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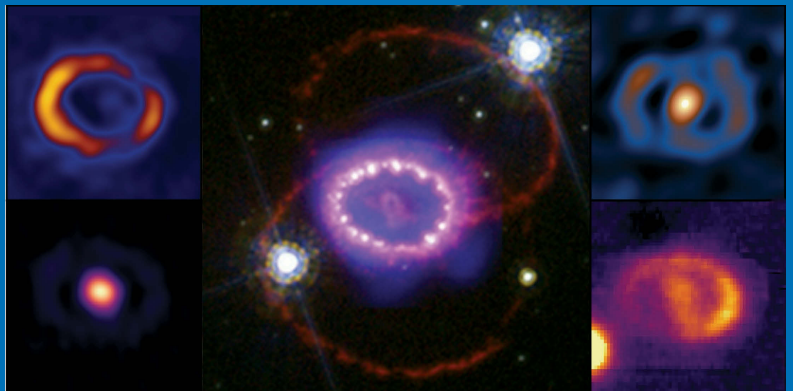
# Supernova 1987A: 30 Years Later

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SUPERNOVA 1987A:30 YEARS LATER - COSMIC RAYS AND NUCLEI  
FROM SUPERNOVAE AND THEIR AFTERMATHS

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*COVER ILLUSTRATION:* Celebrating the 30th anniversary of SN 1987A: a multiwavelength view

*Upper left:* ATCA 44 GHz from Zanardo, G., Staveley-Smith, L., Ng, C.-Y., et al. 2013, ApJ, 767, 98. *Upper right:* ALMA 870  $\mu\text{m}$  from Indebetouw, R., Matsuura, M., Dwek, E., et al. 2014, ApJ, 782, L2. *Lower left:* ALMA CO(J=2-1) from Matsuura, M., Indebetouw, R., Woosley, S., et al. 2017, MNRAS in press (<http://adsabs.harvard.edu/abs/2017arXiv170402324M>). *Lower right:* ESO SINFONI 1.6  $\mu\text{m}$  from Fransson, C., Larsson, J., Spyromilio, J., et al. 2016, ApJ, 821, L5. *Center image:* NASA's Chandra X-ray Observatory and Hubble Space Telescope (HST) composite image, Credit: X-ray: NASA/CXC/PSU/S. Park & D. Burrows; Optical: NASA/STScI/CfA/P. Challis. Figure courtesy of P. Cigan.

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AND THEIR AFTERMATHS**

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## Preface

Supernovae, along with their remnants, are pivotal in many active fields of research as the key sources of cosmic high-energy particles and heavy elements, the privileged sites of cosmic dust formation, and the primary agents of chemical and dynamical evolution of galaxies. The precise observational studies of type Ia supernovae at cosmological distances recently challenged fundamental physics with the dark energy concept. The bright transient phenomena associated with supernovae are among the rare celestial events visible with the naked eye. Yet, many open issues still need to be deeply explored such as the nature of the supernova progenitors and the final stages of stellar evolution, the explosion mechanisms and the associated nucleosynthesis, the shock acceleration processes and the long standing question of the origin of cosmic rays.

A bright “new star” appeared in the Large Magellanic Cloud on the 23rd of February, 1987, at 07:35 UT, manifesting itself firstly in the form of a burst of neutrinos, a few hours before its first light reached the Earth. Sanduleak  $-69^{\circ} 202$ , a blue supergiant in the outskirts of the Tarantula Nebula in the Large Magellanic Cloud had just imploded. The resulting stellar explosion named SN 1987A, visible to naked eye, has been the nearest and brightest supernova witnessed since the invention of the telescope four centuries ago. Thanks to the wealth of multi-wavelength information collected in the course of thirty years of investigation, including the unique detection of MeV neutrinos associated with a core-collapse supernova, SN 1987A became the first case enabling to make significant progress in all of these above-mentioned fundamental topics in modern astrophysics.

At the occasion of the thirtieth anniversary of this “supernova of a lifetime”, this IAUS 331 Symposium aimed at bringing together different communities in order to collate the accumulating knowledge on these explosive events and their remnants and shed further light on the open questions through an interdisciplinary approach. Such a meeting was then thought as the opportunity to make the link between the stellar progenitors and the multi-wavelength and multi-messenger manifestation of their aftermaths in terms of extreme sources of high-energy particles and nuclei. Therefore, several, interconnected, themes have been identified: (1) massive stars as supernova progenitors; (2) explosion mechanisms; (3) supernova properties, outcomes and impacts; (4) multi-wavelength and multi-messenger data on supernovae and their remnants, and (5) “SN 1987A, 30 years later” allowing for these diverse topics to be discussed at once, and hence for bridges among them to be built.

Following endorsement and sponsoring by IAU Commissions and Divisions and subsequent approval by the IAU Executive Committee in May 2016, speakers were invited and the different communities informed. Positive feedback translated into 19 invited review papers, 55 oral contributions and a dozen of posters, with the participation of nearly a hundred astronomers from 22 countries worldwide. The meeting location in La Réunion Island, a French overseas department in the Indian Ocean, has allowed a greater participation by scientists from Asia in particular (India, China, Japan, Taiwan), but also from South Africa and Australia, aside from the possibility it offered to stargaze within the wonders of the Southern Hemisphere.

It is a great pleasure to acknowledge the financial support of our sponsors listed on page *xxi* of these Proceedings, and the active support of the members of the Scientific and Local Organizing Committees in making this Symposium possible, and in the end, a great success.

To conclude, our hope would be threefold:

- may these Proceedings be found useful to anyone interested in supernovae and their remnants. As a healthy consequence of the rapid developments currently experienced in these lively fields of research,
- may their scientific contents become outdated in the horizon of the next decennial anniversary of SN 1987A. In particular, given that the probability of sighting the next Galactic supernova in our lifetimes is, though small, non null,
- may such an exceptional, eagerly awaited, event bring us as many unexpected discoveries and trigger as much excitement as SN 1987A and its historical predecessors in the Milky Way did.

*Astonishing Light Burst At Night Emerges...*

*Matthieu Renaud and Alexandre Marcowith, SOC/LOC co-chairs  
Les Aviron & Montpellier, France, June 9, 2017*

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