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# Dust in the Galactic Environment

D C B Whittet

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# Dust In The Galactic Environment

**Douglas Whittet**



## **Dust In The Galactic Environment:**

**Dust in the Galactic Environment** D.C.B Whittet,2018-10-08 Dust is a ubiquitous feature of the cosmos impinging directly or indirectly on most fields of modern astronomy and astrophysics Dust in the Galactic Environment Second Edition provides a thorough overview of the subject covering general concepts methods of investigation important results and their significance relevant literature and some suggestions for promising avenues of future research Since the publication of the first edition of this popular graduate text major advances have been made in our understanding of astrophysical dust especially in the light of exciting new results from space and ground based telescopes together with advances in laboratory astrophysics and theoretical modeling This new expanded edition highlights the latest results and provides a context for future research opportunities The first chapter provides a historical perspective for current research and an overview of interstellar environments and the role of dust in astrophysical processes followed by a discussion of the cosmic history of the chemical elements expected to be present in dust and an examination of the effect of gas dust interactions on gas phase abundances The next several chapters describe the observed properties of interstellar grains such as their extinction polarization absorption and emission characteristics Then the book explores the origin and evolution of dust tracing its life cycle in a succession of environments from circumstellar shells to diffuse interstellar clouds molecular clouds protostars and protoplanetary disks The final chapter summarizes progress toward a unified model Dust in other galaxies is discussed as an integral part of the text rather than as a distinct topic requiring separate chapters Containing extensive references and problems to aid understanding and illustrate basic principles the book is ideally suited for graduate and advanced undergraduate courses It will also be an invaluable reference for postgraduate students and researchers working in this important field

**Dust in the Galactic Environment** Doug C. B. Whittet,2022 Dust in the Galactic Environment Third Edition provides a thorough overview of the subject covering general concepts methods of investigation important results and their significance relevant literature and some suggestions for promising avenues of future research Major advances have been made in the last two decades in our understanding of astrophysical dust These have been driven by discoveries arising from new observational facilities such as the Spitzer Planck and Herschel Space Telescopes as well as important parallel developments in laboratory studies of cosmic and terrestrial analog materials This new expanded edition reviews these developments summarizes the current state of the field and considers possibilities for future advances for example with the James Webb Space Telescope It includes introductory material for new entrants to the field alongside detailed discussion for more advanced students and researchers

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more advanced students and researchers

**Dust in the galactic environment**, 2003

**A Study of Cosmic Dust in the Galactic Environment** Ajay Mishra (Astrophysicist), 2016

The mysterious 21 micron emission feature seen almost exclusively in the short lived protoplanetary nebula PPN phase of stellar evolution remains unidentified since its discovery two decades ago This feature is always accompanied by the equally mysterious unidentified 30 micron feature and the so called unidentified infrared UIR features at 3.3, 6.2, 7.7, 8.6 and 11.3 micron which are generally attributed to polycyclic aromatic hydrocarbon PAH molecules We explore the interrelations among the mysterious 21 micron 30 micron and UIR features of the 21 micron sources We find that none of these spectral features correlate with each other This argues against a common carrier e.g thiourea for both the 21 micron feature and the 30 micron feature This also does not support large PAH clusters as a possible carrier for the 21 micron feature We also derive the stellar mass loss rates of these 21 micron sources from their dust infrared IR emission using the 2 DUST radiative transfer code for axisymmetric dusty systems and examine the correlation between mass loss rate of AGB phase or mass loss rate of superwind phase with that of fluxes emitted from 21 and 30 micron features In addition we probe the role of carbon in the ultraviolet UV extinction by examining the relations between the amount of carbon required to be locked up in dust with the 2175 Angstrom extinction bump and the far UV extinction rise based on an analysis of the extinction curves along 16 Galactic sightlines We derive abundances of carbon from the model independent Kramers Kronig relation which relates the wavelength integrated extinction to the total dust volume and is less model dependent We also derive carbon abundance from fitting the observed UV optical near infrared extinction with a mixture of amorphous silicate and graphite We find that the carbon depletion tends to correlate with the strength of the 2175 Angstrom bump while the abundance of silicon depleted in dust shows no correlation with the 2175 Angstrom bump This supports graphite or polycyclic aromatic hydrocarbon PAH molecules as the possible carrier of the 2175 Angstrom bump We also see that carbon abundance shows a trend of correlating with  $1 - R_V$  where  $R_V$  is the total to selective extinction ratio suggesting that the far UV extinction is more likely produced by small carbon dust than by small silicate dust Finally we model the infrared emission of 120 Galactic high latitude clouds and 81 Diffuse Infrared DIR excess clouds using silicate graphite PAH model They exhibit notable cloud to cloud variations in the midinfrared with the ratio of the IRAS 12 micron intensity to the IRAS 25 micron intensity varying by up to one order of magnitude We find that hydrogen column density strongly correlates with the far infrared emission this indicates the presence of large grains of similar properties and abundances Also we find that all clouds are rich in PAHs as traced by the IRAS 12 micron data They are heated by the local interstellar radiation field but with the radiation intensity reduced by a factor of about 2 to 3

**The Physics of the Interstellar Medium and Intergalactic Medium** Andrea Ferrara, 1995

*Wisconsin Astrophysics*, 1995

*Nuclear Science Abstracts*, 1975

*Romanian Astronomical Journal*, 1992

*The Astrophysical Implications of the Laboratory Study of Presolar Materials* Thomas J. Bernatowicz, Ernst K. Zinner, 1997

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a fall 1996 conference in sections on the microanalytical study of presolar material from meteorites theory of nucleosynthesis and stellar evolution isotopic composition of the galaxy mixing and grain formation in supernova ejecta grain formation around stars the interstellar medium and molecular clouds presolar cloud collapse and formation of the solar nebula and survival of presolar grains Contributors come from related fields of meteoritics materials science observational astronomy and theoretical astrophysics No index Annotation c by Book News Inc Portland Or *The Astrophysical Implications of the Laboratory Study of Presolar Materials* Ernst K. Zinner, Thomas J. Bernatowicz, 1998-07-09 Annotation Contains revised papers from a fall 1996 conference in sections on the microanalytical study of presolar material from meteorites theory of nucleosynthesis and stellar evolution isotopic composition of the galaxy mixing and grain formation in supernova ejecta grain formation around stars the interstellar medium and molecular clouds presolar cloud collapse and formation of the solar nebula and survival of presolar grains Contributors come from related fields of meteoritics materials science observational astronomy and theoretical astrophysics No index Annotation c by Book News Inc Portland Or *Mid- and Far-infrared Astronomy and Future Space Missions* Toshio Matsumoto, Hiroshi Shibai, 2000 Interpreting Astronomical Spectra David Emerson, 1996-08 Interpreting Astronomical Spectra D Emerson Institute for Astronomy Department of Physics and Astronomy The University of Edingurgh Interpreting Astronomical Spectra describes how physical conditions such as temperature density and composition can be obtained from the spectra of a broad range of astronomical environments ranging from the cold interstellar medium to very hot coronal gas and from stellar atmospheres to quasars In this book the author has succeeded in providing a coherent and integrated approach to the interpretation of astronomical spectroscopy placing the emphasis on the physical understanding of spectrum formation rather than on instrumental considerations MKS units and consistent symbols are employed throughout so that the fundamental ideas common to diverse environments are made clear and the importance of different temperature ranges and densities can be seen Aimed at senior undergraduates and graduates studying physics astronomy and astrophysics this book will also appeal to the professional astronomer

**Novel Forms of Carbon II: Volume 349** C. L. Renschler, 1994-11-21 The MRS Symposium Proceeding series is an internationally recognised reference suitable for researchers and practitioners **Molecules in the Galactic Environment** Mark A. Gordon, Lewis E. Snyder, 1973 International Aerospace Abstracts, 1999 Referativnyi zhurnal, 1997 **Space Vehicle Electronics** David Bruce Newman, 1964 *Science* John Michels (Journalist), 2011

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