Hartmann analyzers, field rotators). Drives with sub-μ and sub-arcsec accuracy, and bearing and guidance systems for high relative accuracies can also be offered.

2.2. LIGHTWEIGHT MIRRORS AND NEW COATINGS

To reduce the weight of optical mirrors the suitability of CC and CFC is tested. R&D projects have been started to find materials and processes to build up polishes layers on the carbon substrates.

The loss of light due to low reflectivities (the reflectivity of an aluminized mirror is only 80-85% a few months after coating) results in a total light deficit at the telescope focus up to 50-60%, depending on the number of mirrors. One can increase the light efficiency by more than 50% by increasing the reflectivity of the mirrors say up to 95%. The Optikzentrum works on developing new processes allowing to use e.g. silver as reflecting material, combined with hard protection layers, removable from the mirror without damaging the polished surface. These coating processes shall also be used to improve large glass surfaces of buildings or protection layers for aircraft and space components.

2.3. CONSULTING AND SUPPORT

Due to the results of the basic experiments in combination with experience in design and construction of new telescopes and instrumentation the Optikzentrum is able to consult and support institutions to build up, to maintain and to modernize their telescope systems.

The Optikzentrum disposes of rich experience in precise distance and length measurement techniques, mechanical (10⁻⁸) and optical (10⁻¹⁸). This allows to design, construct and build precise position measurement systems e.g. for large optical structures and beam combination.

2.4. ORGANIZATION OF R&D PROJECTS

Preparation and organization of projects as well as project managing and controlling become more significant with increasing complexity of the technical systems and with budgeting by an increasing number of partners. The Optikzentrum is prepared to manage large projects or may support institutions which are the investigators in such projects. Additionally it may be consulted to find financial support and appropriate partners in industry and research.

Acknowledgements

The Optikzentrum is sponsored by the Ministry of Economy and Technology of Nordrhein-Westfalen/Germany. The management is supported by Fraunhofer Management Company, a subsidiary of Fraunhofer Gesellschaft, München.

A 690 GHz SIS MIXER

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Abstract. We describe an heterodyne mixer designed to be used at frequencies around 690 GHz. The active component is an SIS junction based on a lead-bismuth superconducting alloy. The receiver's best result to date is a system double sideband noise temperature of 850 K at 692 GHz.

Key words: SIS, superconducting, tunnel junctions, terahertz.

1. The Mixer Block

Some of the main features of the 690 GHz mixer include an oversized circular waveguide, a modified Potter horn (Pickett et al.), a non-contacting backshort, a 4 GHz IF, and concentrators which enhance the magnetic field that suppresses the AC Josephson effect. An oversized waveguide was chosen to allow the propagation of the TE₁₁ and the TM₁₁ circular waveguide modes which are required for the dual mode horn. Also, a larger guide is somewhat easier to manufacture. The oversized waveguide allows radiation through to the SIS junction at frequencies all the way down to 400 GHz making this scheme a possibility for a very wide band receiver (over 300 GHz of bandwidth).

2. The SIS Junction

The Superconductor – Insulator – Superconductor (SIS) junction is manufactured at the Electronics Laboratory of the University of Kent at Canterbury. For the 690 GHz project, a small amount of bismuth is added to the lead – gold – indium alloy that was used in junctions for receivers at the JCMT (Cunningham et al. 1992, Davies et al. 1992, Ellison et al. 1993). This creates a device with a higher bandgap (2.8 mV in this case) and it can be used as the mixing element at 690 GHz.

References


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Fig. 1.  a) 3-D representation of the mixer horn, backshort, and magnetic field concentrators.  
b) Schematic of the receiver showing the Gaussian beam envelope and the far field antenna profile  
c) The current–voltage (I–V) characteristic of the Pb–Bi SIS junction without any magnetic field  
applied across it. d) The double side–band system noise temperature as a function of frequency.