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COMMISSION 21 LIGHT OF THE NIGHT SKY

LUMIÈRE DU CIEL NOCTURNE

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1. Introduction

Commission 21 consists of IAU members and consultants with expertise and interest in the study of the light of the night sky and its various diffuse components, at all accessible electromagnetic frequencies. In cosmic distance scales, the subjects of Commission 21 range from airglow and tropospheric scattering in Earth's atmosphere, through zodiacal light in the solar system, including thermal emission from interplanetary dust, integrated starlight in the Milky Way galaxy, diffuse galactic light due to dust scattering in the galactic diffuse interstellar medium, thermal emissions from interstellar dust and free free emission from ionized interstellar gas, to various diffuse extragalactic background sources, including the cosmologically important cosmic microwave background (CMB). Observations of the diffuse night sky brightness at any frequency typically include signals from several of these sources, and it has been the historic mandate of Commission 21 to foster the necessary collaboration of experts from the different astronomical sub-disciplines involved.

2. Recent significant developments

The arguably most important development since 2006 has been the ongoing analysis of the *COBE*-DIRBE diffuse sky maps and the three-year and five-year CMB data sets from *WMAP*, in which the important corrections for diffuse foreground sources relies heavily on data products generated in earlier years by astronomers affiliated with Commission 21. A detailed model of the zodiacal light is required before reliable templates for galactic dust emission can be produced. Recently, the Fabry-Perot high-resolution spectral line studies of the zodiacal light by Reynolds *et al.* (2004) have been extended (e.g., Madsen *et al.* 2005) and extensively modeled by Ipatov *et al.* (2008). Kiss *et al.* (2008) investigated the the fluctuations produced in the infrared zodiacal emission by the thermal emission from asteroids. An all-sky Hα map serves as a template for the contribution by galactic free-free emission from interstellar ionized gas, while a galactic radio survey provides information on contributions in the form of synchrotron radiation to the *WMAP* data.

All foreground sources must be known with relatively high spatial resolution so as not to introduce false-positive small-scale structure into the CMB data. Thanks to the availability of such data, unprecedented cosmological information concerning the time since the big bang, the Hubble parameter, and the space-time geometry of the universe have emerged in recent years.

In addition, the comparison of *WMAP* data with previously known foreground sources has led to the discovery of a heretofore unknown galactic emission process in the 10 - 50 GHz range, related to interstellar dust. Initially termed 'anomalous dust emission', the process is most likely related to electric dipole microwave emission from rapidly spinning interstellar grains of nanometer size (Dobler & Finkbeiner 2008a,b). The use of all-sky H-α maps as a template for galactic free-free emission may need to be reexamined in light of a finding by Mattila *et al.* (2007) that the enhanced H-α intensity seen in high-latitude galactic cirrus clouds is most likely due to dust scattering of ambient H-α photons in the galactic radiation field rather than to *in-situ* emission.

Along more traditional lines, the difficult measurements of the optical/NIR/FIR extragalactic background light, a potentially very important source of information concerning the star formation history of the universe, continue to receive attention (Hauser & Dwek 2001; Mattila 2003; Matsumoto *et al.* 2005; Dwek *et al.* 2005; Mattila 2006; Bernstein 2007; Odegard *et al.* 2007). New measurements of the diffuse UV background have become possible thanks to *GALEX* (Henry *et al.* 2007; Sujatha *et al.* 2008). The study of extended red emission (ERE), thought to originate in UV-powered photoluminescence of interstellar PAH molecules or clusters, has now been extended to individual high-latitude clouds, which are illuminated by the galactic interstellar radiation field (Witt *et al.* 2008). The advance of detector technology has also enabled the high-resolution mapping of interstellar clouds in near-infrared light (Juvela *et al.* 2006).

3. Status and future of Commission 21

The focus and emphasis of current work on light of the night sky has undergone a strong shift toward extragalactic diffuse backgrounds and CMB data analysis. Many of the new workers in the field have backgrounds other than traditional astronomical backgrounds, and most are not members of the IAU and certainly not of Commission 21. In view of the small number of active members currently in Commission 21, it has been proposed to merge Commission 21 with Commission 22 *Meteors, Meteorites, and Interplanetary Dust* within IAU Division III on *Planetary Systems Sciences*, a move that is not supported by the majority of the active members of Commission 21, as this would effectively end the current mandate of Commission 21. Discussions concerning alternative futures of Commission 21 are currently underway.

Adolf N. Witt
president of the Commission

References

Bernstein, R. A. 2007, *ApJ*, 666, 663
Dobler, G. & Finkbeiner, D. P. 2008a, *ApJ*, 680, 1222
Dobler, G. & Finkbeiner, D. P. 2008b, *ApJ*, 680, 1235
Dwek, E., Arendt, R. G. & Krennrich, F. 2005, *ApJ*, 635, 784
Hauser, M. G. & Dwek, E 2001, *ARA&A*, 39, 249
Henry, R. C., Sujatha, N. V., Murthy, J., & Bianchi, L. 2007, *BAAS*, 210, 4406

Ipatov, S. I., Kutyrev, A. S., Madsen, G. J., Mather, J. C., Moseley, S. H., & Reynolds, R. J. 2008, Icarus, 194, 769
Juvela, M., Pelkonen, V.-M., Padoan, P., & Mattila, K. 2006, *A&A*, 457, 877
Kiss, Cs., Pal, A., Mueller, Th. G., & Abraham, P. 2008, *A&A*, 478, 605
Madsen, G. J., Reynolds, R. J., Ipatov, S. I., Kutyrev, A. S., Mather, J. C., & Moseley, S. H. 2005, *LPI Contr.* 1280, 111
Matsumoto, T., Matsuura, S., Murakami, H., Tanaka, M., Freund, M., Lim, M., Cohen, M., Kawada, M., & Noda, M. 2005, *ApJ*, 626, 31
Mattila, K. 2003, *ApJ*, 591, 119
Mattila, K. 2006, *MNRAS*, 372, 1253
Mattila, K., Juvela, M., & Lehtinen, K. 2007, *ApJ* (Letters), 654, L131
Odegard, N., Arendt, R. G., Dwek, E., Haffner, L. M., Hauser, M. G., & Reynolds, R. J. 2007, *ApJ*, 667, 11
Reynolds, R. J., Madsen, G. J., & Moseley, S. H. 2004, *ApJ*, 612, 1206
Sujatha, N. V., Murthy, J., Karnataki, A., Henry, R. C., & Bianchi, L. 2008, in press [arXiv0807.0189]
Witt, A. N., Mandel, S., Sell, P. H., Dixon, T., & Vijh, U. P. 2008, *ApJ*, 679, 497