Dragonhead cyclone in the Falkland Islands (Malvines Islands)

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April 12, 2024

The Chinese Dragon, is a legendary creature in Chinese mythology, Chinese folklore, and Chinese culture at large. Academicians have identified four reliable theories on the origin of the Chinese dragon: snakes, Chinese alligators, thunder worship and nature worship.They traditionally symbolize potent and auspicious powers, particularly control over water. Cyclones are common in the South Atlantic. They generally arise with the passage of cold fronts to the south of the South American continent, crossing the south of Chile and Argentina. The extratropical cyclone analyzed presented at its peak the very characteristic shape of a Chinese dragon. They present a mathematical form of a double Cotes Spiral curve. Here called the Dragonhead cyclone (DC), due to the singular resemblance to a dragon head, indicate a structural similarity with spiral galaxies, especially NGC 5247, in the constellation Virgo. With an area of influence and a size of around 3,247 thousand km^2 at its peak, it moved quickly in a WNW direction, with an average speed of 76 km/h, with winds of 84 km/h at 100 km from the nucleus, as it passed north of the Falkland Islands (Malvinas Islands). In the data collected (Gobato et al., 2018-2023), and analyzed from the Dragonhead cyclone, it is clear that all extratropical cyclones that appear south of the South American continent, below 40° latitude, have the shape of a spiral curve, like the spiral galaxy. Most of these are in the form of a double Cote's spiral curve.

1 Introduction

As stated in the introduction the characteristic shape of hurricanes, cyclones, typhoons is a spiral. In mathematics, a spiral is a curve which emanates from a point, moving farther away as it revolves around the point. George, 1960; Yorke, 2010,Anderson, 1984; Weisstein, 2024,Whittaker, 2022; Gobato et al., n.d.,Fischer, 1093; Toomre, n.d.,Oort, 1970; Nezlin and Snezhkin, 1993

After an analysis of the different types of spirals , it was found that the shape that came closest to the spiral, is a double Cotes's Spiral. Anderson, 1984; Weisstein, 2024,Whittaker, 2022; Gobato et al., n.d.,Fischer, 1093; Toomre, n.d.,Oort, 1970; Nezlin and Snezhkin, 1993 It was determined the mathematical equation of the shape of the extratropical cyclone, in case of Dragonhead.

A double spiral was also used by Lindblad (1964) Lindblad, 1964, of which Gobato et. al (2020-2023) Gobato et al., 2022b; Gobato et al., 2022c,Gobato, Heidari, and Mitra, 2021; Gobato et al., 2020b,Gobato et al., n.d.; Gobato et al., 2020a,Gobato et al., 2022a; Gobato et al., 2022d,Gobato et al., 2022e,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and

Mitra, 2023c; Gobato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b came to the conclusion that spiral galaxies assumed the Cote's Spiral curve, as did some extratropical cyclones, south of the South American continent.
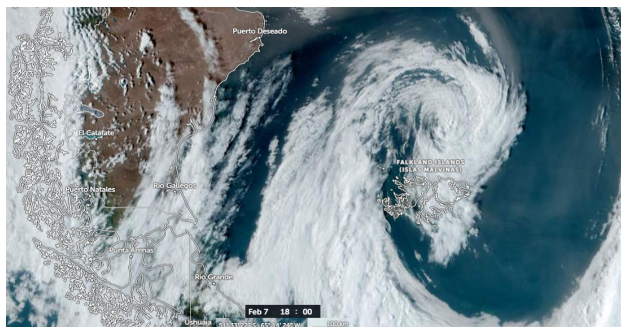

Figure 1: *Image of the* Dragonhead cyclone, *at 6 pm (UTC), February 7, 2024. With the well-defined shape of a dragon's head. [Adapted Authors] Earth, 2024*

1.1 Chinese Dragon

The Chinese Dragon, also known as the loong, long or lung, is a legendary creature in Chinese mythology, Chinese folklore, and Chinese culture at large. Chinese dragons have many animal-like forms such as turtles and fish, but are most commonly depicted as snake-like with four legs. Academicians have identified four reliable theories on the origin of the Chinese dragon: snakes, Chinese alligators, thunder worship and nature worship.They traditionally symbolize potent and auspicious powers, particularly control over water. "Chinese dragon" 2024

Figure 2: *Bronze chariot shaft in the shape of a dragon head, Warring States period. Eastern Zhou Gallery, Henan Provincial Museum, Zhengzhou. China. Earth, 2024*

1.2 Cyclone

A cyclone "Cyclone" 2024; "Glossary of Meteorology: Cyclone" 2024 is a large air mass that rotates around a strong center of low atmospheric pressure, counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere as viewed from above (opposite to an anticyclone). "Cyclone" 2024; "Glossary of Meteorology: Cyclone" 2024,Landsea, 2009; Armentrout and Armentrout, 2007,Sokolovskiy and Verron, 2000,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and Mitra, 2023c; Gobato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b.

Cyclones are compact, circular storms, generally some 320 km (200 miles) in diameter, whose winds swirl around a central region of low atmospheric pressure. The winds are driven by this low-pressure core and by the rotation of the Earth, which deflects the path of the wind through a phenomenon known as the Coriolis force. Landsea, 2009,Gobato et al., 2022e; Gobato et al., 2022b,Gobato et al., 2022c; Gobato and Mitra, 2022,Gobato, Heidari, and Mitra, 2021; Bluestein, 2013,Gobato et al., 2020b; Gobato, Gobato, and Fedrigo, 2016b,Vasquez, 2002; Bluestein, Bosart, and Bluestein, 2008,Santurette and Georgiev, 2005; Gobato and Heidari, 2020aRafferty, 2010; Krasny, 1986,Saffman, 1992; Sokolovskiy and Verron, 2000,Gobato, Gobato, and Fedrigo, 2016a; George, 1960,Yorke, 2010; Anderson, 1984,Gobato et al., n.d.,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and Mitra, 2023c; Gobato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b

1.3 NGC 5247 Spiral Galaxy

Spiral galaxies Lindblad, 1964; "Spiral galaxy" 2024a,Grosbol, 2010; "Spiral galaxy" 2024b form a class of galaxy originally described by Edwin Hubble in his 1936 work The Realm of the Nebulae and, as such, form part of the Hubble sequence. Most spiral galaxies consist of a flat, rotating disk containing stars, gas and dust, and a central concentration of stars known as the bulge. These are often surrounded by a much fainter halo of stars, many of which reside in globular clusters. "Spiral galaxy" 2024a; Grosbol, 2010

Spiral galaxies are named by their spiral structures that extend from the center into the galactic disc. The spiral arms are sites of ongoing star formation and are brighter than the surrounding disc because of the young. Lindblad, 1964; "Spiral galaxy" 2024a,Grosbol, 2010; "Spiral galaxy" 2024b

The Figure (3) shows NGC 5247, a grand design barred spiral galaxy, located 60–70 million light-years away. The galaxy lies face-on towards Earth, thus

providing an excellent view of its pinwheel structure and multiple arms. It is in the zodiacal constellation of Virgo (the Maiden). Grosbol, 2010

The image was made in infrared light with the HAWK-I camera on ESO's Very Large Telescope at Paranal Observatory in Chile. HAWK-I is one of the most powerful infrared imagers in the world, and this is one of the sharpest and most detailed pictures of this galaxy ever taken from Earth. The filters used were Y (shown here in blue), J (in light blue), H (in green), and K (in red). The field of view of the image is about 6.4 arc minutes. Grosbol, 2010

NGC 5247 is a face-on unbarred spiral galaxy located some 60 million light years away in the constellation Virgo. It is a member of the Virgo II Groups, a series of galaxies and galaxy clusters strung out from the southern edge of the Virgo Super cluster. This grand design spiral galaxy displays no indications of distortion caused by interaction with other galaxies. It has two spiral arms that bifurcate after wrapping halfway around the nucleus. The disk is estimated to be 4.9 ± 2.0 kly (1.5 ± 0.6 kpc) in thickness and it is inclined by roughly 28° to the line of sight. Grosbol, 2010; "Spiral galaxy" 2024b

1.4 Cote's spiral

In physics and in the mathematics of plane curves Whittaker and McCrae, 1989; Anderson, 1984,Weisstein, 2024; Whittaker, 2022,Gobato et al., n.d.; Fischer, 1093,Toomre, n.d.; Oort, 1970,Nezlin and Snezhkin, 1993; Lindblad, 1964,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and Mitra, 2023c; Go-bato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b a Cote's spiral (also written Cotes' spiral and Cotes spiral) is one of a family of spirals classified by Roger Cotes.
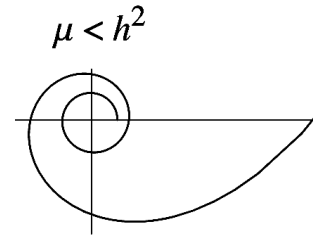
$$\mu < h^2$$

Figure 4: *Shapes of curves called Cote's spiral gives the solution to the central orbit problem. Fischer, 1093; Oort, 1970,Toomre, n.d.; Whittaker, 2022,Weisstein, 2024; Anderson, 1984,Saffman, 1992; Whittaker and McCrae, 1989*

2 Development

After an analysis of the different types of spirals Whittaker and McCrae, 1989; Anderson, 1984,Weisstein, 2024; Whittaker, 2022,Gobato et al., n.d.; Fischer, 1093,Toomre, n.d.; Oort, 1970,Nezlin and Snezhkin, 1993; Lindblad, 1964,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and Mitra, 2023c; Gobato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b it was concluded that the form that came closest the spiral, Figures (1), (6-88), is a double Cotes's Spiral, for the case $\mu < h^2$, Figure (4).

It was determined the mathematical equation of the shape of the DC, in the shape of a spiral called Cotes's Spiral", for the case $\mu < h^2$ Figure (4) and (8) Whittaker and McCrae, 1989; Anderson, 1984,Weisstein, 2024; Whittaker, 2022,Gobato et al., n.d.; Fischer, 1093,Toomre, n.d.; Oort, 1970,Nezlin and Snezhkin, 1993; Lindblad, 1964,Gobato et al., 2022b; Gobato, Heidari, and Mitra, 2021,Gobato et al., 2020b; Casey, 2001,León and Rodrigues, 1989; Gobato, Gobato, and Heidari, 2019b,Gobato et al., 2020c; Gobato and Heidari, 2020b,Gobato, Gobato, and Heidari, 2019a.

A spiral that gives the solution to the central orbit problem under a radial force law

$$\ddot{r} = -\mu[r]^{-3}\hat{r} \tag{1}$$

$$r = A\sec(k\theta + \epsilon), \tag{2}$$

where,

$$k^2 = 1 - \frac{\mu}{h^2}, when \mu < h^2 \tag{3}$$

where A and ε are constants, and h is the specific angular momentum Whittaker and McCrae, 1989;

Weisstein, 2024,Whittaker, 2022.

Analyzing the shape of the Spiral shape called "Cotes's Spiral" for $\mu < h^2$ Whittaker and McCrae, 1989; Weisstein, 2024,Whittaker, 2022, it appears that adding two constants to Equation (2) makes the necessary adjustments for the Isobaric ones. In the case of DC, the spiral that gives the solution to a radial force law is given by Equation (1).

An adjustment in Equation (2) is necessary to obtain the graph of Figure (1). Then, adding the constants $B \neq 0$ and C where for $\mu < h^2$.

The equation is defined for the Dragonhead Cyclone:

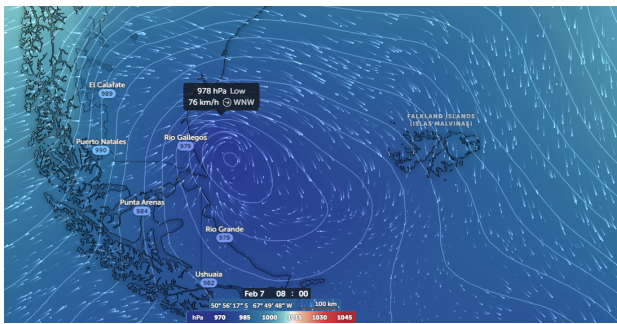$$r = BA \sec(k\theta + \epsilon) + C, \qquad (4)$$

Figure 5: *The Figure (3) shows isobaric and wind lines at 500 m height, in the south of the American continent. [Adapted Authors] Earth, 2024*
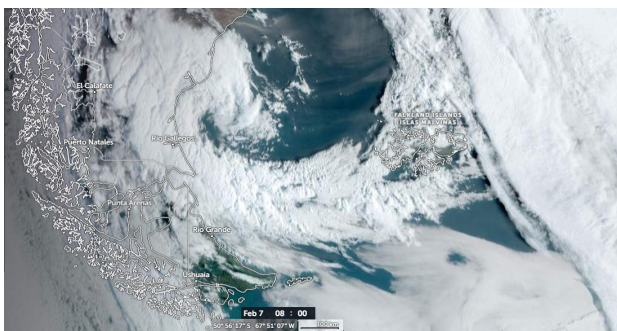

Figure 6: *Image of the Dragonhead cyclone (DC), at 8 am (UTC), February 7, 2024. [Adapted Authors]Earth, 2024*

3   Analysis

With winds coming from the Pacific Ocean, the cold front crosses southern Chile and Argentina. Forming from the region of Puerto Natales, Punta Arenas (Chile), El Calafate, Rio Galegos, Rio Grande and Ushuaia (Argentina), as shown in Figure 1, 4h UTC on
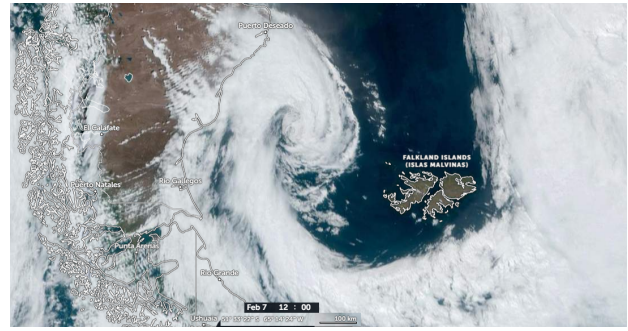

Figure 7: *Image of the DC, at 12 am (UTC), February 7, 2024. [Adapted Authors] Earth, 2024*
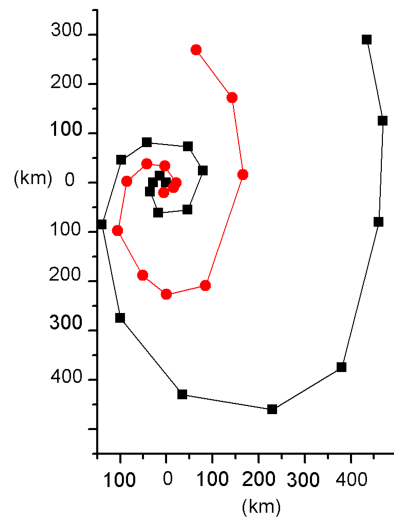

Figure 8: *Graphic plot of the dimensions and shape of the Dragonhead cyclone, as at 18 am (UTC), February 7, 2024. [Authors]*

February 7, 2024. The cold coming from the Pacific collides with a mass of hot air coming from the north of the province of Santa Cruz and central-south of Chubut.

On February 7, 2024 at 18:00 UTC, the cyclone reached an area of influence of 3,247 thousand km2. It had a head/neck of elliptical dimensions measuring 639 km by 552 km, whose core was located at 45°36'S, 21°31'W, north of the Falkland Islands. With winds of 84 km/h, it had already traveled 640 km in 10 hours, with an average of 64 km/h.

It had a pressure of 978 hPa, February 7, 2024 at 08:00 am (UTC), 100 km north of the nucleus Figure

Table 1: *Dragonhead cyclone*
Coordinates / Pressure(P)(mbar). Time hour(h) (UTC), D(day)
February 07, 2024 from 08:00 am and 06:00 pm.

D	Feb 7, 2024		Coordinates	P(hPa)
h	08:00 am		52°46'08"S 67°49'48"W	978
h	06:00 pm		51°33'22"S 65°14'24"W	970

6, with winds of 76 km/h, with a nucleus at 970 hPa. Taking off in the WNW direction.

It appears that the spiral shape of the Dragonhead is very similar to the shape of the spiral galaxy NGC 5247, presenting the same shape.

The analogous shape of Dragonhead cyclone and the NGC 5247 Galaxy, studied here is clear. These present a double Cote's spiral. Studied by Lindblad Lindblad, 1964, but with the Cote's spiral form, (Gobato et al. 2022) Gobato et al., 2022a; Gobato et al., 2022d,Gobato et al., 2022e; Gobato et al., 2022b.

The Figure (4) show shapes of curves called Cote's spiral gives the solution to the central orbit problem.

The Table (1) shows the coordinates of Dragonhead cyclone, February 07, 2024, am/pm, a central vortex pressure of 951 hPa, with an approximate dimension of 10 km.

The Figure (5) shows isobaric and wind lines at 500 m height, in the south of the American continent.

The pressure at 500m height in the cities of El Calafate, Puerto Natales, Ushuaia, Rio Grande, Rio Galegos, are 989, 990, 984, 982, 979 and 979 hPa, respectively. In the Falkland Islands (Malvinas Islands) it is between 984 and 990 hPa.

The Figures (1), (6) and (7)) show the trajectory of the dragonhead cyclone between 08:00 am (UTC) and 06:00 pm, February 7, 2024.

The Figure (8) it represents the dimensions of the points collected from Figure (6), in km, using the Isobaric [30-31] found in Figures (3-6). Other spiral galaxies, vortex storms, have also been analyzed. Gobato et al., 2022b; Gobato et al., 2022c,Gobato, Heidari, and Mitra, 2021; Gobato et al., 2020b,Gobato et al., n.d.; Gobato et al., 2020a,Gobato et al., 2022a; Gobato et al., 2020c,Gobato et al., 2022d; Gobato et al., 2022e

4 Conclusions

Cyclones are common in the South Atlantic. They generally arise with the passage of cold fronts to the south of the South American continent, crossing the south of Chile and Argentina, in the regions of Puerto Natales, Punta Arenas (Chile), Rio Galegos, Rio Grande, El Calafate, and Ushuaia (Argentina). The extratropical cyclone analyzed, presented at its peak the very characteristic shape of a Chinese dragon. Mathematical analyzes of the shape of a double Cotes's Spiral. Here called the Dragonhead cyclone, indicate structural similarity with spiral galaxies,

especially NGC 5247, in the constellation Virgo. With an area of influence and a size of around 3,247 thousand km2 at its peak, it moved quickly in a WNW direction, with an average speed of 76 km/h, with winds of 84 km/h at 100 km from the nucleus, as it passed north of the Falkland Islands (Malvinas Islands).

In the data collected Gobato et al., 2022b; Gobato et al., 2022c,Gobato, Heidari, and Mitra, 2021; Gobato et al., 2020b,Gobato et al., n.d.; Gobato et al., 2020a,Gobato et al., 2022a; Gobato et al., 2020c,Gobato et al., 2022d; Gobato et al., 2022e,Bluestein, Bosart, and Bluestein, 2008,Gobato and Mitra, 2023a; Gobato and Mitra, 2023d,Gobato and Mitra, 2023c; Gobato and Mitra, 2023b,Gobato, Mitra, and Ahmed, 2024a; Gobato, Mitra, and Ahmed, 2024b and analyzed from the Dragonhead cyclone, it is clear that all extratropical cyclones that appear south of the South American continent, below 40° latitude, have the shape of a spiral curve, like the spiral galaxy. Most of these are in the form of a double Cote's spiral curve.

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