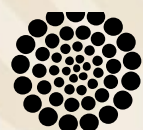


Capacidades en México para apoyar la industria de semiconductores

Dr. Edmundo A. Gutiérrez D.
Director General de INAOE
edmundo@inaoep.mx

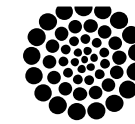


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CENAM, 25 de abril 2024, Querétaro.

Capacidades a nivel industrial y académico



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1 Diseño



Diseño analógico



Diseño digital



2 Fabricación



0.8 μm , clase 10



5 μm , clase 100

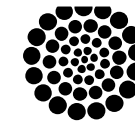
3 Encapsulado y pruebas



Industria

Academia

¿Donde puede México incursionar?



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Industria automotriz

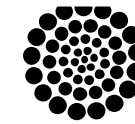


**Instrumentos médicos y
metrología**

- 1 Materiales nano estructurados**
- 2 Sensores físicos, químicos, y biológicos**
- 3 Diseño de circuitos integrados**



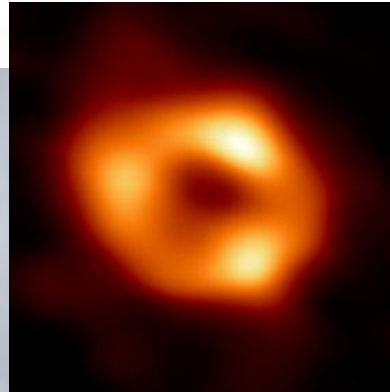
Danzando a las orillas del universo



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Gran Telescopio Milimétrico (GTM)

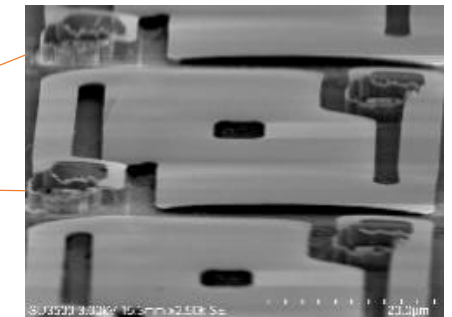
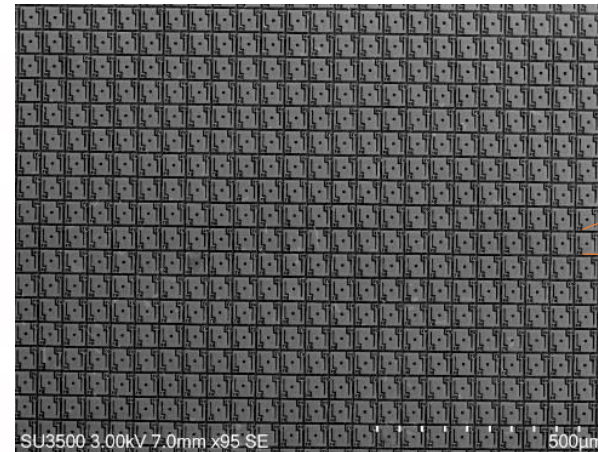


- The BH is 27,000 light-years away from Earth, and it was imaged with an array of 8 radio telescopes (RT) that form a single “Earth-sized virtual RT.”

A light-year= 9.46×10^{12} Kms= 9.46 trillion Kms.

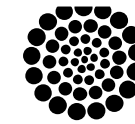
Arreglo de sensores de IR fabricados en INAOE

Escala de decenas de μm en x-y,
y de unos cuantos nm en z.



Instrumentos científicos

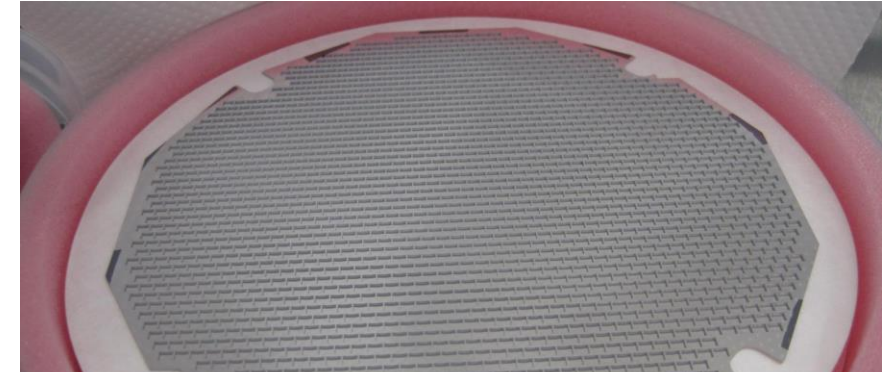
TolTEC a three-band imaging polarimeter



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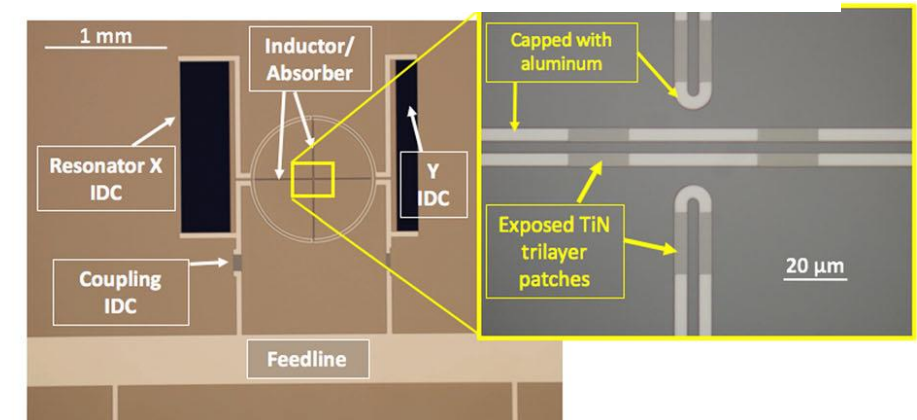
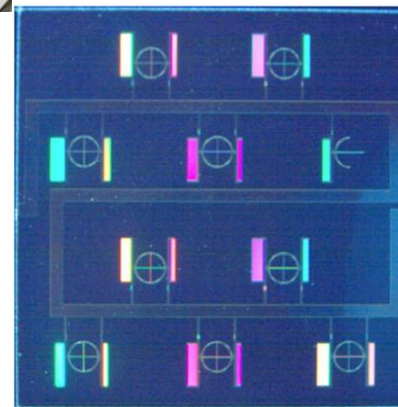


On-wafer 4006 Kinetic Inductance Detectors 6" Si SOI wafer

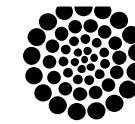


A TiN/Ti/TiN trilayer with thicknesses of 4/10/4 nm serves as the inductor of the resonant circuit and the absorber. After J. E. Austermann, et al. @ T=160 mK.

Wavelength	FWHM (arcsec)	Number of LEKIDs	Number of Pixels
1.1 mm	5	4012	2006
1.4 mm	6.3	2532	1266
2.0 mm	9.5	1172	586



Componentes ópticas de calidad mundial



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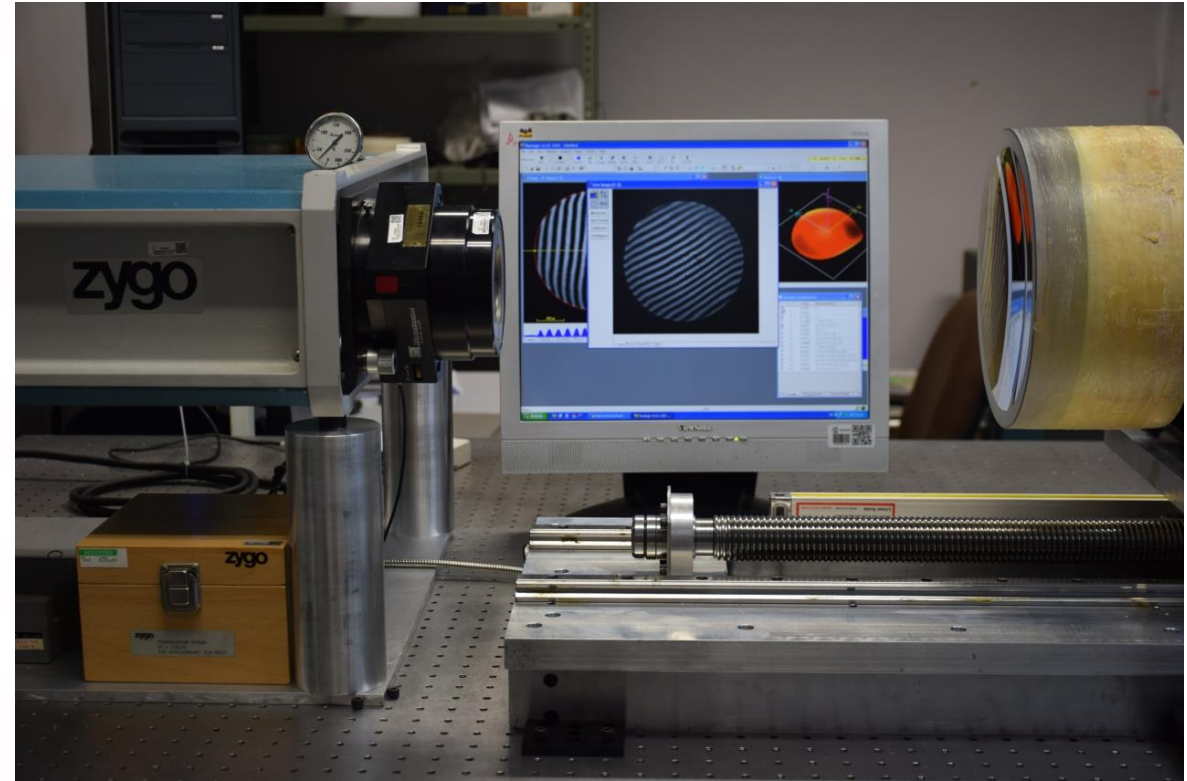


The INAOE 2.5 m diameter optical telescope at Sonora, Mexico

Started operations in 1987. Fully designed and built at INAOE.



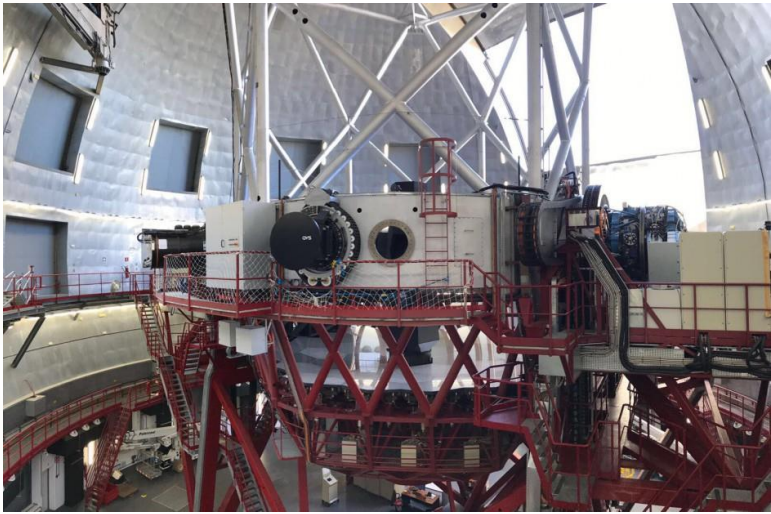
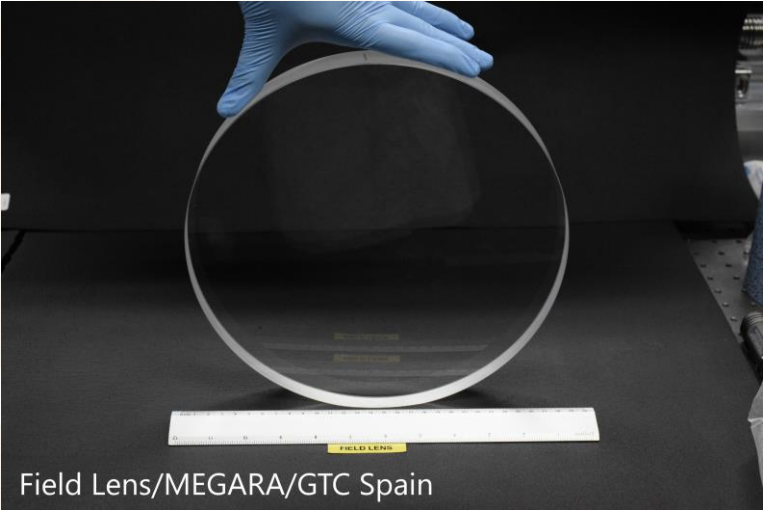
The spectrometer and the electronics were designed and fabricated at INAOE

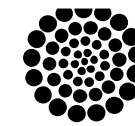


High-quality optical components for scientific instruments are designed and fabricated at INAOE.



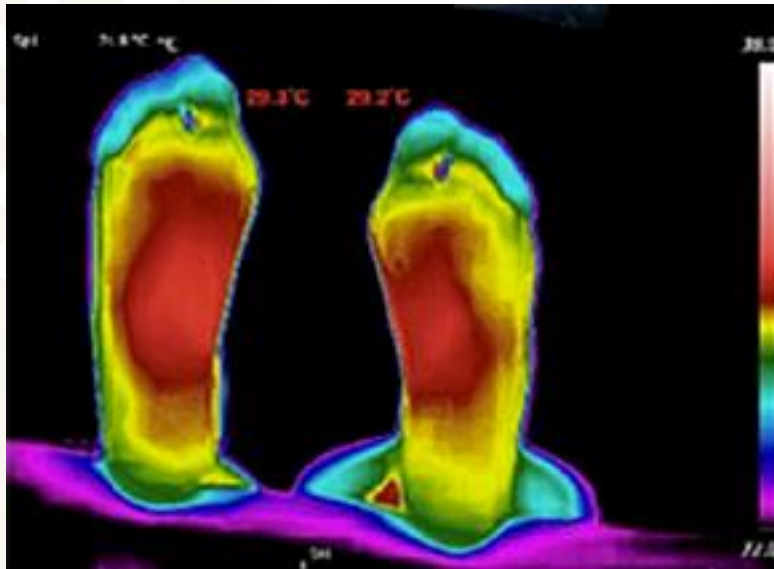
High-tech optical components for scientific instruments



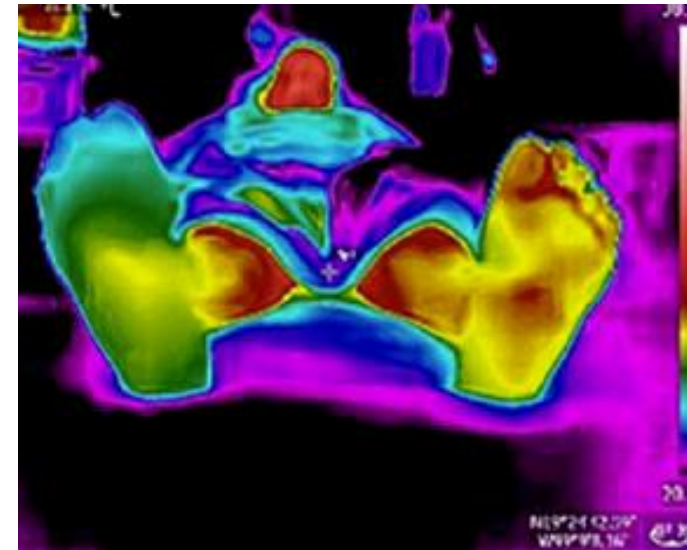


Optical thermography for medical applications

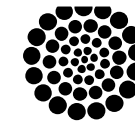
Thermogram of a healthy patient



Thermogram of a non-healthy patient



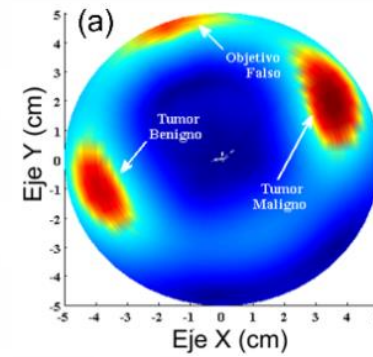
The thermography of the plantar skin is used to study the peripheral artery disease, which serves as medical prediction of diabetes.



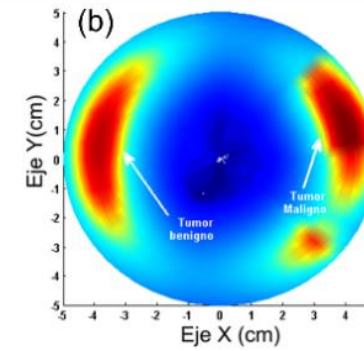
Bolometer camera for breast thermography developed at INAOE



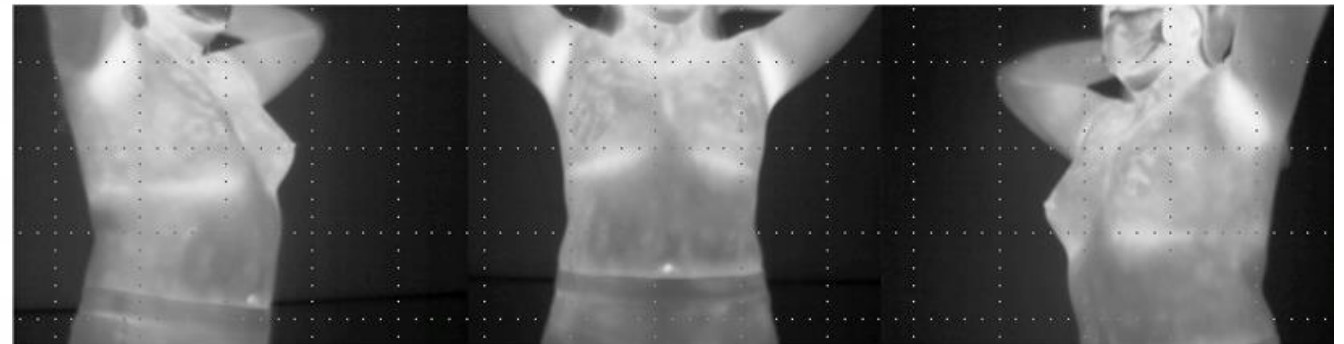
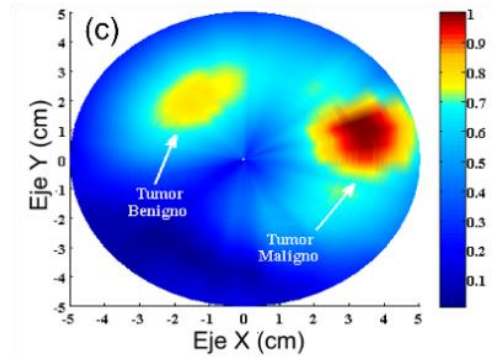
Vertical polarization



Horizontal polarization

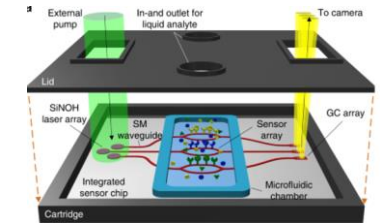
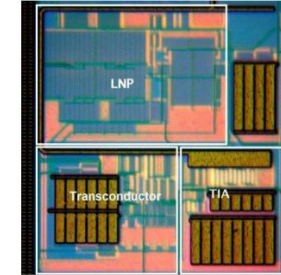
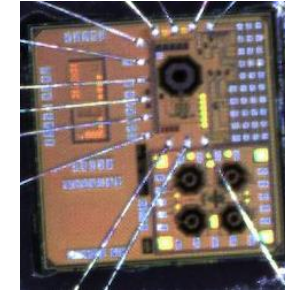
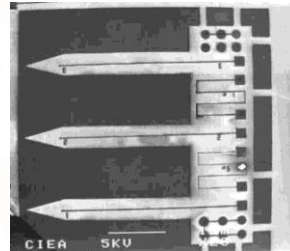
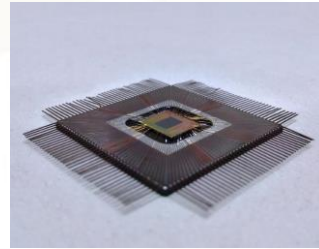


Circular polarization





Encapsulamiento híbrido

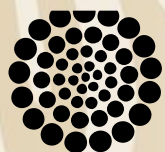


Prototype





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