ISO Science Legacy – a compact review of ISO's major achievements

Foreword

Building upon pioneering work in the 1960's and 1970's using ground-based, rocket- and balloon-borne systems, the realm of infrared astronomy was fully opened by the first cryogenic telescope in space – IRAS, launched in 1983. Over its ten-month lifetime, IRAS surveyed almost the whole sky in four broad infrared bands. This survey permitted the first evaluations of the total energy emitted by various systems in our galaxy and in the local universe. However, it could not address the detailed mechanisms and processes responsible for the emission detected, nor the exploration of the distant universe. IRAS results graphically illustrated to astronomers the need for sensitive infrared observatories, allowing detailed spatial and spectroscopic study of specific targets. All over the world, high priority was assigned to cooled space infrared telescopes.

Following the Japanese IRTS mission, the first major satellite of this type to fly was ESA's Infrared Space Observatory (ISO). Launched in November 1995, ISO completed almost 30 000 scientific observations in its 2.5-year operational lifetime. Making use of its four sophisticated and versatile scientific instruments (a camera, a photopolarimeter and two spectrometers), ISO provided astronomers with a wealth of data of unprecedented sensitivity at infrared wavelengths from 2.5 to 240 μm. ISO has made, and continues to make, lasting contributions to all areas of astronomy, from the solar system to the frontiers of cosmology, unravelling the history of the universe. Between 1996 and 2004, over 1200 papers appeared in the refereed literature based on ISO data.

NASA's Spitzer Space Telescope, launched eight years later, has enhanced capabilities compared to ISO and, once again, infrared astronomers are offered matchless observing opportunities. However, the published ISO results and the ISO archive remain a valuable resource for research work. They provide guidelines for studies not only with Spitzer but also with future facilities, such as ASTRO- F, SOFIA, Herschel, JWST and ALMA.

With the Spitzer Space Telescope now in full operations, we thought that it would be beneficial to the astronomical community to have at hand, in a single volume, a review of the main discoveries owed to the ISO satellite. We did not ask the ISO founding fathers and mothers to write the articles, but instead turned mostly towards younger astronomers whose careers have been strongly influenced by ISO. The articles have been refereed by ourselves or by other scientists at our request. The book is organised as follows: first, overviews of four major themes investigated with ISO (crystalline silicates, molecular hydrogen, deep surveys; water in the universe), and then thirteen chapters reviewing ISO science from the solar system to the distant universe. It is not possible to gather in one book all the advances due to ISO, but we hope that this 450 pages compendium will give the essence of the original results obtained by the first full-fledged space infrared observatory.

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Guest editors