



You Are What You Eat: Is Flamingo Actually Kirby?

It may be surprising to know that the bright pink color of flamingos actually comes from their diet. The algae they eat contains high levels of beta-carotene, a red-orange pigment also found in carrots and tomatoes. Their mollusks and crustaceans snack also contain pigments in the carotenoid family. The carotenoids are processed by the enzymes in the bird's digestive system. They are eventually dissolved in fats and deposited in the flamingo's feathers, skin and even egg yolks!

Origin of TeX

Definition 2.9. An object Y of a monoidal category \mathcal{C} is a **left dual** to X , denoted $Y = X^*$, if there exist **evaluation** and **coevaluation** morphisms

(2.20)
$$\text{ev} : Y \otimes X \rightarrow \mathbb{1}, \text{coev} : \mathbb{1} \rightarrow X \otimes Y,$$

such that the following morphisms are the identities:

(2.21)
$$\begin{aligned} X &\xrightarrow{\text{coev} \otimes \text{id}} (X \otimes Y) \otimes X \xrightarrow{\alpha_{XYX}} X \otimes (Y \otimes X) \xrightarrow{\text{id} \otimes \text{ev}} X, \\ Y &\xrightarrow{\text{id} \otimes \text{coev}} Y \otimes (X \otimes Y) \xrightarrow{\alpha_{YXY}^{-1}} (Y \otimes X) \otimes Y \xrightarrow{\text{ev} \otimes \text{id}} Y. \end{aligned}$$



Figure 1 (left): Equation in a random paper.

Figure 2 (right): Complex arrangement of an equation

The typesetting of the equations in Science papers is very beautiful, which we find naturally true. But before computers were invented, writing equations in books was a nightmare for the publishing industry with movable type printing machines. The symbol in the formula has a different height with the letter (Fig. 2) which needs to be typed in different rows, which usually leads to mistakes in typing. "Typesetters" (people who typeset the paper) deal with the paper from famous scientists seriously. However, for normal people, they can only handwrite by themselves.

The l 's are used to calculate a table of $D_{[X+k] + m/l_2 + s}^l$
 where

$$D_{[X+k] + m/l_2 + s}^l = \sqrt{X+k+m/l_2+s} \binom{l}{[X+k] + m/l_2 + s}$$

In 1976, Donald Knuth wanted his book to be typeset. However, the technique that uses that time makes the equation a mess. Then he decides to make a standard typesetting equation by himself. i.e. TeX.

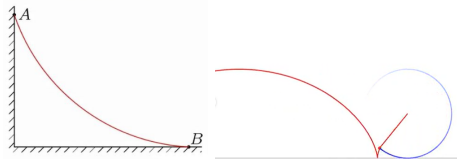
最速降線問題

“一個質點在純重力作用下，從一個給定點位移至非垂直下方一點。問沿著甚麼線段滑下所需時間最短？設兩點處於同一平面並忽略一切阻力。”

呢個就係最速降線問題，最早由義大利科學家伽利略提出。伽利略本人認為答案係圓弧，然而其實佢係錯嘅。後來，瑞士數學家約翰·伯努利(Johann Bernoulli)以此問題向全歐洲學者發起挑戰，最後僅有五人得出正確答案(佢本人、佢哥哥、牛頓、萊布尼茲、洛比達)——擺線 Cycloid。

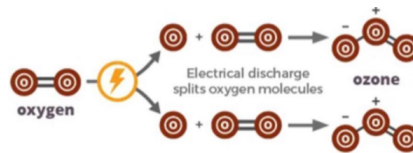
好，可能大家都有個問題——擺線係咩？數學堂教漏左？放心，阿Sir無教漏，因為擺線根本就唔係DSE Syllabus裡面。擺線嘅定義係，一個圓係一條直線上滾動時，圓周上嘅一定點所形成嘅軌跡。想象唔到？唔緊要，有圖。

至於證明就.....老實講中學階段嘅數係證明唔到嘅，呢度就唔提啦。



Lightning and Ozone

When lightning strikes, O_3 is produced. It is because the lightning cracks oxygen in air into radicals which reform into ozone. This is why theoretically one can feel a clean smell sensation after a thunderstorm (Don't try it).



Ozone acts as a protective stratospheric blanket against UV light. Note that lightning plays no part in repairing the ozone layer, only in making some small amount of ozone in the troposphere. This ozone is decayed back into oxygen before it makes it to the ozone layer.

Lightning discharges are a major source of nitrogen oxide gases called NO_x . Two primary gases (NO and NO_2) are formed during the lightning discharge when the air is heated to 30000 degrees inside the lightning channel.

Anthropogenic burning of fossil fuels contribute to NO_x concentrations too. As lightning adds nitrogen to the soil, as nitrates dissolves in precipitation, it helps plants, but microorganisms in the soil do the vast majority of nitrogen fixation.

白肩雕是世界上分佈比較廣泛的猛禽，在亞歐大陸、非洲和北美洲的部分地區幾乎遍布它們的踪跡，但它在鳥類中最突出並已被科學證明的特點，是對愛情的忠貞不渝、之死靡它。



在猛禽中，白肩雕算是比較大，體長達73—84厘米，體重在2.9—4.0公斤左右。肩部明顯的白斑，是白肩雕區別其他雕的主要特徵，這在它黑褐色的體羽上格外搶眼，其名也因此而得。中國是其典型的棲息地，廣東、青海、新疆等十幾個省份和地區都有它活動的身影。

白肩雕主要獵捕啮齒類、野兔、雉雞、石雞、鸕鶿、斑雞等小中型哺乳動物和鳥類為食。因具有長約41—46毫米且堅硬的嘴鋒，以及鋼鉤般的爪子，加之靈活多樣的捕食方式，使它不僅可以站在岩石、樹上和地面觀察等待獵物出現進行突然襲擊，又能在高空和低空飛翔巡獵。所以，進入白肩雕視野的獵物，不管是空中飛的，還是地上跑的，最終都將成為它的味美佳餚。

白肩雕屬於單一物種，無亞種分化，族群數量較稀少。近年來，由於生存環境的喪失或改變，致使其陷入瀕危泥潭，我國已將其列入國家一級重點保護物種。

每年的4—6月是白肩雕的繁殖期，而建巢是排在第一位的任務，從選址到建材都非常講究，巢址的選擇是根據所處環境而定。例如，在森林中，通常是選於高大的松樹、榿樹和楊樹上；在稀疏樹木的空曠地域，一般是選於孤立的樹上，或懸崖石上。營巢所用材料，外部以枯枝為主，內部鋪墊以細枝、獸毛、枯草莖和草葉為主。建造完成的巢呈盤狀，通常直徑為1.0—1.5米，高0.5—1.0米，這在鳥類住宅中屬於大型，可謂是豪宅級。

巢建成後，雌性白肩雕開始產卵，每窩2—3枚，從產下第一枚卵後，即開始孵化。對白肩雕而言，孵化並不是妻子獨有專利，在43—45天的孵化期內，夫妻倆相互輪替進行孵卵，直到最後一隻破殼而出。

對於雛鳥的撫育，也是由夫妻共同承擔。不過，此階段不像孵化期那樣互相輪換，而是妻子留在巢中負責照顧雛鳥，丈夫外出捕獵食物，最多時，一天要餵五六次。如此，經過夫妻55—60天的共同精心撫育，雛鳥才可離巢獨飛，夫妻共同撫育的責任履行完畢。

白肩雕實行一夫一妻制，一對白肩雕自結成伴侶後，一生一世都不分離，愛情專一，從無二心，是世界上最忠貞的鳥類。

這個結論是經過科學研究而得出的。科學家研究發現，在鳥類世界中，對自己伴侶最為忠貞的恐怕要數來

自中亞地區的白肩雕了。

研究人員在哈薩克斯坦一個自然棲息地發現一個獨立的白肩雕部落，為了研究它們的自然規律，對遺留在這些白肩雕產卵地的羽毛進行了DNA檢測。分析結果發現，沒有一隻成年鷹會與自己的配偶失散，這種高度的忠實度在鳥類中非常少見，因為絕大部分鳥類會有多個配偶和兒女，即使以忠貞聞名的藍鵲，雖然夫妻一起築巢、孵卵和餵養雛鳥，但也有15%—20%的藍鵲雛鳥的父親是養父而非生父。還有一項研究顯示，在鳥類和哺乳動物中，對終生伴侶保持忠貞者大約只有10%。

What is Special Relativity?

Special Relativity, introduced by Einstein in 1905, redefined our concept of space and time. It is based on two principles. The first principle is that it is not possible to tell which object is moving and which object is standing still. The second principle is that the speed of light is the same for all observers.

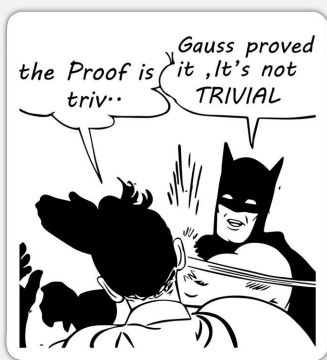
Time Dilation and Length Contraction

One mind-boggling consequence of Special Relativity is time dilation, meaning that time can appear to slow down for objects moving at high speeds. Additionally, length contraction occurs, meaning that objects in motion can appear shorter in the direction of their motion.

Imagine that you are standing on a planet. You see that your friend is in a rocket which is moving to your left at 90% of the speed of light.

A Sneak Peek at General Relativity

Special Relativity paved the way for the development of general relativity, which revolutionized our understanding of gravity. According to this theory, massive objects cause curvatures in spacetime, influencing the paths of nearby objects.



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