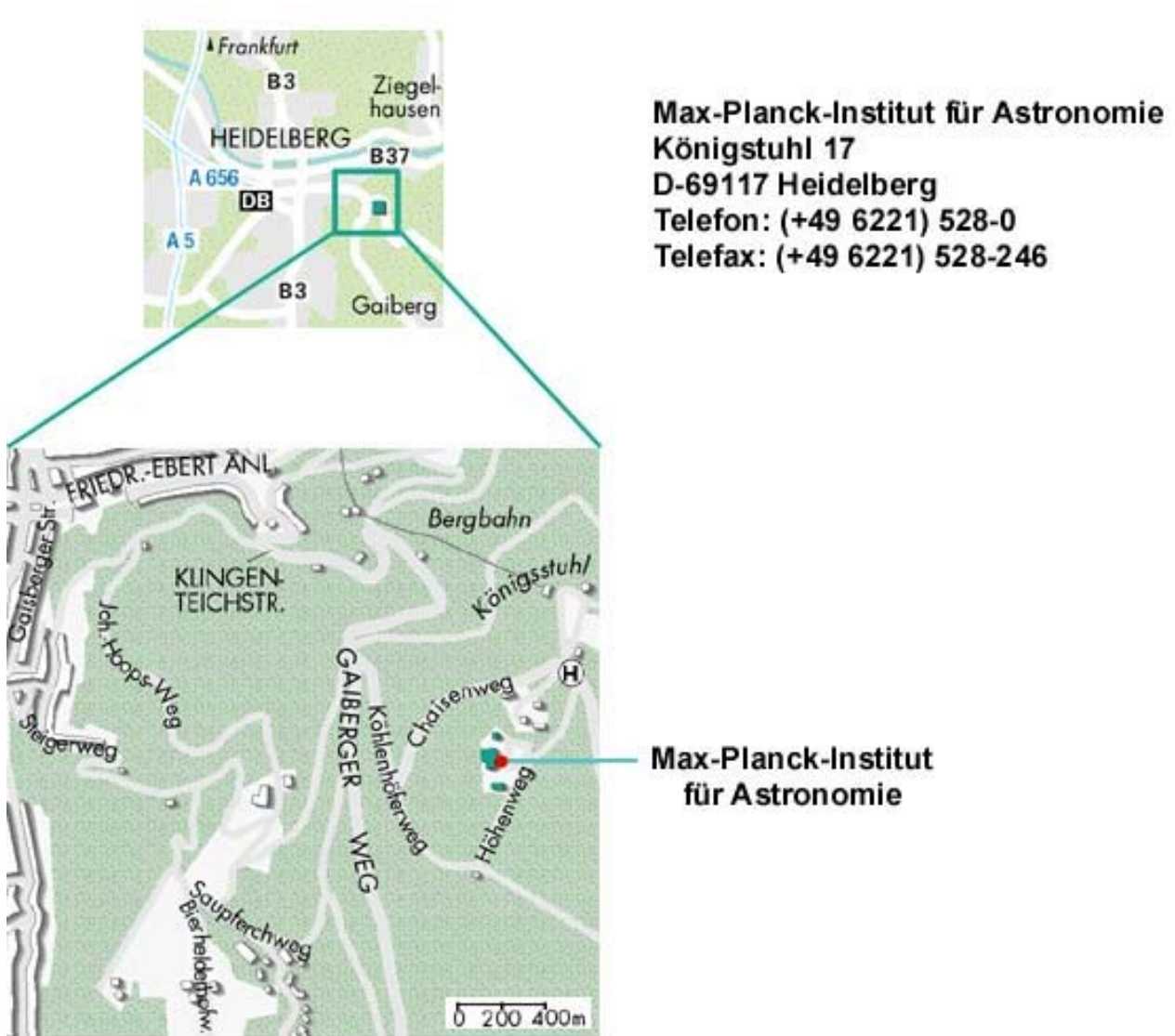


Figure 2. Location of the Max-Planck-Institut für Astronomie at Heidelberg.



Figure 3. Map of highways around Heidelberg and location of MPIA