

1. Record Nr.	UNINA9910141151703321
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Titolo	Organic matter in the universe [[electronic resource] /] / Sun Kwok
Pubbl/distr/stampa	Weinheim, : Wiley-VCH, c2012
ISBN	1-283-86983-7 3-527-63703-6 3-527-63705-2 3-527-41119-4
Descrizione fisica	1 online resource (279 p.)
Disciplina	111 523.02
Soggetti	Cosmochemistry Organic compounds Interstellar matter Astronomical spectroscopy Organic compounds - Synthesis Spectrum analysis Electronic books.
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di bibliografia	Includes bibliographical references (p. 211-243) and index.
Nota di contenuto	Organic Matter in the Universe; Contents; Preface; Abbreviations; Color Plates; 1 History and Introduction; 1.1 Origin of Chemical Elements; 1.2 Extraterrestrial Organics; 2 The Chemistry of Organic Matter; 2.1 Families of Organic Molecules; 2.2 Different Forms of Carbon; 2.2.1 Graphite; 2.2.2 Diamond; 2.2.3 Fullerenes; 2.2.4 Nanotubes and Fullerene Onions; 2.2.5 Carbynes; 2.2.6 Amorphous Forms of Carbon; 2.3 Molecules of Biological Significance; 2.3.1 Carbohydrates; 2.3.2 Lipids; 2.3.3 Proteins; 2.3.4 Nucleic Acids; 2.4 Summary; 3 Interstellar Molecules 3.1 Electronic, Vibrational, and Rotational Structures of Molecules 3.1.1 Electronic Transitions; 3.1.2 Vibrational Transitions; 3.1.3 Rotational Transitions; 3.1.4 Effects of Electron and Nuclear Spins; 3.2 Hydrocarbons; 3.3 Alcohols; 3.3.1 Methanol; 3.3.2 Vinyl Alcohol; 3.4

Carboxylic Acids; 3.5 Aldehydes and Ketones; 3.5.1 Formaldehyde; 3.5.2 Cyanoformaldehyde; 3.5.3 Acetaldehyde; 3.5.4 Propynal, Propenal and Propanal; 3.5.5 Ketene; 3.5.6 Acetone; 3.6 Ethers and Esters; 3.7 Amines, Nitriles, and Nitrogen-Containing Molecules; 3.7.1 Ammonia; 3.7.2 Hydrogen Cyanide; 3.7.3 Methylenimine 3.7.4 Methylamine 3.7.5 Cyanamide; 3.7.6 Formamide; 3.7.7 Acetamide; 3.7.8 Ketenimine; 3.7.9 Amino Acetonitrile; 3.8 Radicals; 3.8.1 CH; 3.8.2 CH<sup>+</sup>; 3.8.3 The Methylene Radical; 3.8.4 Methyl Radical; 3.9 Carbon Chains; 3.9.1 Carbynes; 3.9.2 Carbon Chain Ions; 3.9.3 Pure Carbon Chains; 3.10 Acetylene Derivatives; 3.11 Rings; 3.11.1 Propynyl; 3.11.2 Cyclopropenylidene; 3.11.3 Cyclopropenone; 3.11.4 Ethylene Oxide and Propylene Oxide; 3.12 Phosphorus Containing Molecules; 3.12.1 PH; 3.13 Polycyclic Aromatic Hydrocarbons; 3.14 Molecules Containing Trace Elements; 3.14.1 Metal Hydrides 3.14.2 Halides and Cyanides 3.14.3 Calcium Carbide; 3.15 Biomolecules; 3.15.1 Amino Acids; 3.15.2 Sugars; 3.15.3 Nucleic Acids; 3.16 Diamonds; 3.17 Fullerenes; 3.18 Spectroscopic Scans; 3.18.1 Unidentified Lines; 3.18.2 All-Sky Spectral Scans; 3.19 Search for Large, Complex Molecules; 3.20 Summary; 4 Organic Molecules in the Interstellar Medium; 4.1 Dark Clouds; 4.2 High-Mass Star Formation Regions; 4.2.1 Sagittarius B2; 4.2.2 Orion Nebula; 4.3 Reflection Nebulae; 4.4 Diffuse Interstellar Medium; 4.5 Cirrus Clouds; 4.6 Summary; 5 Organic Compounds in Galaxies 5.1 Aromatic Compounds in Galaxies 5.2 The Aliphatic Component; 5.3 Other Organics; 5.4 Summary; 6 Synthesis of Organic Compounds in the Late Stages of Stellar Evolution; 6.1 Molecular Synthesis in the Stellar Wind; 6.2 Beyond the Asymptotic Giant Branch; 6.3 Chemical Evolution; 6.4 Enrichment of the Interstellar Medium; 7 Organic Compounds in the Solar System; 7.1 Techniques; 7.2 The Sun; 7.3 The Earth; 7.4 Planets and Planetary Satellites; 7.4.1 Planetary Atmospheres; 7.4.2 Ices; 7.4.3 Organic Solids; 7.5 Meteorites; 7.6 Meteoroids and Interplanetary Dust Particles; 7.7 Comets; 7.8 Asteroids 7.9 Trans-Neptunian Objects

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## Sommario/riassunto

Authored by an experienced writer and a well-known researcher of stellar evolution, interstellar matter and spectroscopy, this unique treatise on the formation and observation of organic compounds in space includes a spectroscopy refresher, as well as links to geological findings and finishes with the outlook for future astronomical facilities and solar system exploration missions. A whole section on laboratory simulations includes the Miller-Urey experiment and the ultraviolet photolysis of ices.

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