
Hubble capture 3 visages d'une supernova en évolution dans l'univers primordial

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Trois moments différents d'une explosion de supernova lointaine ont été capturés en un seul instantané par le télescope spatial Hubble de la NASA. L'étoile a explosé il y a plus de 11 milliards d'années, alors que l'univers avait moins d'un cinquième de son âge actuel de 13,8 milliards d'années.

Il s'agit du premier aperçu détaillé d'une supernova si tôt dans l'histoire de l'univers. La recherche pourrait aider les scientifiques à en savoir plus sur la formation des étoiles et des galaxies dans l'univers primitif. Les images de supernova sont également spéciales car elles montrent les premiers stades d'une explosion stellaire.

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Grâce à un phénomène appelé lentille gravitationnelle, trois moments différents d'une explosion de supernova lointaine ont été capturés en un seul instantané par le télescope spatial Hubble de la NASA. La lumière de la supernova, située derrière l'amas de galaxies Abell 370, a été multipliée par l'immense gravité de l'amas.

"Il est assez rare qu'une supernova puisse être détectée à un stade très précoce, car ce stade est vraiment court", a expliqué Wenlei Chen, premier auteur de l'article et chercheur postdoctoral à l'École de physique et d'astronomie de l'Université du Minnesota. "Cela ne dure que quelques heures à quelques jours, et il peut facilement être manqué même pour une détection à proximité. Dans la même exposition, nous pouvons voir une séquence d'images, comme plusieurs visages d'une supernova.

Cela a été possible grâce à un phénomène appelé lentille gravitationnelle, qui a été prédit pour la première fois dans la théorie de la relativité générale d'Einstein. Dans ce cas, l'immense gravité de l'amas de galaxies Abell 370 a agi comme une lentille cosmique, courbant et grossissant la lumière de la supernova plus éloignée située derrière l'amas.

La déformation a également produit plusieurs images de l'explosion sur différentes périodes de temps qui sont toutes arrivées sur Terre en même temps et ont été capturées dans une image Hubble. Cela n'a été possible que parce que les images agrandies ont emprunté des itinéraires différents à travers l'amas en raison à la fois des différences de longueur des voies suivies par la lumière de la supernova et du ralentissement du temps et de la courbure de l'espace dus à la gravité.

L'exposition Hubble a également capturé le changement rapide de couleur de la supernova qui s'estompe, ce qui indique un changement de température. Plus la couleur est bleue, plus la supernova est chaude. La première phase capturée apparaît en bleu. Au fur et à mesure que la supernova refroidissait, sa lumière devenait plus rouge.

"Vous voyez différentes couleurs dans les trois images différentes", a déclaré Patrick Kelly, responsable de l'étude et professeur adjoint à l'école de physique et d'astronomie de l'Université du Minnesota. "Vous avez l'étoile massive, le noyau s'effondre, il produit un choc, il se réchauffe, puis vous le voyez refroidir pendant une semaine. Je pense que c'est probablement l'une des choses les plus incroyables que j'aie jamais vues !

C'est aussi la première fois que les astronomes ont pu mesurer la taille d'une étoile mourante dans l'univers primitif. Ceci était basé sur la luminosité et le taux de refroidissement de la supernova, qui dépendent tous deux de la taille de l'étoile progénitrice. Les observations de Hubble montrent que la supergéante rouge dont les chercheurs ont découvert l'explosion en supernova était environ 500 fois plus grande que le Soleil.

Grâce à une « astuce » de la gravité qui courbe la lumière, le télescope spatial Hubble a capturé trois moments différents de l'explosion d'une supernova très lointaine, le tout en un seul instantané !

Crédits : Centre de vol spatial Goddard de la NASA

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Digital marketing refers to any marketing activity that uses digital channels to promote a product, service, or brand. Digital channels include search engines, social media platforms, email, mobile apps, websites, and other digital media. Digital marketing is important because more and more people are spending time online, and businesses need to reach their target audience where they are spending their time.

These are just a few examples of digital marketing strategies. The key to a successful digital marketing campaign is to identify your target audience, select the right channels, create valuable content, and track and measure your results to continually improve your strategy.

SEO

SEO, or search engine optimization, is a digital marketing strategy that involves optimizing your website and its content to rank higher in search engine results pages (SERPs) and drive more organic traffic to your site. The goal of SEO is to make it easier for search engines like Google to understand what your website is about and to provide valuable and relevant content



to users who are searching for information related to your business or industry.

SEO is an ongoing process that requires continuous monitoring, tracking, and optimization to achieve and maintain high search engine rankings. It's also important to keep up-to-date with the latest SEO best practices and algorithm updates to ensure that your website stays ahead of the competition.

PPC, or pay-per-click advertising

PPC, or pay-per-click advertising, is a digital marketing strategy that involves placing ads on search engine results pages (SERPs) or social media platforms and paying for each click on the ad. PPC ads are typically shown at the top or bottom of search engine results pages, or within social media feeds, and they are marked as ads to differentiate them from organic search results.

PPC advertising works on an auction system, where advertisers bid on the keywords and phrases they want to target, and the ad platform (such as Google Ads or Facebook Ads) selects the winning ad to display based on a variety of factors, including bid amount, ad quality, relevance, and other factors.

PPC ads can be highly targeted, allowing businesses to reach specific audiences based on demographics, interests, behaviors, and other factors. They can also be optimized for specific goals, such as driving website traffic, generating leads, or increasing sales.

PPC advertising can be complex and requires ongoing monitoring and optimization to achieve the best results. It's important to have a clear strategy, set realistic goals, and continually test and refine your campaigns to ensure they are delivering the best possible results.

Social media marketing

Social media marketing is a digital marketing strategy that involves using social media platforms like Facebook, Instagram, Twitter, LinkedIn, and others to build brand awareness, engage with customers, and drive traffic to your website.

Social media marketing typically involves creating and sharing content, such as images, videos, and text-based posts, that are designed to engage and entertain your audience, promote your products or services, and build brand loyalty. Social media marketing also involves interacting with your followers and responding to their comments and messages.

To be successful in social media marketing, it's important to have a clear strategy, set measurable goals, and consistently create and share high-quality content that resonates with your target audience. It's also important to track and measure your results and continually refine your approach to ensure you are achieving the best possible outcomes.

Email marketing

Email marketing is a digital marketing strategy that involves sending targeted emails to your subscribers or customers to promote your products or services, build relationships, and drive conversions. Email marketing can take many forms, including newsletters, promotional emails, product updates, and more.

To be successful in email marketing, it's important to have a clear strategy and set measurable goals. This involves building a quality email list of subscribers who have opted-in to receive emails from your business, creating engaging content that resonates with your audience, and consistently testing and optimizing your campaigns to achieve the best results.

It's also important to comply with email marketing regulations, such as the CAN-SPAM Act, by including clear opt-out links and contact information in your emails and avoiding misleading or spammy messaging.

Content marketing

Content marketing is a digital marketing strategy that involves creating and sharing valuable, relevant, and consistent content to attract and retain a clearly defined audience, with the goal of driving profitable customer action.

Content marketing can take many forms, including blog posts, videos, infographics, podcasts, social media posts, and more. The key is to create content that provides value to your target audience and aligns with your business objectives.

To be successful in content marketing, it's important to have a clear strategy and set measurable goals. This involves identifying your target audience, understanding their needs and interests, and creating content that aligns with their preferences and expectations.

It's also important to consistently create and share high-quality content that is optimized for search engines and promoted through social media and other channels. This involves creating a content calendar, conducting keyword research, and leveraging analytics and other tools to track and measure your results and continually refine your approach.

Affiliate marketing

Affiliate marketing is a digital marketing strategy where a business partners with an affiliate or publisher to promote its products or services in exchange for a commission on sales or leads generated through the affiliate's efforts. This means that the affiliate promotes the business's products or services on their website or other digital channels and earns a commission for each sale or lead that they refer.

To be successful in affiliate marketing, it's important to choose the right affiliates and build strong relationships with them. This involves identifying affiliates who are a good fit for your business and who have an audience that aligns with your target market.

It's also important to provide affiliates with high-quality promotional materials, such as banner ads and product descriptions, and to track and measure the results of your affiliate marketing campaigns to continually refine your approach and optimize your results. Additionally, it's important to comply with relevant laws and regulations, such as the Federal Trade Commission's guidelines on endorsements and testimonials.

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