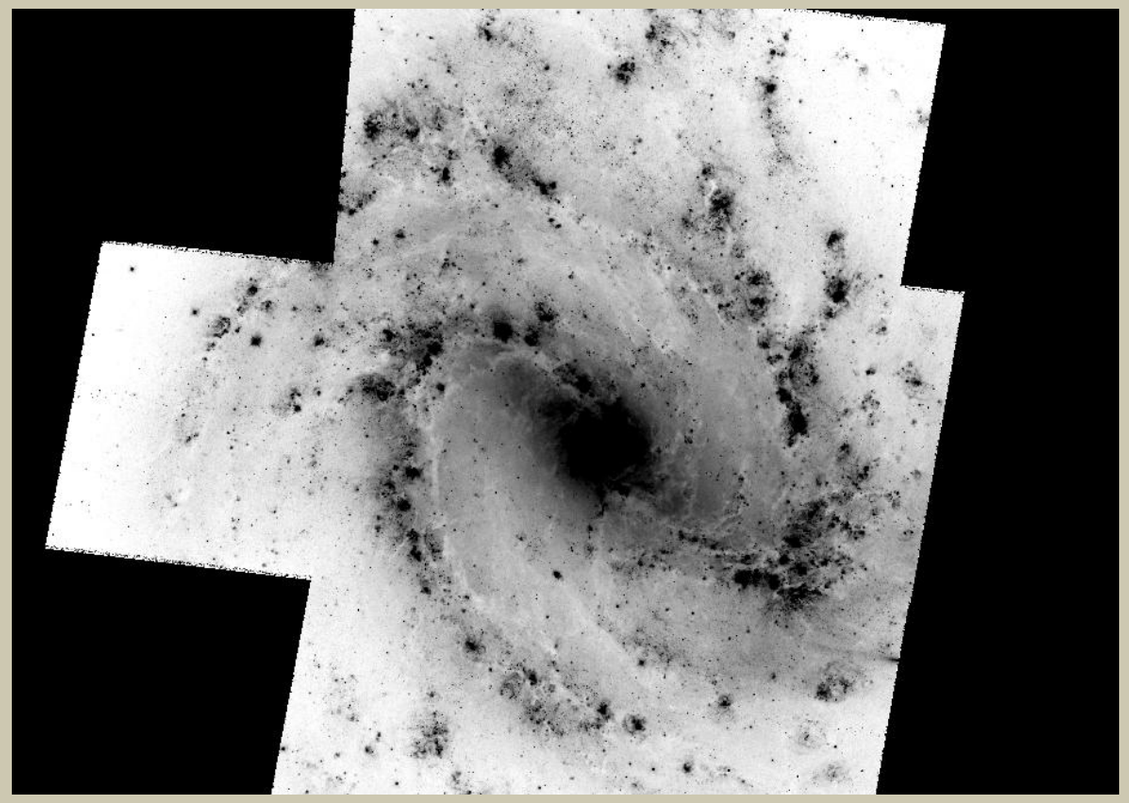
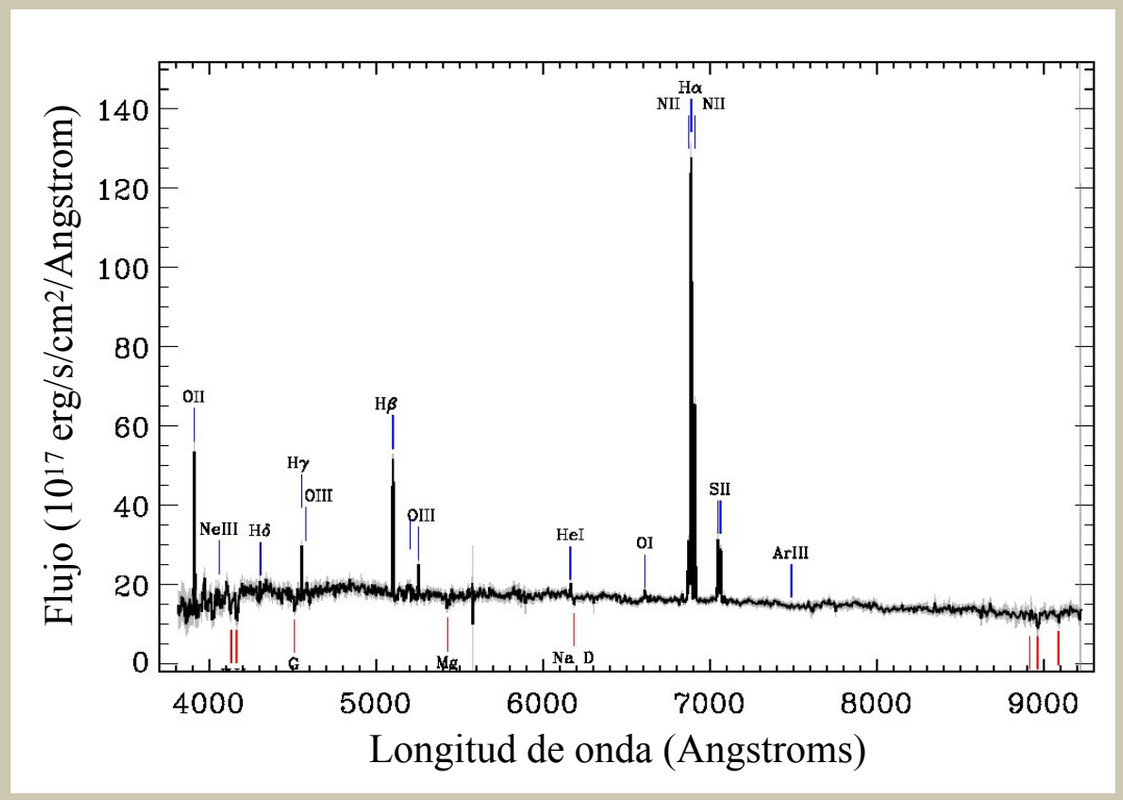
Taller de introducción al análisis de datos astronómicos



INSTRUCTORES:
Aida Nava de Wofford (IA, UNAM)
Sundar Srinivasan (IRyA, UNAM)

SEDE Y FECHA:
U. Autónoma de Ciudad Juárez
22-23 Abril 2021, 11-13 hr, CDMX



Introducción a las bases de datos astronómicas

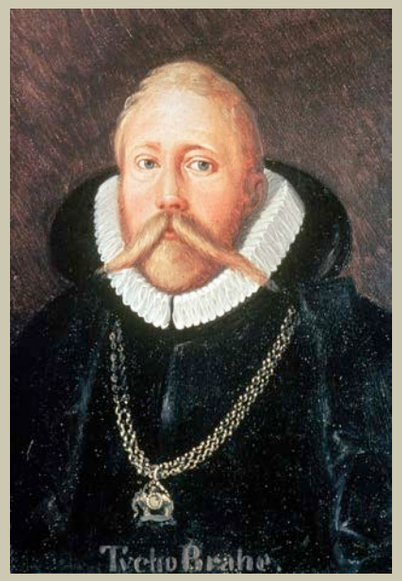
An introduction to astronomical databases

How it started

Hipparchos (c.190 BCE—c.120 BCE)
Wikimedia, Public Domain

Catalogue of star positions

Tycho Brahe (1546-1601)
Edouard Ender/Wikimedia, Public Domain



Positions of naked-eye planets

Charles Messier (1730—1817)
Ansiaux/Stoyan et al. 2008, Public Domain

Catalogue of nebulae and star clusters

Henrietta Swan Leavitt (1868–1921)
Wikimedia, Public Domain

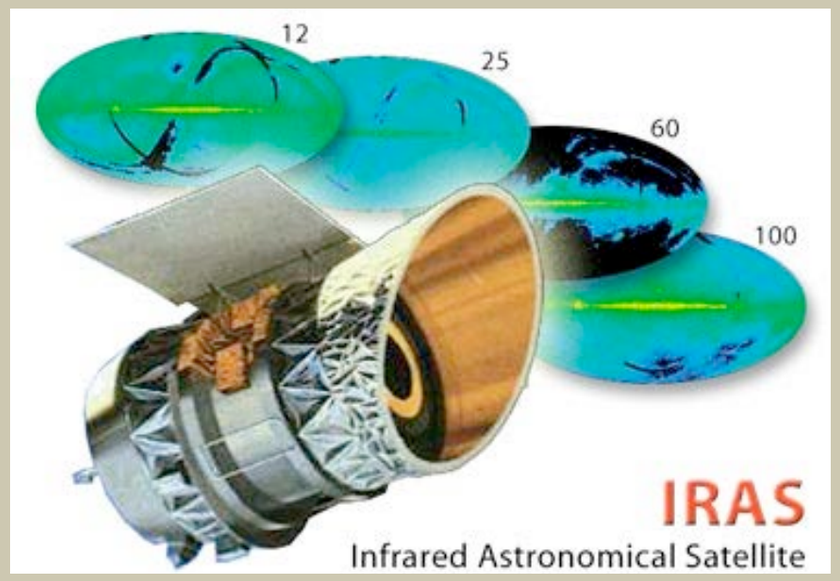
Catalogue of stellar brightnesses

Edwin Hubble (1889-1953)
Mt. Wilson Archive, Carnegie Inst. of Washington

Era of large area/all-sky imaging surveys

How it's going

Infrared Astronomical Satellite (1983-1983)
Wikimedia, Public Domain

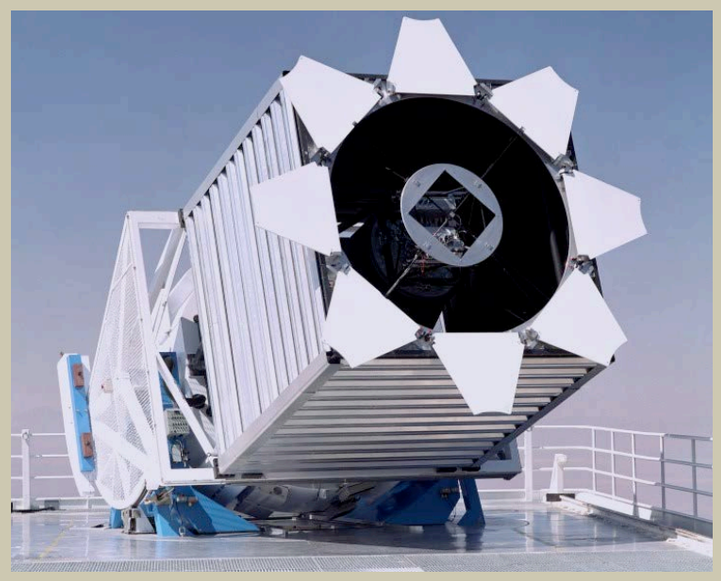


>250,000 infrared point sources

Hipparcos satellite (1989–1993)
M. Perryman/CC BY-SA 3.0

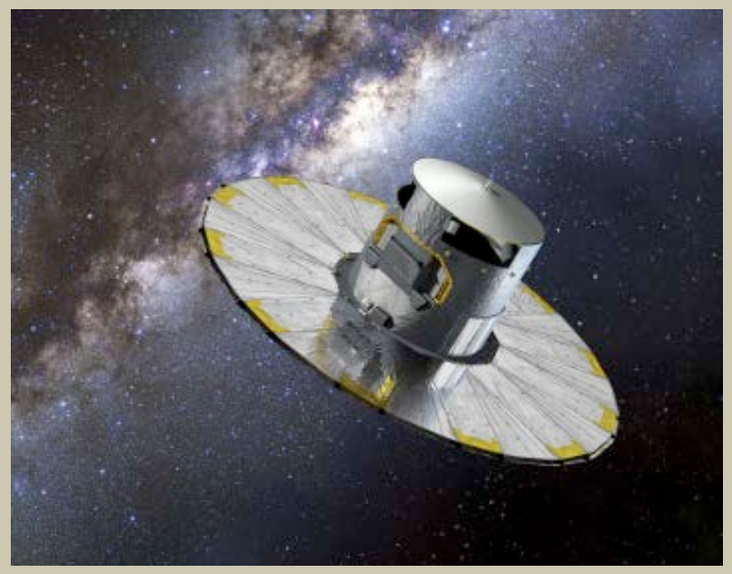
>10^6 star parallaxes

Sloan Digital Sky Survey (2000—)
SDSS.org



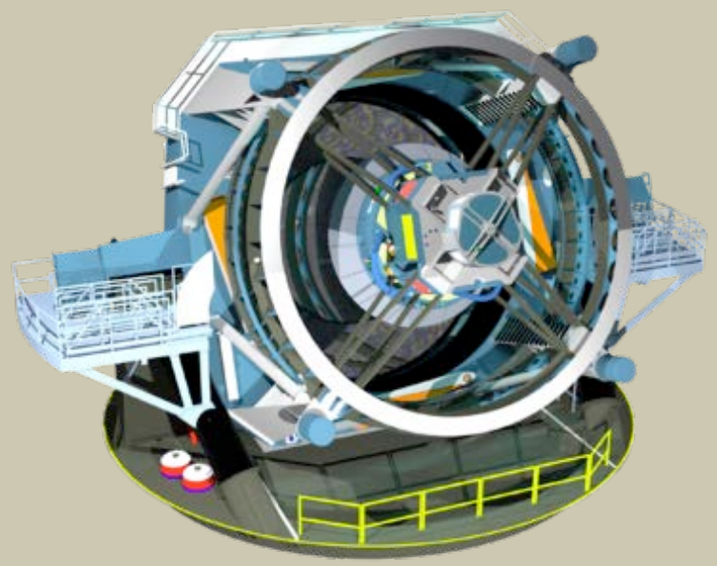
Photometry/spectra of 4x10^6 objects

Gaia (2013–c. 2022)
European Space Agency



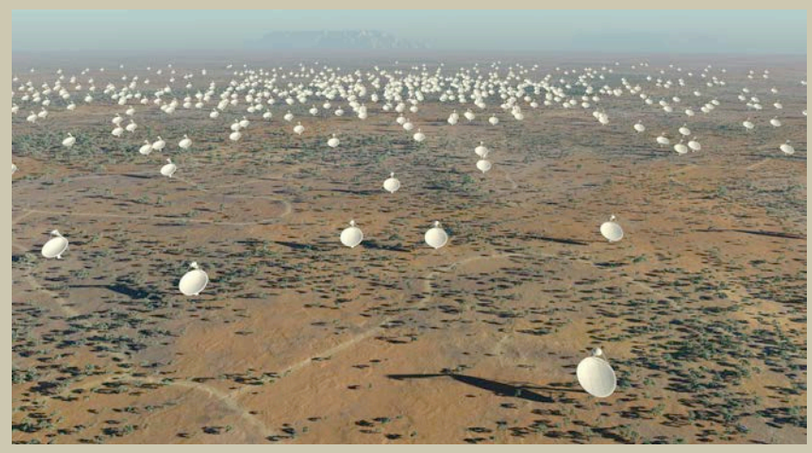
Astrometry for >10^9 objects, 60 TB @ 1 Mb/s

Vera C. Rubin Observatory (2020s)
LSST.org / CC BY-SA 3.0



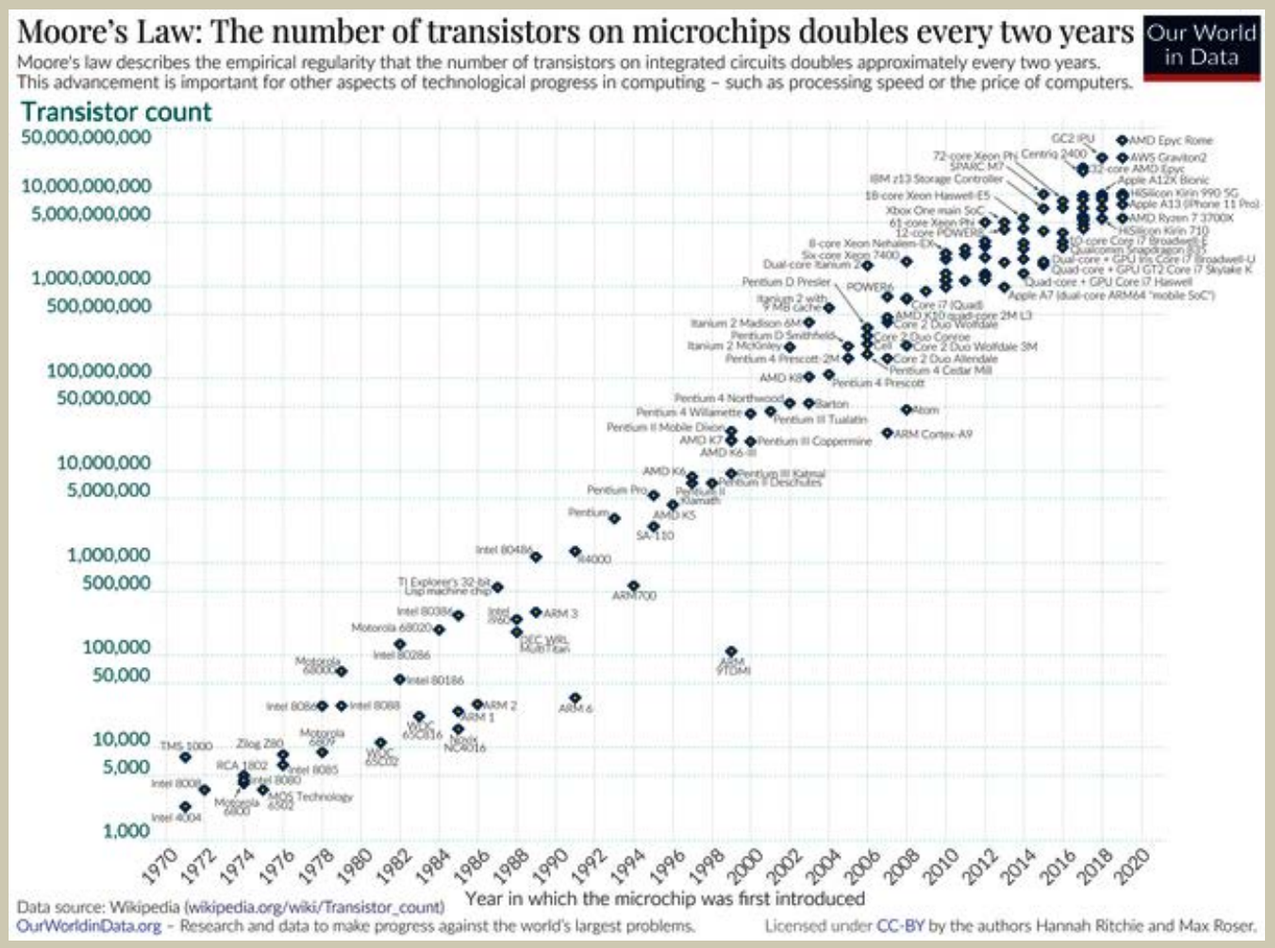
30 TB/night, 100 Gb/s

Square Kilometer Array (2020s)
SKAtelescope.org / CC BY-SA 3.0

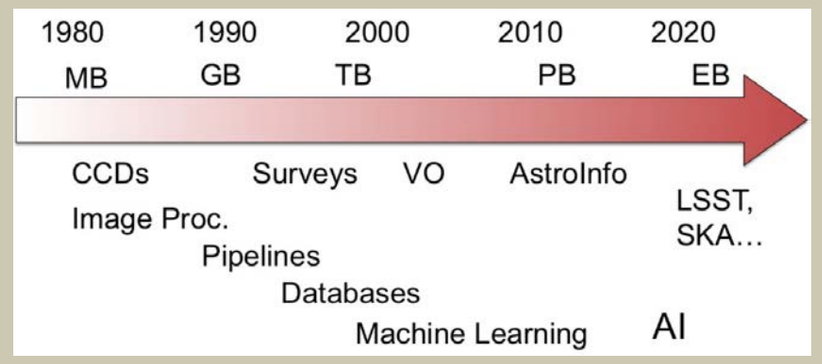


~EB of data, ~Pb/s

The Big Data Challenge



M. Roser & H. Ritchie / CC BY-SA 4.0



Increasing computing capability, storage, memory, and speed of connectivity has led to increase in quality and quantity of digital archives.

Improved internet access and speeds have improved accessibility of these archives.

Software and web-based tools are required to access large archives.

Citizen science projects (e.g., zooniverse.org — classify galaxies on your phone).

Data-driven science rather than hypothesis-driven science!

Information content: Most data will never be seen by humans.

Information complexity: Patterns in these data cannot be directly comprehended by humans.

The Rise of Virtual Scientific Organizations

- A grassroots response to the challenges of the data glut
- A new type of scientific organizations:
  - ✧ Inherently geographically distributed (data, people, tools)
  - ✧ Discipline-based, not institution-based
  - ✧ Based on an exponentially changing technology and data
  - ✧ Crossing the traditional disciplinary boundaries

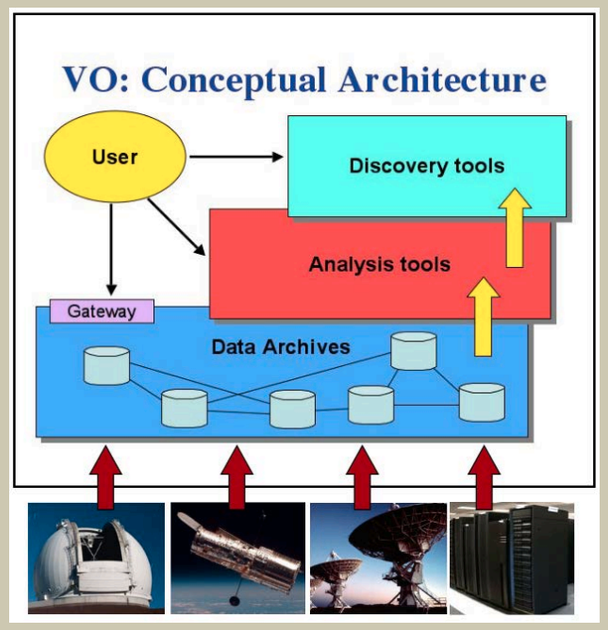
Virtual Observatories

Offers infrastructure for storage of and tools for access to massive and complex datasets.

Can combine data from a number of surveys over a large range of wavelengths.

Education and outreach.

Enables science in developing countries through data access.



International Virtual Observatory Alliance
http://ivoa.net

Tools to access astronomical databases

Web interfaces — astronomical data archives have web-based interfaces that allow for simple searches of one source or a small number of objects.

SQL (Structured Query Language) and ADQL (Astronomical Data Query Language) — construct "queries" to access specific components of a catalogue. Offers a lot of flexibility. Can choose which pieces of the data you want to view/download.

TAP (Table Access Protocol) — allows access to astronomical databases. Public archives offer a TAP service which allows searching the database using ADQL. Usually much more freedom than using web interfaces.

Python-based resources — astroquery, PyVO, and others.

File format — VOTable (Virtual Observatory Table, similar to XML)

Some astronomical databases

Astronomical publications: the SAO/NASA Astrophysics Data System (ADS)

“How many papers before 1950 mention white dwarfs?”

Database of objects beyond the Solar System:

SIMBAD (Set of Indentificiations, Measurements, and Bibliography for Astronomical Data)
“What is the radial velocity of α Centauri?”

NED (NASA Extragalactic Database)
“What is the distance to the Triangulum Galaxy M33?”

Published astronomical catalogues: Vizier

“I want to find the 25 μm fluxes of the ten brightest sources in the IRAS point-source catalogue!”

(Repeat same using TAP query with TOPCAT)

We need you!

Contribute to the science — whether as a student or as a citizen. A degree in astronomy concentrating on results from large datasets will prepare you for careers in science as well as technology! Astrostatistics, big data.

Contribute to the software development — improve your Python skills and prepare yourself for careers in support science and technology! Astroinformatics.

Some resources

Astronomy using archival data (Y. Wadadekar, Radio Astronomy Winter School 2020, IUCAA)

Astronomy in the Era of Big Data (S. G. Djorgovski, TIARA Summer School 2017)

SIMBAD, Vizier, and Alladin: the CDS astronomical tool suite (Pierre Fernique, New Year Lectures from Astronomical Software Masters)

Virtual Observatory Tools for Astronomers (Justyn Campbell-White, University of Kent)

NASA Virtual Observatory (NAVO) workshop

Citizen science with Zooniverse

Oportunidades de licenciatura y/o posgrado en astronomía en la UNAM campus Ensenada o Morelia.

Ocho científicos en México han liderado 20 programas de observación con el Hubble.

Luc Binette

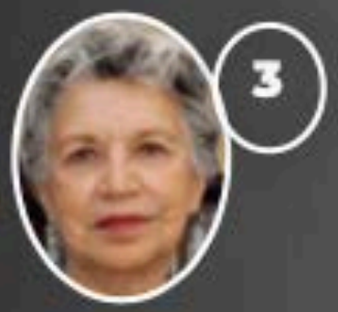
Gloria Koenigsberger

Yair Krongold

Anna Lia Longinotti

Alberto López

Miriam Peña

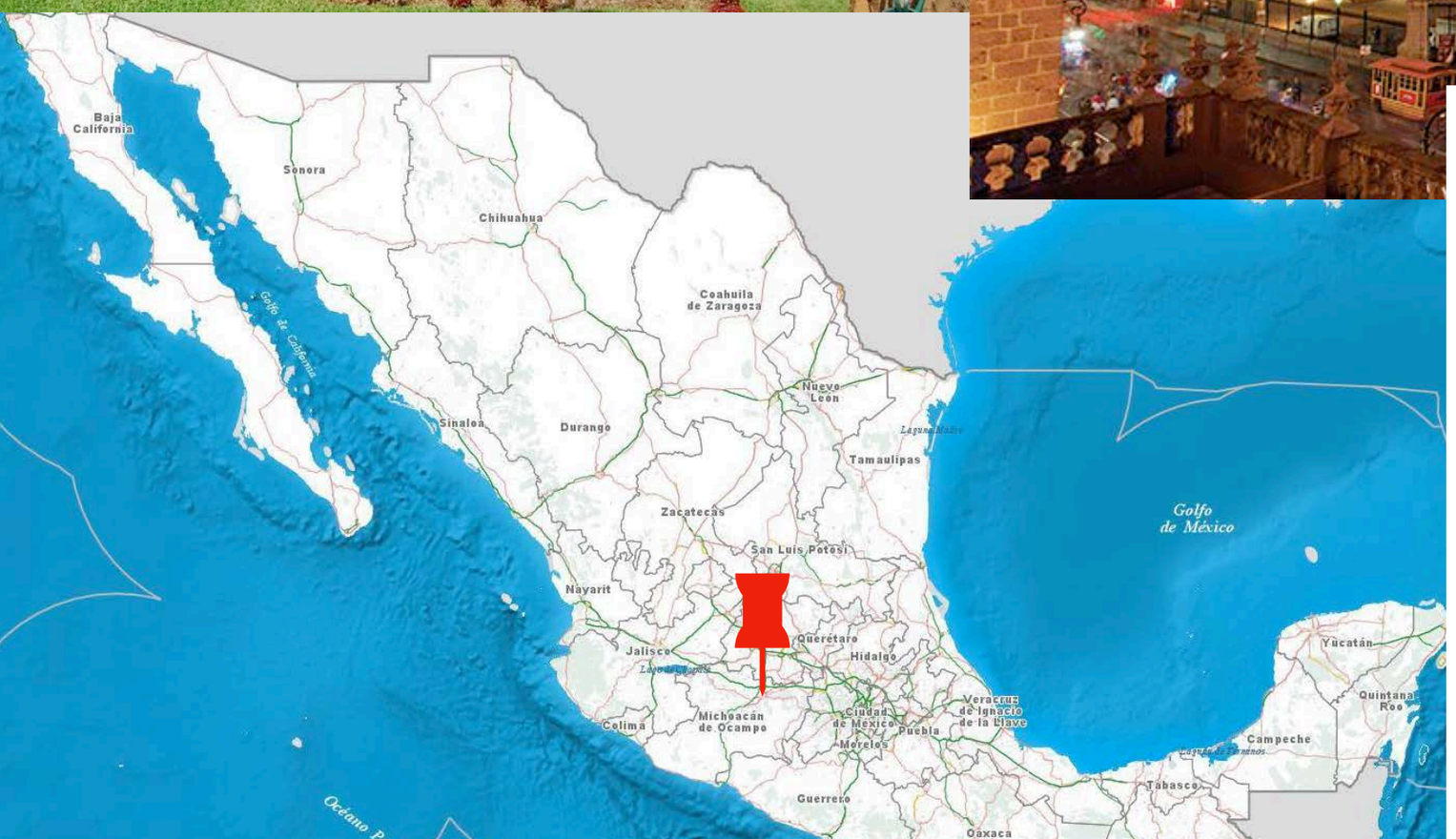


Silvia Torres-Peimbert

Aida Wofford

Instituto de Radioastronomía y Astrofísica

Universidad Nacional Autónoma de México

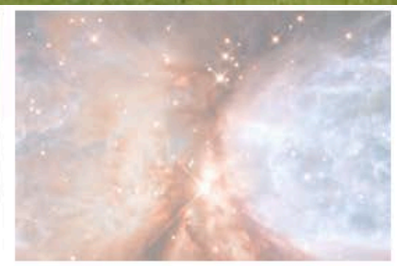


Instituto de Radioastronomía y Astrofísica
Universidad Nacional Autónoma de México

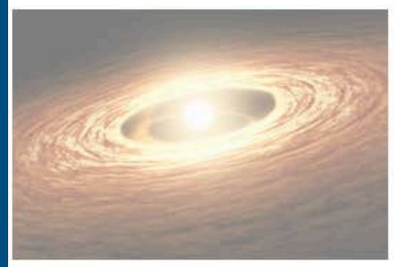
www.irya.unam.mx

- Investigación a nivel internacional
- 27 investigadores
- 7 postdocs
- 43 estudiantes de posgrado
- Posgrado de excelencia CONACYT

Radioastronomía



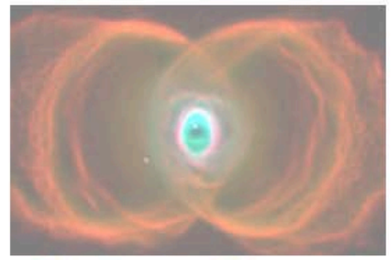
Medio interestelar



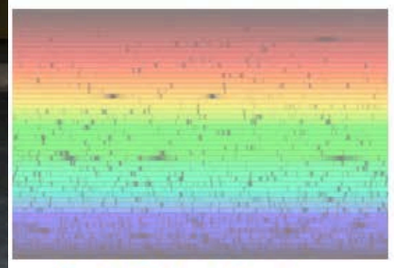
Formación de estrellas y discos protoplanetarios

Astrofísica de altas energías

Astronomía extragaláctica y cosmología



Estrellas evolucionadas



Astrofísica atómica y molecular

Instrumentación astronómica

Opportunities (Let's Make Lots of Money)

Dr. Sundar Srinivasan
s.srinivasan@irya.unam.mx, https://bit.ly/32DhjOg

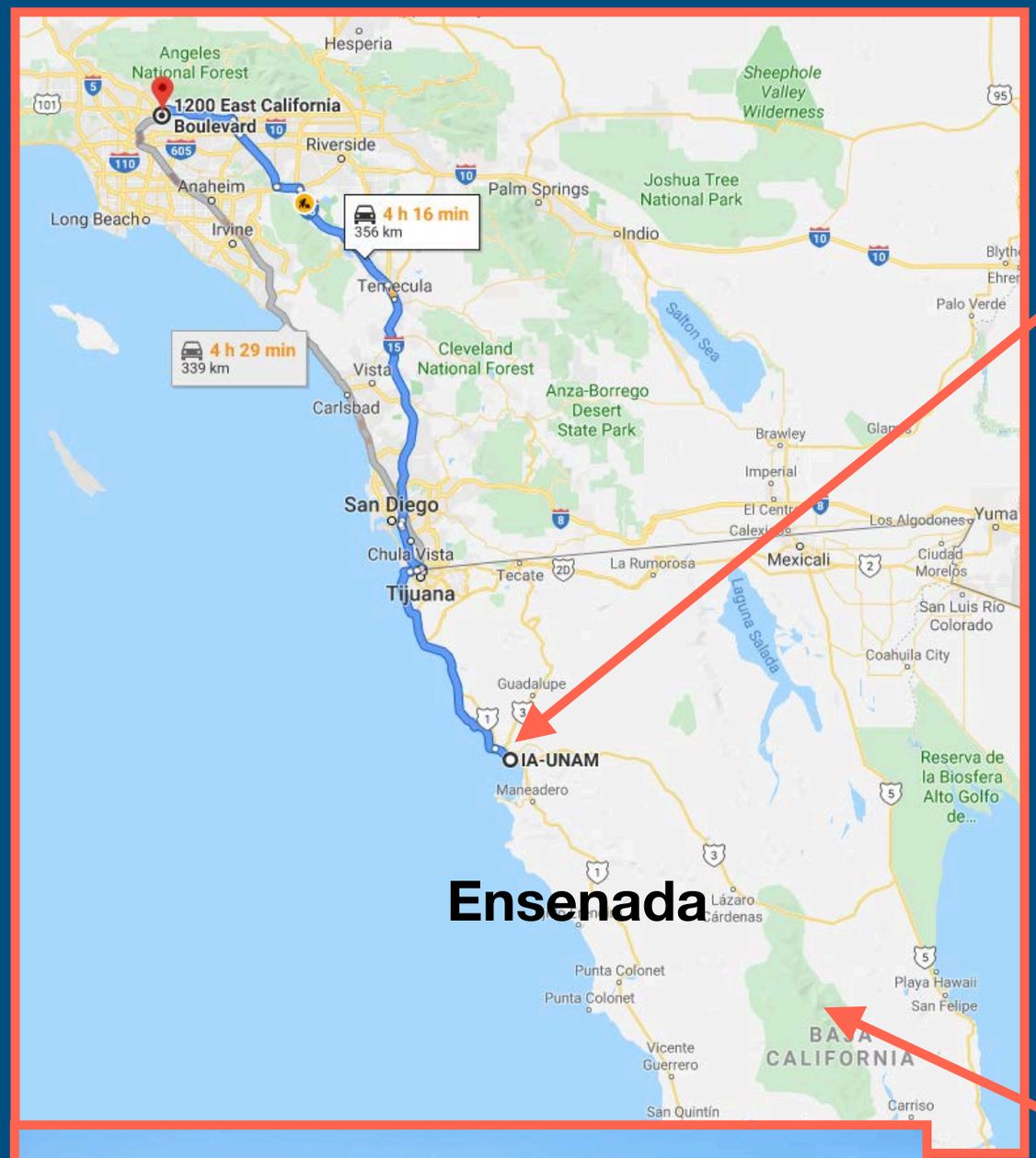
The Nearby Evolved Stars Survey (NESS) is creating an inventory of the nearest ~800 evolved stars and studying the properties of their circumstellar dust and gas.

How you can help:

- Reduction and analysis of sub-millimetre data of nearby (<2 kpc) dusty evolved stars.
- Automated classification of evolved stars from their photometry/spectra.
- Investigate properties of the dust around evolved stars.

Skills you will learn:

- Software (Python code) development.
- Analysis of large datasets of photometry and spectra.
- Querying large astronomical archival databases.
- These skills will help you with future careers in astronomy as well as in data science!


Angeles National Forest
Hesperia
1200 East California Boulevard
Riverside
Sheephole Valley Wilderness
Anaheim
Long Beach
Irvine
Palm Springs
Joshua Tree National Park
Indio
4 h 16 min
356 km
Temecula
Palo Verde
4 h 29 min
339 km
Vista
Cleveland National Forest
Carlsbad
Anza-Borrego Desert State Park
Salton Sea
Brawley
Imperial
San Diego
El Centro
Los Algodones
Yuma
Chula Vista
Tecate
La Rumorosa
Mexicali
Ciudad Morelos
Tijuana
San Luis Río Colorado
Laguna Salada
Coahuila City
Guadalupe
IA-UNAM
Maneadero
Reserva de la Biosfera Alto Golfo de...
Ensenada
Lázaro Cárdenas
Punta Colonet
Playa Hawaii
San Felipe
Vicente Guerrero
BAJA CALIFORNIA
San Quintín
Carriso


Instituto de Astronomía, UNAM


ENSENADA


Observatorio Astronómico Nacional

Dr. Carlos Román Zúñiga, croman@astro.unam.mx

1) Hacer un portal de visualización via web para datos espectroscopicos de estrellas jóvenes en el catálogo SDSS-IV APOGEE-2.

2) Hacer una análisis de las propiedades espectrales de estrellas jóvenes con datos ópticos e infrarrojosdel sondeo SDSS-V Milky Way Mapper.

Dra. Margarita Pereyra Talamantes, mpereyra@astro.unam.mx

1) Estudio de variabilidad en la emisión de la binaria compacta *MAXI J1807+132* observada desde el Observatorio Astronómico Nacional.

2) La búsqueda del instrumento DDOTI, de las contrapartes ópticas para estallidos de rayos gamma detectados por Fermi-GBM.

Dr. Gagik Tovmasian, gag@astro.unam.mx

1) Selecionar todos novalikes que tienen distancias de Gaia, medir luminosidades y ver dependencias con el ángulo de inclinación de orbita y periodo orbital.

Dr. Diego Buitrago, dgonzalez@astro.unam.mx

1) "Estudio observacional de variables cataclísmicas polares". Tengo datos tanto de espectroscopia y fotometria de un grupo de CVs.

2) Trabajo social y/o tesis, Tengo datos de multiples AGNs observadas con el telescopio RATIR a través de multiples filtros. Por tanto, la idea es bajar estos datos, realizar las reducciones, obtener las curvas de luz y realizar su análisis.

3) Proyecto, hace un año había iniciado la automatización de reducción de datos obtenidos con el instrumentos B&Ch (T2.1m) a través de python, con la idea de expandirlo a otros instrumentos. El proyecto ya esta avanzado, pues ya tenemos automatizadas, quitar bias, flat, extraer los espectros a 1D, y nos quedamos en pasar de pixel a longitud de onda. Pero desafortunadamente, debido a la pandemia los tiempos estan un poco limitados por tanto este proyecto esta un poco olvidado, pero seria bueno retomarlo y tener un estudiante que nos ayude y nos motive a continuar.

Thanks very much to the organisers and to the students!