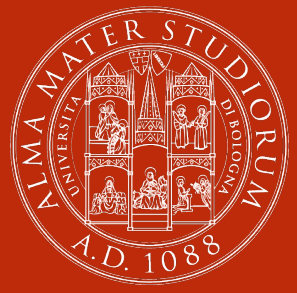
Astronomical Instrumentation



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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2023/2024

Dipartimento di Fisica e Astronomia

Astronomical Instrumentation Intro

1. The «Navile» campus
    1. Unique concentration of astrophysical research: theory, observations and *instruments development*
    2. **UniBo/DIFA** Astrophysics section of the Deptarment of Physics and Astronomy
    3. **INAF-OAS** Observatory for Space Astrophysics
    4. **INAF-IRA** Institute for Radioastronomy
    5. **CTA-HQ** headquarters of the Cerenkov Telescope Array

2. All areas of astrophysics research are represented, in a multiband approach

3. Astrophysical Instrumentation
    1. This course is not based on a single professor teaching all topics
    2. Individual experts will illustrate the different topics
    3. No attempt to write the Encyclopedia of Instrumentation
    4. In depth overview of some of the top-level technological developments that we do here in Bologna
    5. Direct experience with the DIFA-INAF Laboratory for Astrophysical Technologies
    6. Option for a «tirocinio», possibly linked to the master thesis

Astronomical Instrumentation Intro

1. General Introduction LT
    1. EM radiation and its detection, S/N ratio, resolution and psf
2. Specific modules
    1. Microwave technologies – INAF-OAS/DIFA LTA/Cryowaves
        1. Villa, Cuttaia, Morgante, Terenzi
    2. Radioastronomy technologies – INAF-IRA (from Medicina to SKA)
        1. Monari, Naldi, Pucillo
    3. High Energy Technologies – INAF-OAS HEA payload construction
        1. Amati, Campana, Virgili
    4. Cerenkov Telescope Array – CTA-HQ telescopes, detectors, strategies
        1. Zanin
    5. Adaptive Optics for Large Telescopes – INAF-OAS/DIFA LTA/Morfeo
        1. Rodeghiero
3. Special topics
    1. Science Requirements, concept design and development phases of astrophysics space missions – Amati INAF-OAS
    2. ESO VLT and ELT Instrumentation – Origlia INAF-OAS
    3. ALMA – LT
    4. Microwave receivers in laboratory astrochemistry (at «Ciamcian»)
4. Visits to Medicina and Merate

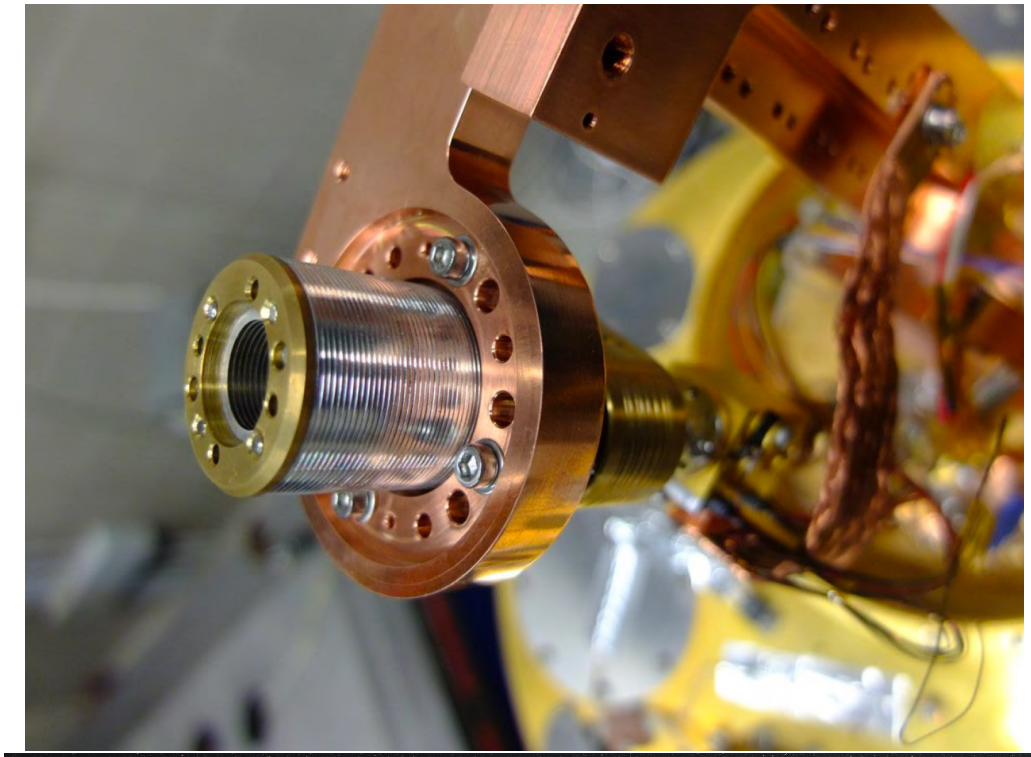
SKA phase I

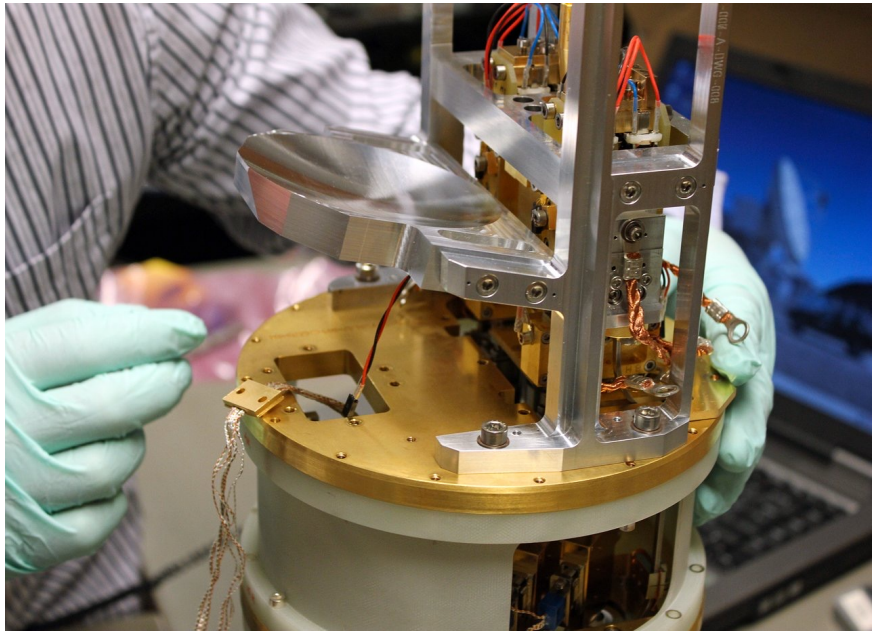
after rebaseline 2015

Not clear if ASKAP will part of SKA enabling ASKAP to provide an early survey capability for SKA1

SKA1-LOW: Australia
50 – 350 MHz
Phase 1: ~130,000 antennas distributed over a 40km radius region
Phase 2: ~ 500,000

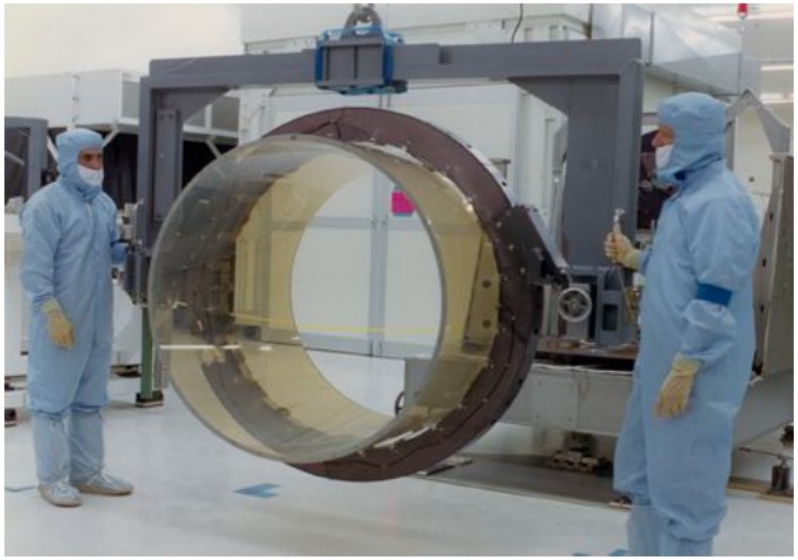
Microwave technologies

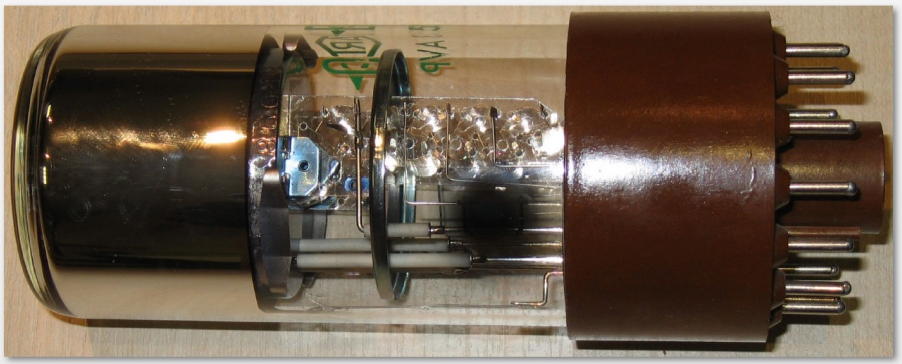


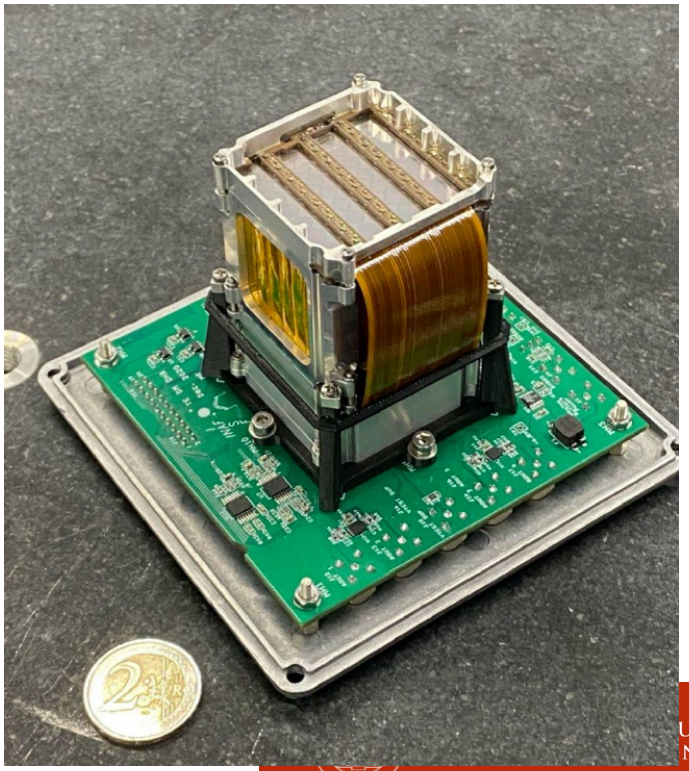


Adaptive Optics for Opt/IR telescopes

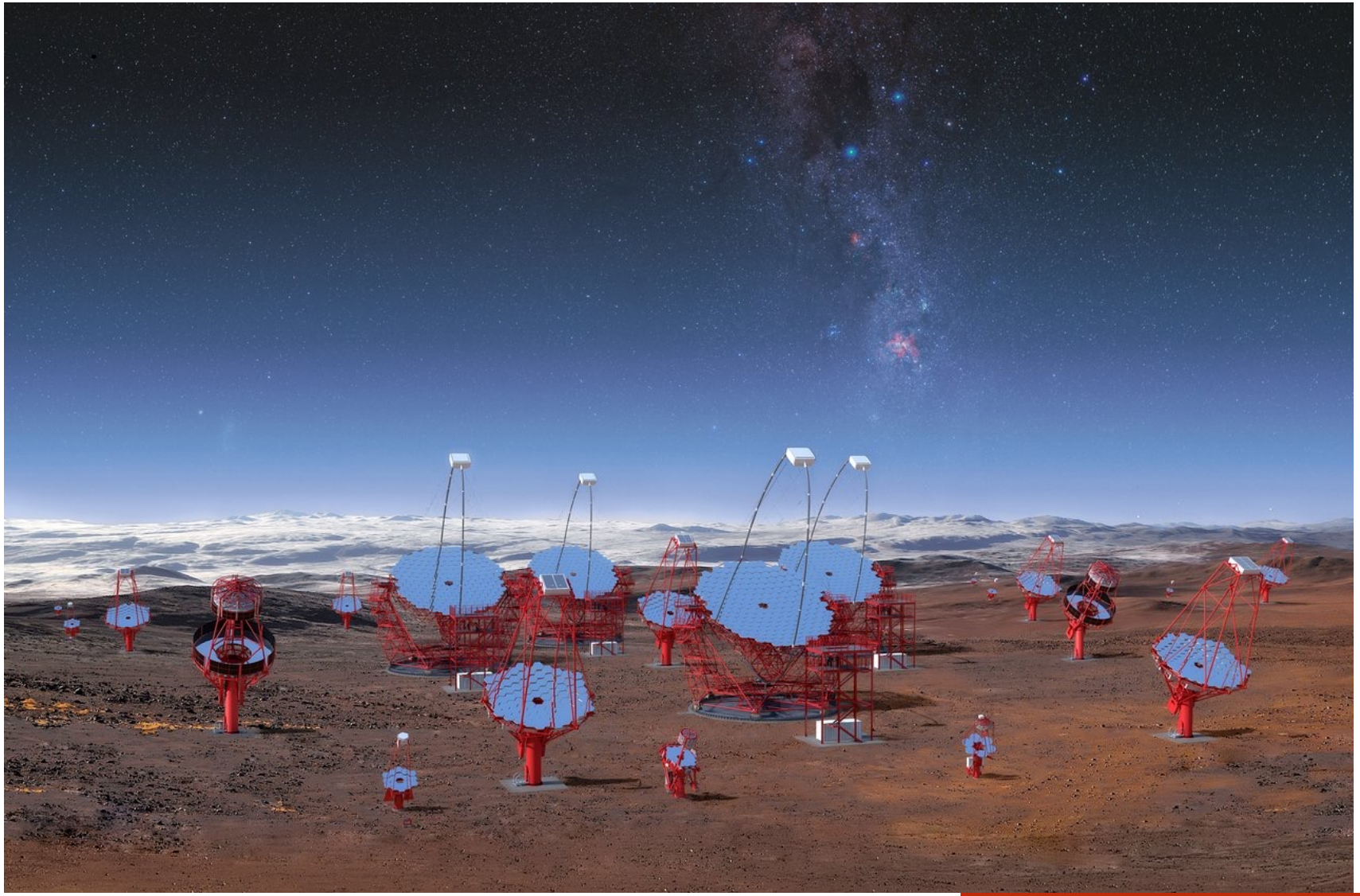
High Energy missions and detectors







Cherenkov Telescope Array



Additional discussion time and Exam

1. «Tirocinio» - 3 credits
    1. You are welcome to use the oportunities offered by the labs
    2. Last year: successful experiences with ASTRI and AdOpt

2. Exam format:
    1. 70% presentation of a topic of choice in depth (to be agreed at least one month in advance, preferably at the end of the course)
    2. 30% general questions on the content of the course (only general concepts)

3. Preparation for the exam:
    1. Focus on the general concepts
    2. Dive into the topic that you will choose, with the support of the Lecturers

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