

**Molecular Universe ESR Position  
Team 20**

- **Location of Appointment** : Manchester
- **Team Leader (contact person)**: T J Millar
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- **Various URL** : <http://jupiter.phy.umist.ac.uk>, <http://aristote.obspm.fr/MIS/>
- **Duration of Appointment (in months)** : 36
- **Starting Date** : 01-10-2005 at the latest
- **Requirements with respect to candidate** : Physics/Astronomy/Chemistry degree
- **Title of Research project** : PAH and hydrocarbon chemistry in photon-dominated regions
- **Abstract of Research Project**

All molecular clouds in the Universe are, to a greater or lesser extent, bathed in ultraviolet photons. These photons are capable of ionization and dissociation and give rise to chemical processes which both synthesize (via ion-neutral and radical-radical reactions) and destroy (via photodissociation and ion-electron recombination) molecules. These effects occur within regions in interstellar clouds called Photon-Dominated Regions (PDRs). In recent years molecules of increasing chemical complexity, including small hydrocarbon chains, have been observed in PDRs. The Unidentified Infrared Bands, thought to be due to emission from polycyclic aromatic hydrocarbons (PAHs), are also found in the same environments.

This graduate project will combine a physical model of a PDR region with a chemical kinetic model of hydrocarbon and PAH formation. As well as investigating the in-situ formation of these species, the project will also include the study of PAH degradation as a path to the synthesis of simpler hydrocarbon chain molecules. The isotopic chemistry of deuterium is a sensitive probe of chemistry and physics, particularly at low temperatures, and the chemical networks will be extended to include the formation of singly and multiply deuterated species and applied to PDRs and the cold environments of protostars. Study of the HD/D<sub>2</sub> transition due to photodissociation processes will be introduced in to the Meudon PDR code.

This project is a collaboration between the University of Manchester and the Observatoire de Paris-Meudon and the individual appointed will be expected to spend an extended period, of up to one year, in Meudon (close to Paris).

Application:

The position is available immediately but a start date up to October 1st 2005 is possible. Letters of application for this position should be sent by March 31st 2005 to the address below. The application should include a curriculum vitae together with a detailed list of university courses taken and their grades, as well as a brief statement of research experience. The applicant should arrange for two letters of recommendation by persons familiar with his/her undergraduate studies and/or research to be sent to the same address by the deadline. Information on the Astrophysics Group at the University of Manchester can be found at <http://jupiter.phy.umist.ac.uk/>

Further information on this post can be obtained from Professor T J Millar, School of Physics and Astronomy, University of Manchester, Sackville Street Building, PO Box 88, Manchester M60 1QD, UK (e-mail: Tom.Millar@manchester.ac.uk)

All applicants should be aware of the nationality constraints associated with this position. Applications from females are particularly welcomed.

References :

P M Woods, T J Millar, E Herbst and A A Zijlstra: The Chemistry of Proto-Planetary Nebulae, *Astron. Astrophys.*, 402, 189-199 (2003)

T J Millar: Organic Molecules in the Interstellar Medium, in 'Astrobiology: Future Perspectives', eds. P Ehrenfreund et al., Kluwer Academic Publishers, pp. 17-31 (2004)

D Teyssier, D Fossé, M Gerin, J Pety, A Abergel, and E Roueff: Carbon Budget and Carbon Chemistry in Photon Dominated Regions, *Astron. Astrophys.*, 417, 135-149 (2004)