SIRIO (Alpha Canis Maior)

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ABSTRACT

Situated in the Canis Maior constellation, Sirius has been a guide for men since the beginning of history. Its brightness makes it the most shining star in the sky.

Sirius was worshiped by a great deal of civilizations, but it was probably Old Egyptians who respected it most. This star was so important for them that its rise in the sky indicated the beginning of each new year (the helium rise of Sirius).

It also hides some unresolved mysteries: Old Romans and Greeks described Sirius as a red colour star; it is white now, was it red 2000 years ago? It seems it was not, but we will research upon what this enigmatic and important star really is. By means of exhaustive interdisciplinary research, the students have discovered the relations between astronomy and history, between myths and reality... No doubt, they have also realized how much the man knows due to his curiosity, patience and tenacity. With the only help of our eyes, and with the use of no other tools or technical machinery, we have been able to observe the relative movement of Sirius in the sky, its evolution through the different seasons, and its characteristic colour, which is an indicator of its temperature. For these students the sky will never be the same as before, it is more familiar now but at the same time more enigmatic. That is precisely the objective: to rouse their curiosity.

RESUMEN

Situada en la constelación del Can Mayor, Sirio ha servido de guía al hombre desde los albores de la historia. Protagonista del cielo, su brillo hace de esta estrella la más luminosa del firmamento.

La estrella Sirio fue venerada por multitud de civilizaciones, pero quizás los antiguos egipcios fueron los que más respetaron dicho astro. Su importancia llegaba hasta el extremo de que su salida en el cielo marcaba el nuevo año (salida heliaca de Sirio).

También nuestra protagonista encierra misterios sin resolver. Los antiguos romanos y griegos describían a Sirio como una estrella de color rojo, ¿pero realmente era roja hace 2000 años? Parece que no, pero en este trabajo vamos a investigar sobre quién es esta enigmática e importante estrella. Mediante una exhaustiva investigación interdisciplinar, los alumnos han descubierto las relaciones entre la astronomía y la historia, entre los mitos y la realidad... Sin duda, también se han dado cuenta de lo mucho que el hombre sabe gracias a su curiosidad, paciencia y tenacidad. Con tan solo la ayuda del ojo y sin recurrir a herramientas ni aparatos técnicos complejos, hemos podido observar el movimiento relativo de Sirio en el cielo, su evolución en las distintas estaciones y su característico color, indicador de su temperatura. Para estos muchachos el cielo ya no será el mismo, ahora es más familiar y conocido pero a la vez más enigmático e interrogante. Ése es precisamente el objetivo perseguido: despertar la curiosidad.

Antares, at death's door
(Antares, al borde de la muerte)

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ABSTRACT

Our work has been based on four sections which are very different among themselves. Although we have always taken into account the different relationship each section has with the star we have chose, Antares.

We have named the first section: "Antares, at death's door". In this section we have studied the placement of the star within its constellation, its physical composition, its aspect, the origin of its name dating back from the " Catasterisms" of Eratosthenes, as well as its different mythological meanings.

The second section is called: "Neighbours and other acquaintances" and in this we have studied the stars and objects which are near our star within the Scorpio Constellation: Antares B, the M4 and M80 globular clusters and the star Al Niyat.

On the third section: "Lost sisters in space: other giant red stars" we have compared some other giant red stars with Antares. In this way we have described the physical characteristics of the stars, its constellations, its mythology, etc.

On the fourth and last section "The future of Antares star", it has been studied the evolution of our star once it collapses, because all its energetic resources will have been used up, at this point it will explode turning into a supernova, collapsing its nuclei and expelling its outer layers. The result of all this will produce a nebula similar to the Crab nebula or planet nebula.

Our project has consisted of comparing the size of Antares and the planet nebula after its explosion with the solar system.

RESUMEN

Nuestro trabajo se ha articulado en cuatro apartados bien diferenciados, aunque como es natural siempre se ha tenido en cuenta las distintas relaciones con la estrella elegida, Antares.

En el primer apartado titulado "Antares, al borde de la muerte" hemos estudiado la situación de la estrella dentro de su constelación, su composición física, su apariencia, el origen de su denominación arrancando desde los "Catasterismos" de Eratóstenes, etc. así como sus distintas interpretaciones mitológicas.

En el segundo apartado, "Vecinos y otros conocidos", hemos estudiado estrellas y objetos cercanos a nuestra estrella dentro de la constelación de Scorpius, tanto su compañera Antares B, como los cúmulos globulares M4 y M80 y la estrella Al Niyat.

En el tercero, "Hermanas perdidas en el espacio: Otras gigantes rojas", hemos comparado algunas otras gigantes rojas con Antares, así hemos descrito las características físicas de las estrellas, sus constelaciones, su mitología, etc.

El cuarto y último apartado “El futuro de la estrella Antares”, se ha supuesto la evolución de nuestra estrella cuando colapse, una vez que haya agotado todos sus recursos energéticos y haga explosión como una supernova, colapsando su núcleo y expulsando sus capas externas, que al chocar con el medio interestelar producirá una nebulosa como la nebulosa del Cangrejo o una nebulosa planetaria, una vez que su núcleo se contraiga.

Nuestra práctica ha consistido en comparar el tamaño de Antares y la nebulosa planetaria posterior con el Sistema Solar.

Cometas. 55P/Tempel-Tuttle

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ABSTRACT

This work belongs to the category "CATH a STAR" and focuses its attention on comets, specially in the comet 55P/Tempel-Tuttle.

Our work constitutes a interactive Web page with the following chapters accessed through its respective buttons:

- *WHO ARE WE?*: A comic and restrictive description of the members of the group. It also appears a link to the Web page of our College where we are studying.
- *COMETS*: General information about comets.
  - *What are they?*: A reference to the Whippel's model and to the notation according to IAU.
  - *Structure*: A description of the nucleus, coma tails and hydrogen cloud.
  - *How do the comets move?*: Description of the 6 main orbital parameters that define its ellipse around the sun (T, e, q, w, i, N) and other ones derivated from those ones.
  - *Origin*: Here we answer the question "where do they come from?" according to the latest theories (Kuiper's Belt, Oort's Cloud).
- *55P/TEMPEL-TUTTLE*: This chapter is dedicated to aur comet..
  - *History*: Brief description of appearances in its movement around the sun.
  - *Photogallery*: This a chronology of a meeting. A set of photographs from its first appearance in March 1997 up to its farewell in July 1998.
  - *Ephemeredes*: Description of the algorithm we have developed to compute the position of any comet in several coordinate system (heliocentric, geoecliptics and geoequatorials). So far the possibilities are restricted to our comet TT and the comet Encke, but in a short future the list of available comets will enlarge to other ones based on the dates of BDL, Paris.
  - *By means of the program we can make a comparative study of both comets*: light curves, variation of distance along time, etc.
  - *Data Storm*: More and more data about TT.
- *SCIENTISTS*: On describe the methodology and technical used in Astronomy to get information about a comet.
  - *Instruments*: This is look to the main instruments used in detection and following of celestial objects: prismatic, telescopes, CCD, etc; characteristics, properties and advantages.
  - *Properties*: Here is the method and analytic technical used to find the chemical composition of meteorites and cometary dust accumulated on Earth.
  - *Missions*: Here appear the main NASA's and ESA's missions whose objective is studying in situ the nucleus, of several comets to know their composition.
- *AND WE?*: What can we do?
  - *Situation*: We propose in this button to familiarize with several coordinates system to situate objects on the celestial sphere.

- *Instruments*: We supply several advices based on the experience of expert observer to purchase and to enhance an observation instrument.
- *Experience*: We narrate our experience in the "Leonids Storm-1999". It is interesting because it can easily be reproduce, it used to cause a great impact in the young observers and one can contribute to a better knowledge of the properties of meteorites.

To sum up, remark that we have to brush and add new contents to our web page, but in a short time we'll get it.

The enigmatic centre of the Milky Way
(El enigmático centro de la Vía Láctea)

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ABSTRACT

After decades of controversy, measurements of stellar dynamics have confidently established that the nucleus of the Milky Way Galaxy harbours a massive black hole (MBH) with a mass of $M = (2.6 \pm 0.2) 10^6$ Ms. The MBH coincides with the compact nonthermal radio source of Sagittarius A* (Sgr A*), but no emission at other wavelengths have been convincingly associated with it.

The region bounded by the few inner parsecs at the Galactic Centre contains six principal components that coexist within the intense central gravitational potential of the Milky Way. These constituents are of a supermassive black hole, the surrounding cluster of evolved and young stars, a molecular dust ring, ionised gas streamers, diffuse hot gas, and a powerful supernova-like remnant. Many of the observed phenomena occurring in this complex and unique portion of the Galaxy can be explained by the interaction of these components.

Though largely shrouded by the intervening gas and dust, the Galactic Centre is now actively being explored and observed at radio, sub-millimetre, infrared, X-ray and gamma-ray wavelengths with unprecedented clarity and spectral resolution. The interactions governing the behaviour and evolution of this nucleus are attracting many astronomers and astrophysicists interested in learning about the physics of black hole accretion, magnetized gas dynamics and unusual stellar formation among others. The Galactic Centre is one of the most interesting regions for scientific investigation because it is the closest available galactic nucleus and therefore can be studied with a resolution that is impossible to achieve in other galaxies. One arcsecond at the Galactic Centre distance of approx. 8 kpc corresponds to only 0.04 pc

(approx. 1.2×10^{17} cm.). Thus, developing a consistent theoretical picture of the phenomena we observe not only improves our understanding of the Galaxy, but also our view of galactic nucleus in general.

For example, the Galactic Centre is now known to harbour by far the most evident condensation of dark mass, which is apparently coincident with the compact radio source Sgr A*, the primary subject of this study. An overwhelming number of observations (proper and radial motion of stars and gas) now strongly support the idea that this compact radio source in the centre of the Galaxy has a mass of 2.6×10^6 Ms. Due to these unique observations and the proximity of Sgr A*, the supermassive black hole paradigm for galactic cores may be strengthened or refuted based on what we learn about the Galactic Centre.

RESUMEN

Tras décadas de controversia, las mediciones de dinámica estelar han determinado firmemente que el núcleo de la Vía Láctea contiene un agujero negro masivo (MBH) con una masa $M = (2.6 \pm 0.2) \times 10^6$ M_s. El MBH coincide con la fuente compacta, no térmica de radio Sagitario A* (SgrA*) aunque no se le han asociado otras emisiones en otras longitudes de onda.

La zona que delimitan los pocos parsecs interiores del Centro Galáctico contiene seis componentes principales que coexisten dentro de la fuente central de intenso potencial gravitatorio de la Vía Láctea. Estos componentes son un agujero negro supermasivo, a su alrededor un grupo de estrellas jóvenes y evolucionadas, un anillo de polvo molecular, flujos de gas ionizado, gas caliente difuso y un intenso remanente similar a una supernova. La interacción de dichos componentes explica muchos de los fenómenos observados que ocurren en esta compleja y única parte de la Galaxia.

A pesar de encontrarse envuelto en su mayor parte de polvo y gas intermedio, el Centro Galáctico se explora activa y detenidamente en la actualidad en longitudes de onda radio, submilimétricas, infrarrojos, rayos X y rayos gamma con una claridad y resolución espectral sin precedentes. Las interacciones que determinan el comportamiento y evolución de este núcleo atraen la atención de muchos astrónomos y astrofísicos interesados en conocer la física de acreción del agujero negro, la dinámica del gas ionizado y las formaciones inusuales de estrellas, entre otras. El Centro Galáctico es una de las regiones más interesantes para la investigación científica al tratarse del núcleo galáctico más cercano, con lo que puede estudiarse con una resolución imposible de alcanzar en otras galaxias. Un segundo de arco en la distancia del centro Galáctico de ~8 kpc corresponde sólo a 0.04 pc ($\approx 1.2 \times 10^{17}$ cm.). De este modo, el desarrollo de una teórica y sólida visión de conjunto consistente en los fenómenos allí observados contribuye a mejorar, no sólo nuestra comprensión de la Galaxia, sino también nuestro criterio sobre los núcleos galácticos en general.

Por ejemplo, hoy en día se sabe que el Centro Galáctico reúne, con mucho, la más manifiesta condensación de materia oscura, coincidente en apariencia con la fuente compacta de radio de SgrA*, tema central de este estudio. En la actualidad, un considerable número de observaciones enfocadas al movimiento propio y radial de estrellas y gas apoyan firmemente la idea de que esta fuente compacta de radio en el Centro Galáctico dispone de una masa de 2.6×10^6 M_s. Debido a estas observaciones y a la proximidad de SgrA*, el paradigma sobre agujeros negros supermasivos en núcleos galácticos podría consolidarse o rebatirse a partir de nuestro conocimiento sobre el Centro Galáctico.