康逸雲
Francisca Kemper

中央研究院天文及天文物理研究所副研究員

代表作名稱：

★ F. Kemper*, A. J. Markwick, Paul M. Woods. "The Crystalline Fraction of Interstellar Silicates in Starburst Galaxies." *Monthly Notices of the Royal Astronomical Society* 413 (2011): 1192-1199.

★ S. Hony*, F. Kemper, P. M. Woods, J. Th. van Loon, V. Gorjian, S. C. Madden, A. A. Zijlstra, K. D. Gordon, R. Indebetouw, M. Marengo, M. Meixner, P. Panuzzo, B. Shiao, G. C. Sloan, J. Roman-Duval, J. Mullaney, A. G. G. M. Tielens. "The Spitzer Discovery of a Galaxy with Infrared Emission Solely Due to AGN Activity." *Astronomy & Astrophysics* 531 (2011): A137.

★ O. C. Jones*, F. Kemper, B. A. Sargent, I. McDonald, C. Gielen, Paul M. Woods, G. C. Sloan, M. L. Boyer, A. A. Zijlstra, G. C. Clayton, K. E. Kraemer, S. Srinivasan, P. M. E. Ruffle. "On the Metallicity Dependence of Crystalline Silicates in Oxygen-rich Asymptotic Giant Branch Stars and Red Supergiants." *Monthly Notices of the Royal Astronomical Society* 427 (2012): 3209-3229.

得獎簡評：

康逸雲博士於 2002 年取得荷蘭阿姆斯特丹大學天文學博士學位，2010 年迄今擔任中央研究院天文及天文物理研究所的長聘副研究員。

康博士的研究專長為星際介質中的塵埃。她發現源自活躍銀河核的風中有塵埃存在。並且對塵埃在演化晚期恆星形成過程有重要的貢獻，大大推動了相關領域的發展。她的研究成果對未來光學與紅外線波段的太空望遠鏡計畫會有重大的影響力。

中央研究院陣容堅強的塵埃研究團隊是由康博士領軍，她目前擔任「史匹哲太空望遠鏡大型經典計畫」之一的大麥哲倫雲內塵埃演化研究計畫主持人、「阿塔卡瑪大型毫米及次毫米波陣列—第一波段」研發計畫的計畫主持人，以及「宇宙學及天文物理學太空紅外線望遠鏡—臺灣計畫」的首席科學家。

得獎人簡歷：

Dr. Francisca Kemper is an astrophysicist specializing in the properties of interstellar dust, particularly the mineralogical composition. She obtained her Ph.D. in 2002 from the University of Amsterdam on a thesis focusing on the formation of silicates and other minerals in the circumstellar environments of old stars. Notably, Kemper and her collaborators were the first to discover carbonates outside of the Solar System, in an environment where their normal formation path, aqueous alteration, does not apply. This means that an alternative formation mechanism for carbonates exists, and indeed, direct condensation has since been confirmed in laboratory experiments.

In 2002 Ciska Kemper received one of the inaugural Spitzer fellowships, on which she was appointed at the University of California in Los Angeles until 2004, broadening her research on silicates in astrophysical environments. Specifically, she set a firm upper limit on the fraction of silicates in the interstellar medium that shows a crystalline lattice structure, implying swift amorphization of stellar silicates by cosmic rays, upon injection in the interstellar medium. In 2005, Kemper joined the faculty of the University of Virginia, and almost two years later, she moved to a faculty position at the University of Manchester. During this period, she set up the SAGE-Spec collaboration, which used the Spitzer Space Telescope to perform an infrared spectroscopic follow-up survey to the successful SAGE survey of the Large Magellanic Cloud. The project was awarded more than 200 hours of observing time on the Spitzer Space Telescope, and includes over 50 collaborators in the United States, France, the United Kingdom, Japan, and now also Taiwan. The infrared spectroscopic measurements are extremely useful to study the dust and gas content of a range of environments in the Large Magellanic Clouds, and to date, approximately 40 publicatoins have used the data from this survey.

Since 2010, Dr. Kemper is a member of the faculty at the Academia Sinica Institute of Astronomy and Astrophysics. She has continued her successful line of research in the mineralogy of dust in astrophysical environments, while also branching out to other research areas. In particular, with members of her current research group, she is working on the dust production by evolved stars; the properties of silicates in active galaxies; the molecular content of the diffuse interstellar medium of the Large Magellanic Cloud; and the properties and occurrence of carbonaceous components such as polycyclic aromatic hydrocarbons, fullerenes and graphite. Her expertise has earned her a spot on the science team of the Space Infrared Telescope for Cosmology and Astrophysics (SPICA), serving as the SPICA-Taiwan project scientist. She is also the principal investigator of the Band 1 Receiver for the Atacama Large Millimeter/submillimeter Array (ALMA).

Francisca Kemper has authored over 60 peer-reviewed publications, and has an h-index of 31.

代表作簡介：

Dust is an important component of the interstellar medium of galaxies, absorbing typically about one third of the starlight in galaxies, and reemitting it as thermal emission at infrared wavelengths. In particularly dusty galaxies, this fraction can be as high as 90%. Silicates, a common group of minerals on Earth, represent a significant fraction of the interstellar dust reservoir, although it is shown to be almost completely amorphous in interstellar conditions in the Milky Way. Repeated cosmic ray hits by heavy ions have typically destroyed the crystalline lattice structure.

The presence of crystalline silicates, on the other hand, can be seen as evidence for thermal processing of the dust grains, as temperatures in excess of 1000 K are required to crystallize the silicates. Such temperatures are usually only achieved in the direct vicinity of stars, including the dust-producing oxygen-rich Asymptotic Giant Branch stars and Red Supergiants. The crystallization is known to be a function of density, however, the exact mechanism remained unclear. The SAGE-Spec paper “On the Metallicity Dependence of Crystalline Silicates in Oxygen-rich Asymptotic Giant Branch Stars and Red Supergiants” by Jones, Kemper et al., addresses the question whether the crystallization is triggered by an increasing gas density or an increasing dust density. This paper uses data from different metallicity environments, and hence different dust-to-gas ratios. Jones et al. established that the crystalline fraction more strongly depends on the dust density, and concluded that annealing of amorphous silicates is the most likely formation mechanism of crystalline silicates.

The crystalline fraction of the silicates in these AGB stars and RSGs is typically of the order of 10-20%, while the interstellar silicates are less than 2% crystalline. Some starburst galaxies show higher crystalline fractions in their silicates, though, and in the paper entitled “The Crystalline Fraction of Interstellar Silicates in Starburst Galaxies”, Kemper et al. showed that the dust production by newly formed stars in the starburst can indeed elevate the crystallinity levels in the interstellar silicates, provided that not enough time has passed for amorphization by cosmic rays.

Finally, the work on “The Spitzer Discovery of A Galaxy with Infrared Emission Solely Due to AGN Activity” by Hony, Kemper et al., is a serendipitous SAGE-Spec result. Rather than an object in the Large Magellanic Cloud, this point source with somewhat unusual infrared colors appears to be a background galaxy. The object shows very clear silicate emission features, and a warm dust continuum and due to its radio emission can be identified as an active galactic nucleus (AGN). The dust emission is arising from the circumnuclear torus and associated dust clouds. However, the object does not show a clear signature of a host galaxy; it is lacking the characteristic blue emission due a young stellar population and

the far-infrared emission arising from cold interstellar dust. A small old stellar population may be present, but the emission from this galaxy is dominated by the AGN, and it appears that this may be a hostless quasar. It is unique in its kind.

得獎感言：

I would like to thank Academia Sinica for recognizing the relevance of my work in the field of astromineralogy. This work would not have been possible without the input from many colleagues. I would like to give special thanks to the main co-authors on the awarded works: Sacha Hony has been a long time friend and collaborator with whom I have spent many hours discussing science, life and everything else that matters, while Libby Jones is a keen young researcher whom I had the privilege to supervise during her Ph.D. I would also like to thank the Mega-SAGE team, and all students and post-docs that I have supervised.