

Processo FAPESP nº 2006/00258-4

Outorgado: CARLOS ALEXANDRE WUENSCHÉ DE SOUZA

Linha de Fomento: Auxílio Organização de Evento

Projeto: I^o Brazilian Workshop on Astrobiology” Rio de Janeiro, RJ, 20 e 21 de março de 2006.

RELATÓRIO CIENTÍFICO

1. Introdução

Apresentam-se neste relatório as atividades científicas desenvolvidas durante o “I Brazilian Workshop on Astrobiology” (I BWA), realizado no Palácio Universitário da Praia Vermelha, Rio de Janeiro, RJ, nos dias 20 e 21 de março de 2006. Este workshop foi dirigido a pesquisadores, pós-doutorandos e estudantes de pós-graduação, especialmente aqueles envolvidos com Programas de Mestrado e Doutorado que abordam temas relacionados a Astrobiologia (principalmente relacionados às áreas de: Astronomia, Biologia, Química, Geologia e Física).

2. Comitês

- Organização
 - Amâncio Friaça (IAG/USP)
 - Carlos Alexandre Wuensche (DAS/INPE)
 - Cláudia Alencar S. Lage (IBCCF/UFRJ)
 - Gustavo F. Porto de Mello (OV/UFRJ)
 - Vivian H. Pellizari (ICB/USP)

- Científico
 - Adriana Valio Roque da Silva (CRAAM/Mackenzie)
 - Cezar Sá (IB/UNB)
 - Eduardo Janot-Pacheco (IAG-USP)
 - Jaime Fernando V. da Rocha (IF/UERJ)
 - Jorge Ernesto Horvath (IAG-USP)
 - Waldenor. Cruz (IB/UnB)

3. Participantes e Trabalhos Apresentados

O I-BWA teve 165 inscritos e 104 participantes efetivos. No total foram apresentados 60 trabalhos, sendo 2 palestras convidadas; 18 contribuições orais; e 40 trabalhos na forma de painel.

4. Palestrantes Convidados

- David Catling (University of Bristol, UK): “*Planetary Habitability*”
- Janet Siefert (Rice University, USA): “The Origin of Life”

5. Descrição das Atividades

A programação do workshop foi organizada de forma a apresentar trabalhos relacionados às áreas de Astrofísica, Biologia, Química, Geologia e Física. O programa de cada dia constou de uma palestra convidada, nove apresentações orais, e uma sessão de painéis no final do período da tarde, com cerca de 1 hora de duração. Ao final de cada período foi organizada uma mesa redonda, com a participação dos conferencistas convidados, para uma discussão mais ampla dos trabalhos. Cada comunicação oral teve a duração de 25 minutos (20 minutos de exposição + 5 minutos para perguntas). As palestras convidadas duraram 1 hora (50 minutos de exposição + 10 minutos para perguntas). Para as sessões de painéis foram reservados 55 minutos no final de cada dia, não havendo separação dos trabalhos por áreas. O formato do workshop foi o seguinte:

- 20 de março - trabalhos relacionados ao tema habitabilidade planetária, na parte da manhã, e à proposição de experimentos para detecção de extremófilos na parte da tarde.
 - Período da manhã: após cerimônia de abertura, apresentação de palestra convidada proferida por representante internacional de destaque, seguida pela apresentação de duas contribuições orais. Após um intervalo, foram apresentadas outras duas contribuições orais. No final do período, sessão de discussão dos trabalhos apresentados.
 - Período da tarde: apresentação de três contribuições orais. Após um intervalo, foram apresentadas outras duas contribuições orais, e, na sequência, sessão de painéis. No final do período, sessão de discussão dos trabalhos apresentados.
- 21 de março - trabalhos relacionados ao tema detecção da vida em condições extremas e microbiologia, na parte da manhã, e à detecção de exoplanetas na parte da tarde.
 - Período da manhã: apresentação de palestra convidada proferida por representante internacional de destaque, seguida pela apresentação de duas contribuições orais. Após um intervalo, foram apresentadas outras duas contribuições orais. No final do período, sessão de discussão dos trabalhos apresentados.
 - Período da tarde: apresentação de três contribuições orais. Após um intervalo, foram apresentadas outras duas contribuições orais, e, na sequência, sessão de painéis. No final do período, sessão de discussão dos trabalhos apresentados e encerramento do workshop.

6. Objetivos

A questão relacionada à possibilidade de existência de vida no Universo é uma das mais antigas curiosidades da humanidade, responsável pela criação de mitos e lendas e por chamar a atenção do público em geral. Recentemente, esta questão vem recebendo uma maior atenção de cientistas de várias áreas e o tema de procura de vida no Universo vai rapidamente deixando de ser tema exclusivo da ficção científica e se transformando em tema de estudo científico de fato. Astrobiologia, a ciência relacionada a estas pesquisas, é nos dias de hoje respeitada como ciência e pode ser usada (na verdade, já tem sido usada), como um forte elo entre a ciência biológica e física. De um ponto de vista bastante otimista, Astrobiologia engloba o estudo de todas as formas de vida existentes no Universo, incluindo, é claro, a vida na Terra. Muitos aspectos diferentes deste novo campo multidisciplinar têm sido abordados por especialistas de diversas áreas, como Astronomia, Biologia, Física, Química, Geologia e Ciências Planetárias.

Percebeu-se ainda mais o grande potencial e grande interesse por este tipo de reunião assim que os coordenadores deram início à organização do workshop. O I-BWA teve como

objetivo principal o desenvolvimento de cientistas e estudantes graduados interessados nesta área multidisciplinar com a finalidade de trocar idéias, discutir resultados e perspectivas para o desenvolvimento desta nova área no Brasil.

7. Resultados Alcançados

O I-BWA possibilitou, pela primeira vez no Brasil, o encontro de profissionais cientistas e estudantes graduados de diversas áreas que estão trabalhando ou têm interesse em iniciar carreira em um dos vários tópicos relacionados à Astrobiologia. Os trabalhos apresentados no workshop abrangeram áreas como: Astronomia, Biologia, Física, Química, Geologia e Ciências Planetárias. As sessões de discussão no final de cada período foi uma ótima oportunidade para a troca de conhecimentos específicos entre os especialistas das várias áreas representadas neste workshop.

8. Conclusão

As discussões ao final de cada sessão e o debate final permitiram a identificação de algumas áreas comuns e o conseqüente estabelecimento de abordagens visando elaborações de projetos. Foi proposta a criação de um núcleo de cientistas que trabalham em áreas afins à astrobiologia e já está sendo conduzido um projeto de pesquisa envolvendo o mecanismo de identificação de biomoléculas usando observações em rádio e medidas de seções de reação no Laboratório Nacional de Luz Síncrotron (LNLS), por alguns dos pesquisadores deste núcleo. Esse projeto envolve o grupo de extremófilos do ICB/USP, o IBCCF/UFRJ, o OV/UFRJ, o IQ/UFRJ, o LNLS e, possivelmente, o INPE, caracterizando uma colaboração inter-institucional e multidisciplinar.

Várias propostas do fórum de discussão ao final do evento foram ponderadas pelos dois visitantes, que passaram por experiências semelhantes durante a criação de seus próprios grupos de pesquisa e o estabelecimento de programas de colaboração multidisciplinar. Uma delas envolve o fortalecimento do núcleo organizador do BWA, com o objetivo de atrair mais adeptos para a área, através de mini-cursos de verão ou inverno, em áreas de interesse para a Astrobiologia, dada por alguns dos especialistas presentes. Exemplos dos possíveis temas para esses mini-cursos são “Astronomia planetária e evolução estelar para biólogos”, “Microbiologia e extremófilos para astrônomos”, alguns tópicos de geologia que possam ser usados em geologia planetária, paleogeologia, etc. Outra decisão, aparentemente consensual, foi a introdução da disciplina Astrobiologia em alguns currículos nos cursos de física e biologia no país. Essa disciplina já existe, como matéria optativa, na UFRGS e na USP /SP.

Finalmente, a sugestão do fórum foi que esse evento aconteça bianualmente, de forma que na próxima versão, já existam trabalhos a serem apresentados que reflitam as colaborações surgidas no I BWA.

A realização deste evento contou também com o patrocínio da Fundação Universitária José Bonifácio e da Scientific American-Brasil, assim como o apoio das seguintes organizações: Observatório do Valongo/UFRJ, Instituto de Física/UERJ, SBPC, Instituto Astronômico e Geofísico/USP, INPE, Instituto de Biofísica Carlos Chagas Filho/UFRJ, UnB, CRAAM-Mackenzie, Instituto de Ciências Biológicas/USP.

Anexamos a este relatório o programa final, com a programação do evento, abstracts, lista de participantes; e cartaz de divulgação do evento com crédito aos patrocinadores.

São José dos Campos, 10 de abril de 2006

Carlos Alexandre Wuensche de Souza
Outorgado,
Processo nº 2006/00258-4

Anexos.

First Brazilian Workshop on Astrobiology

www.das.inpe.br/astrobio

March, 20-21, 2006
Rio de Janeiro, BRAZIL
Forum de Ciência e Cultura
Universidade Federal do Rio de Janeiro

Deadline for Registration
and Abstract Submission:
February, 24, 2006

Invited Speakers:

David Catling (University of Bristol, England)
Janet Siefert (Rice University, USA)

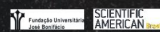
Local Organizing Committee:

Amâncio Fritça
Carlos Alexandre Wuensche
Cláudia Alencar Lage
Gustavo F. Porto de Mello
Vivian Pellizari

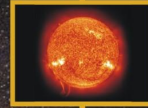
Scientific Organizing Committee:

Adriana V. R. da Silva
Cesar Sá
Eduardo Janof Pacheco
Jaime F. Villas da Rocha
Jorge Horvath
Waldenor Cruz

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First Brazilian Workshop on Astrobiology

March, 20-21, 2006

Fórum Universitário de Ciência e Cultura
Universidade Federal do Rio de Janeiro
Rio de Janeiro, RJ, Brazil

SCIENTIFIC PROGRAM

(Program – Abstracts – List of Participants)

Local Organizing Committee

**A. Friaça (IAG/USP),
C. A. Wuensche (DAS/INPE),
C. A. S. Lage (IBCCF/UFRJ),
G. F. Porto de Mello (OV/UFRJ),
V. H. Pellizari (ICB/USP).**

Local Scientific Committee

**A. V. R. da Silva (CRAAM/Mackenzie),
C. Sá (IB/UnB),
E. Janot-Pacheco (IAG/USP),
J. F. V. Rocha (IF/UERJ),
J. E. Horvath (IAG/USP),
W. Cruz (IB/UnB).**

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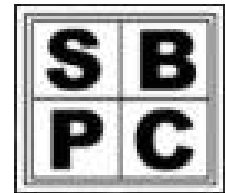


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Scientific Program

Monday, 20 March 2006

8:00	Registration
8:30	Opening Ceremony
09:00 – 10:00	<u>Review Conference</u> – <i>Planetary Habitability</i> – David Catling
10:00 – 10:25	<i>Astrobiologically interesting binary stars within 15 parsecs of the Sun</i> – Gustavo Porto de Mello
10:25 – 10:50	<i>Biological aspects to search for life in the cosmic neighborhood</i> – Claudia A. S. Lage
10:50 – 11:10	Coffee-break
11:10 – 11:35	<i>Are we being Earth-centered when looking for life in the Universe?</i> – Carlos A. Wuensche
11:35 – 12:00	<i>COROT and the search for rocky extrasolar planets</i> – Eduardo Janot Pacheco
12:00 – 12:30	<u>Morning Discussion Session</u>
12:30 – 14:00	Lunch
14:00 – 14:25	<i>Biomembrane precursors in ISM simulation conditions, an exobiologically-relevant approach to the origin of life studies in Brasil</i> - Jorge Quillfeldt
14:25 – 14:50	<i>Signs of life - what should we look for?</i> - Richard J. Ward
14:50 – 15:15	<i>Origin of ATP: terrestrial or cosmic? An enigma for replication and metabolism</i> - Adalberto Vieira
15:15 – 15:45	Coffee-break
15:45 – 16:10	<i>Steps towards complexity - from galaxy formation to biophilic environments</i> - Amâncio Friaça
16:10 – 16:35	<i>The Protoplanetary Disk problem of M dwarfs stars, the SETI Program and all those Matters</i> - Ramiro de la Reza
16:35 – 17:30	<u>Poster Viewing</u>
17:30 – 18:00	<u>Afternoon Discussion Session</u>

Tuesday, 21 March 2006

- 09:00 – 10:00 Review Conference - *The origins of life* - Janet Sieffert
- 10:00 – 10:25 *Survival of aminoacids and nucleobases in interstellar and interplanetary radiation conditions* - Sergio Pilling
- 10:25 – 10:50 *Mineral interface: terrestrial-like niches for the appearance of life in extreme habitats* - Fernando Souza Barros
- 10:50 – 11:10 Coffee-break
- 11:10 – 11:35 *On the continuity of chemical and biological evolutions* - Ricardo Ferreira
- 11:35 – 12:00 *Microbiology: One of the pearls of Astrobiology researches* - Emanuele Kuhn
- 12:00 – 12:30 Morning Discussion Session
- 12:30 – 14:00 Lunch
- 14:00 – 14:25 *Search for planetary candidates within the OGLE stars* - Adriana Silva
- 14:25 – 14:50 *The age - metallicity distribution of earth-harboring stars* - Hélio J. Rocha-Pinto
- 14:50 – 15:15 *Radio emission from extrasolar planets* - Abraham Chian
- 15:15 – 15:45 Coffee-break

15:45 – 16:10	Biological Effects of Gamma-Ray Bursts - Jorge Horvath
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16:35 – 17:30	<u>Poster Viewing</u>
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(1)

ASTROBIOLOGICALLY INTERESTING BINARY STARS WITHIN 15 PARSECS OF THE SUN

Gustavo F. Porto de Mello (OV/UFRJ), Tatiana Mitchenko (IAG/USP)

Binary stars are universally thought as second rate sites for the location of habitable planets. It is questionable and still open to debate in the current state of planetary formation theory whether a) planetary formation similar to the one that seems to follow the formation of single stars can proceed in binary or multiple systems; b) whether once formed planets have an appreciable probability of remaining in stable orbits inside the stellar continuously habitable zones (CHZs) for lengths of time compatible with the evolution of life. In this work we consider a sample of binary stars which were rejected in previous studies of astrobiologically interesting stars on the sole basis of their binarity. These stars have been selected by having masses, temperatures, metallicities, luminosities and degree of chromospheric activity compatible with the long term permanence of habitable telluric planets inside their CHZ, being rejected only by their binary/multiple status. We obtain and discuss their evolutionary masses, luminosities, state of evolution, degree of chromospheric activity and isochronal ages. Also, we investigate the dynamical stability of the system composed by the binary and an Earth-like planet within the CHZ of the primary component. Our analysis is modeled semi-analytically in the frame of the three-dimensional general three-body problem. We investigate the topology of the phase space without any restriction on the magnitude of the eccentricities and inclinations. We obtain the boundaries of the secular stability of the system, as a function of the masses, semi-major axes and inclinations, and qualitatively supplement these results by direct numerical investigations.

(2)

BIOLOGICAL ASPECTS TO SEARCH FOR LIFE IN THE COSMIC NEIGHBORHOOD

Claudia A. S. Lage, IBCCF/UFRJ

The definition of life, as we know it, is based on the model occurring on Earth. Its origin probably reports to the presence of simple prebiotic molecules, capable of having generated biological complexity as the physico-chemical conditions evolved in the planet environment. The search for spectral signatures of biomolecules in signals coming from the Solar System, from the interstellar medium, and from new planetary systems focuses the chemical tracking of putative life forms. Despite the identification of more than one hundred different chemical species with variable degrees of complexity, spectral data do not point to the existence of nucleic acid constituents. Nucleic acid components, such as deoxyribose sugar and nitrogen bases, are looked as key tracks of life, once they can accomplish the living attribute of self-replication. Nevertheless, the predicted chemical precursors of nitrogen bases, hydrogen cyanide and acrylonitrile, appear to be relatively abundant. Besides the astrobiological interest for such discussion, this study brings out another important consideration about the role of the genetic code in setting the basis for life: is the genetic code unique to life on Earth, or if it is eventually found elsewhere, a widespread model to code for life in the Universe?

(3)

ARE WE BEING EARTH CENTERED WHEN LOOKING FOR LIFE IN THE UNIVERSE?

C. A. Wuensche, C. A. S. Lage, S. Pilling, H. Boechat-Roberty, A. Friaca.

INPE, IBCCF/UFRJ, LNLS, OV/UFRJ, IAG/USP

One of the paths to search for life outside Earth has focused on chemical tracking of water [Ball, 2004], and organic primordial molecules in spectroscopic data obtained from natural satellites or planets in our own Solar System. This approach implies that life should have followed a pattern somehow similar to the one found on Earth. In the very likely case of a negative answer to the above assumption, which is the exact form of life we are searching for? In the present work we discuss some current concepts of a widespread trend to assume life as depending upon a particular function of one biomolecule: the self-replicating DNA. If it has driven the evolution of life under terrestrial conditions, we investigate the possibility of determining its presence and abundance in investigated sources coming from outer space.

(4)

COROT AND THE SEARCH FOR ROCKY EXTRASOLAR PLANETS

Eduardo Janot-Pacheco. IAG/USP

CoRoT is a space mission devoted to broadband stellar photometry in visible light during long observing runs. It will be launched in 2006 with two pioneering scientific programs: star seismology and detection of terrestrial planets. CoRoT will use the transit method looking for terrestrial planets slightly larger than the

Earth, in the habitable zone and closer. More than 160 extra-solar planets are presently known from Doppler measurements and can be studied with statistical approaches. CoRoT will enhance the sample of the discovered planets by a factor 3 or more and we expect significant changes in our understanding of the exoplanetary systems. Planetary radii will be measured down to Uranus size around solar type stars and down to Earth size around M type stars. Orbital periods up to 75 days will be determined with certainty from three detected transits. CoRoT is developed by the french space agency CNES through a wide cooperation including european countries and Brazil.

(5)

BIOMEMBRANE PRECURSORS IN ISM SIMULATION CONDITIONS, AN EXOBIOLOGICALLY-RELEVANT APPROACH TO THE ORIGIN OF LIFE STUDIES IN BRASIL

Jorge A. Quillfeldt, Horácio Dottori, Israel Baumvol.

Lipid bilayer biomembranes are essential to life on earth. But, contrary to what happens with other biomolecules central to life as we know (i.e., proteins and ADN) its constituent double-tailed amphiphilic lipids are (a) structurally very simple, and (b) do not require complex assembly mechanisms, only liquid water in order to self-organize by the hydrophobic effect: in the chemical evolution phase of the origin of life on earth, this "Step" may be considered almost solved. Notwithstanding the fact that there are only a few known prebiotic synthesis routes for lipids, these molecules seem to be able to readily form in interstellar conditions simulations from simple starting mixtures [Dworkin et al. (2001) PNAS 98, 815-819]. Since similar molecules have been detected in carbonaceous chondrites, it is reasonable to suppose an extraterrestrial origin for the primitive materials that furthered the first phase of life evolution in our planet. Organic-rich interstellar ices also integrate comets, a true molecular cloud free "sample" recently reachable by terrestrial space probes, and both, meteorites and comets, may have delivered complex molecules to primitive Earth. PROPOSITION: We propose a feasible set of experiments to be implemented in a surface physics laboratory taking advantage of a preexistent ultra-high vacuum chamber coolable to extremely low temperatures. A gas mixture (ibidem) will be deposited under vacuum onto a rotatable, cold (15 K) nickel, aluminum, or brass substrate, resulting in the formation of an amorphous mixed-molecular ice, and then irradiated in situ with UV from a microwave-powered, flowing hydrogen discharge lamp; The UV output flux is nearly evenly divided between the hydrogen Lyman α -line at 121.6 nm and a 20-nm-wide molecular transition centered near 160 nm, in order to assure only single-photon processes. This setup will work a reasonable interstellar / proto-stellar matter simulator, where different radiation stress may be applied (UV, X-rays, etc). Two possible analysis may be performed: (1) Direct Chemical Characterization: chromatographic separation of the irradiation photolysis products (aqueous suspension in organic solvent) after different exposure protocols, trying to identify lipid-like products (e.g., HPLC) and its proportion to other chemical species such as amino acids; (2) "Remote" Spectroscopic Characterization: (IR, etc) spectroscopy of the molecules and ions in the gas-phase, as well as the interstellar ice analog "signature," in order to suggest new strategies to real nebulae observation, specially the promising propylid-plenty ones. JUSTIFICATION: We present this experimental proposition to be discussed among fellow specialists that may detect incongruences and suggest practical solutions within the grasp of the limited technology and budget we presently have in Brazil right. It shows also that we MAY really contribute to the present global exo/astrobiology drive, not only in the already advanced areas of (a) nebulae astrophysics and proto-planetary disks observation and (b) exoplanet detection (e.g., COROT's participation), or the less costly, self-driven (c) theoretical/conceptual areas (modeling, computer simulation, etc), and (d) extremophile-related microbiology studies, but also in concrete astro-chemistry investigation relevant to the origin of life studies. In terms of Solar System exploration, our Space Agency (AEB) may not lead us farther than some brief stays in the ISS by now, but Brazil may certainly be present in the exo/astrobiology world landscape.

(6)

SIGNS OF LIFE - WHAT SHOULD WE LOOK FOR?

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Experiments to detect living systems have been included in several robotic interplanetary missions. These experiments aimed to detect basic carbon metabolism, either through "pulse/chase" type experiments using radioactive markers, or by analysis of the natural carbon isotope abundance. Interpretation of the limited data that is available is ambiguous, and it is recognized that careful design is the key to the success of future experiments. The ideal experiment should provide unequivocal evidence for the presence or absence of life, and to design better experiments it is necessary to have a clear answer to the question, what is life? Terrestrial life can be analyzed to identify fundamental traits that are

likely to be present in living systems wherever they may occur. A key event that results in the incorporation of material into living systems is the emergence of self-replicating, dissipative structures. These structures exist far from chemical equilibrium, and consequently result in the modification of the chemical composition of their environment. Consequently, the presence of living systems should be revealed by long-term perturbations in the chemical equilibrium of the environment in which the living system is found. Following the pioneering work of Winogradsky and Beijerinck, the influence of bacteria on geochemical cycles has been clearly demonstrated, and the Winogradsky column is a simple experimental method used to evaluate the environmental chemistry of complex microbial ecosystems. The robotic technology necessary for the experimental set up and spectroscopic monitoring of a Winogradsky column on future interplanetary missions is safely within the limits of current technology. A positive result would not only reveal the presence of life, but also the chemical basis of metabolic processes of extraterrestrial living systems.

(7)

ORIGIN OF ATP: TERRESTRIAL OR COSMIC? AN ENIGMA FOR REPLICATION AND METABOLISM

Adalberto Vieyra and Ana Cláudia Tessis, Institute of Biophysics Carlos Chagas Filho, Federal University of Rio de Janeiro, 21941-590 Rio de Janeiro, Brazil.

Adenosine 5'-triphosphate (ATP) is considered the chemical energy molecular currency in all living processes. Besides its role in powering endergonic chemical reactions, it also appears to have participated in the transmission of genetic information since the appearance of primitive forms of life on Earth and even before. Several scenarios have been proposed for the appearance of ATP in early stages of the Earth (and Universe) formation. There are difficulties concerning the postulated scenarios for synthesis and accumulation of ATP (and other nucleotides) in the prebiotic world. Ancient minerals could have played different roles in the catalytic synthesis and polymerization of adenine nucleotides at moderate and high temperatures. However, the most abundant minerals in possible scenarios for the appearance and evolution of Life on Earth hydrolyse rather than synthesize ATP. For these reasons, extraterrestrial formation of ATP can not be ruled out, even though there are some problems concerning the availability of phosphate in some potential cosmic scenarios. Plausible cosmic intermediates not completely related with the modern ATP molecule could be considered, as well as separated and later convergent routes of pyrophosphate synthesis - the energy-rich phosphorylated chain of ATP - and adenosine synthesis in very early epochs of chemical evolution.

(8)

STEPS TOWARDS COMPLEXITY -FROM GALAXY FORMATION TO BIOPHILIC ENVIRONMENTS

Amancio Friaça, IAG/USP

In this work we present the results of models of formation and chemical evolution of galaxies, to determine habitable zones in a variety of galactic environments, and under a number of habitability criteria: the presence of metals; the occurrence of violent events (Supernovae and Gamma-Ray Bursts) and the formation of molecular clouds. We consider the evolution of the UV radiation field in the galaxies and the evolution of C, N and O abundances in molecular clouds. The evolution of Si, Mg and Fe abundances are also considered when searching for the development of life in rocky planets. Galaxies are in itself environments in which chemical evolution leads to optimal concentration of chemical elements and radiation levels, leading to high levels of complexity in molecular chemistry, a necessary condition for life to form. Among the several galactic environments, the galactic disks seem to be the most biophilic, in comparison, for instance, to elliptical galaxies.

(9)

THE PROTOPLANETARY DISK PROBLEM OF M DWARFS STARS, THE SETI PROGRAM AND ALL THOSE MATTERS

Ramiro de la Reza. ON

After 50 years pointing solar type stars, the SETI program is now shifting towards M dwarf stars. Recent results indicating that the majority of stars in our Galaxy are single M dwarfs and the first discovery of a terrestrial type exoplanet around a M dwarf will give a strong impulse to the new SETI program. However, astronomers do not find protoplanetary disks older than 11 Myr around M dwarfs. Have older disks vanished? If giant stars can form rapidly in some few million years, how can the slower disk factory of terrestrial type planets work in those conditions?

(10)

SURVIVAL OF AMINO ACIDS AND NUCLEOBASES IN INTERSTELLAR AND INTERPLANETARY RADIATION CONDITIONS.

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OV/UFRJ e IQ/UFRJ*

The goal of this work is to experimentally study the photoionization and photodissociation processes of some amino acids and nucleobases in interstellar and interplanetary radiation conditions. Those biological molecules have been extensively detected in meteorites and micrometeorites: nucleobases up to 530 ppb (Stocks & Schwartz 1981 and references therein) and amino acids up to 3 ppm (Cronin 1998 and references therein). The simplest amino acid, glycine (NH₂CH₂COOH), was recently detected in the molecular clouds associated to the star forming regions SgrB2, Orion KL and W51 (Kuan et al. 2003a). Traces of Glycine were also observed in the comet Hale-bopp (Crovisier et al. 2004). The authors have derived a molecular upper limit for fractional abundance with respect to water of < 0.15, which corresponds to ~ 0.3% in cometary ice mass, or 0.05% in cometary total mass. Despite no direct detection of nucleobases in comets or in the molecular clouds, some of their precursor molecules like HCN, pyridines and pirimidines were reported in the Vega 1 flyby of comet Halley but no amino acids (Kissel & Krueger, 1987). Despite no direct detection of nucleobases in the interstellar medium, some of their precursor molecules have been detected by Kuan et al. (2003b). The measurements were taken at the Brazilian Synchrotron Light Laboratory (LNLS) at Campinas-SP, employing VUV and soft X-ray photons from two experimental beamline: the toroidal grating monochromator-TGM and the spherical grating monochromator-SGM. The experimental set up consists of a high vacuum chamber with a time-of-flight mass spectrometer TOF-MS. Mass spectra were obtained using photoelectron photoion coincidence (PEPICO) technique. Kinetic energy distributions and abundances for each ionic fragment released by photodissociation have been obtained from the analysis of the corresponding peak shapes in the mass spectra. We reported some results obtained from the survival of thymine (C₅H₆N₂O₂), glycine, alanine (C₃H₇NO₂) and proline (C₅H₉NO₂) to the space radiation conditions. Combined with our data we present a compilation of several amino acids and nucleobases data taken from literature. Our results have shown that the amino acids are effectively more destroyed by stellar radiation than the nucleobases. In the VUV spectral range this differences reach up 80 % decreasing to high energy photon energy range. The nucleobases are able to form a stable cation in gas phase. Since polycyclic aromatic hydrocarbons (PAHs) and polycyclic aromatic nitrogen-rich hydrocarbons (PANHs) have the same capability and seem to be ubiquitous in the ISM (Allamandola et al. 1986), it is not unreasonable to predict that aromatic nucleic acid bases could survive in the ISM. The radicals and ionic products released by dissociation of larger biomolecules become also an alternative and efficient route to increase the molecular complexity of a region, since some ion-molecule reactions do not have an activation barrier and are also very exothermic. Moreover, due to the high kinetic energy of some fragments maybe some endothermic pathways could occur.

(11)

MINERAL INTERFACE: TERRESTRIAL-LIKE NICHES FOR THE APPEARANCE OF LIFE IN EXTREME HABITATS.

Fernando de Souza-Barros. Institute of Physics Federal University of Rio de Janeiro,

It is presented a short review of mineral-aqueous media interfaces that might have been relevant in the evolution of insulated organisms and in their differentiation on terrestrial-like planets or satellites. The model interface formed by pyrite in the presence of artificial primitive seawater is chosen to show the functional richness of this special niche.

(12)

ON THE CONTINUITY OF THE CHEMICAL AND THE BIOLOGICAL EVOLUTIONS

Ricardo C. Ferreira, UFPE

It is shown that the base sequence of an RNA-like oligomer synthesized from a chemical model is closer to the base sequence of prokaryotes than that of eukaryotes.

(13)

MICROBIOLOGY: ONE OF THE PEARLS OF ASTROBIOLOGY RESEARCHES.

Kuhn, E. and Pellizari, V.H. ICB, USP

Astrobiology is a multidisciplinary field that studies the origin, evolution and distribution of life in the Universe. This new and transcendent science, link areas as Astronomy, Physics, Planetary Science, Chemistry, Geology, Engineering and Biology. In biological context, Microbiology plays a very important role in Astrobiology studies considering the microbial capacity of adaptation and survival in extreme environments, and the longevity of microorganisms in Earth's history. The goal of this presentation is to show the importance and development of Microbiology researches inside the field of Astrobiology, since Microbiology researches have become more and more robust during the last few years showing its importance in Astrobiology researches.

(14)

SEARCH FOR PLANETARY CANDIDATES WITHIN THE OGLE STARS

Adriana V. R. Silva and Patricia C. Cruz. CRAAM/Universidade Mackenzie

We develop a method to distinguish between planetary and stellar companions to stars which present a periodic decrease in brightness, interpreted as a transit. Light curves from a total of 177 stars from the OGLE project were fitted by the model which simulates planetary transits using an opaque disk in front of an image of the Sun. The simulation results yield the orbital radius in units of stellar radii, the orbital inclination angle, and the ratio of the planet to the star radii. Combining Kepler's third law with a mass-radius relation for main sequence stars, it was possible to estimate values for the masses and radii of both the primary and secondary objects. This model was successfully tested with the confirmed planets orbiting the stars HD 209458, TrES-1, OGLE-TR-10, 56, 111, 113, and 132. The method consists of selecting as planetary candidates only those objects with primary densities between 0.7 and 2.3 solar densities (F, G, and K stars) and secondaries with radius less than 1.5 Jupiter radius. The method is not able to distinguish between a planet and a dwarf star with mass less than 0.1 M_{Sun} , such as OGLE-TR-122. We propose a selection of 28 planetary candidates (OGLE-TR-49, 51, 55, 63, 71, 76, 90, 97, 100, 109, 114, 127, 130, 131, 134, 138, 140, 146, 151, 155, 159, 164, 165, 169, 170, 171, 172, and 174) for high resolution spectroscopy follow up.

(15)

THE AGEMETALLICITY DISTRIBUTION OF EARTH-HARBOURING STARS

Helio J Rocha-Pinto. OV/UFRJ

The metallicity distribution of long-lived dwarfs at past epochs is calculated from a sample having chromospheric ages and photometric metallicities. Our results can be used to calculate how common were solar-metallicity stars at the time of formation of the Sun, as well an estimate on the frequency of earth-harboring stars in the age-metallicity plane. We show that the Sun was in the 10% metal-rich tail of the metallicity distribution when it was formed. It is likely the bulk of earth-harboring stars are younger than the Sun by 1-2 Gyr, although their metallicity distribution is nearly solar.

(16)

RADIO EMISSIONS FROM EXOSOLAR PLANETS

Abraham Chian. INPE

We present an overview of nonthermal planetary radio waves emitted in the solar system due to solar-planetary interactions. Earth, Jupiter, Saturn, Neptune and Uranus are known to be sources of intense radio emissions produced in the auroral regions of the planetary magnetospheres. These radio emissions are excited by plasma processes such as cyclotron maser or nonlinear wave-wave interaction, and are triggered by solar activities such as coronal mass ejections. We suggest that similar scenario may occur in other solar systems which leads to the generation of intense radio waves in the magnetospheres of some exosolar planets. The detection of these radio emissions will provide valuable information on the physical processes governing the stellar-planetary electrodynamic coupling and help us to investigate the possibility of extra-terrestrial intelligent life.

(17)

BIOLOGICAL EFFECTS OF GAMMA-RAY BURSTS

J. Horvath and Douglas Galante

In this work it is presented a unified, quantitative synthesis of analytical and numerical calculations of the effects caused on an Earth-like planet by a Gamma-Ray Burst (GRB), considering atmospheric and biological implications. The main effects of the illumination by a GRB are classified in four distinct ones and analyzed separately, namely: direct gamma radiation transmission, UV flash, ozone layer depletion and cosmic rays. The "effectiveness" of each of these effects is compared and lethal distances for significant biological damage are given for each one. Biological modelling is also used in order to evaluate the evolutionary importance of such astrophysical events on speciation/extinction processes.

(18)

BIO10-012/ EXOBIOLÓGIA (BIOLOGICAL SCIENCES, UFRGS), AN UNDERGRADUATE COURSE IN EXO/ASTROBIOLOGY

Jorge A. Quillfeldt, Aldo Mellender de Araújo, Horácio Dottori, Miriani Pastoriza, Kepler S. de Oliveira Filho, Rommulo Conceição and Eduardo D. Barcelos (in memoriam). Universidade Federal do Rio Grande do Sul

Exo/Astrobiology as a scientific discipline has experienced, in the last few years, a great impulse. It has been formally institutionalized in different countries (USA, UK, Germany, Spain, Australia, etc) with the creation of government supported research centers; in parallel, specific undergraduate courses have been established in several Universities (see, e.g., <http://www.issol.org/educationtext.html>). One of NASA's main scientific strategies (Origins Roadmap) is openly based upon the astrobiology rationale, and the NASA Vision states as their mission to "improve life here, to extend life to there, to find life beyond". Motivated by this effervescent environment, we have created in 2002 a new undergraduate course of "Exobiology" (BIO10-012) in the Biological Sciences career, at the Federal University of Rio Grande do Sul (UFRGS), the third largest public higher education institution in Brasil. A group of teachers from different areas (astrophysics, geology, biophysics, evolution and history), despite not necessarily working in exobiology research, join efforts to provide up-to-date, multidisciplinary presentation of the most important (and fertile) themes in the area. It is directed to science students in order to encourage vocations. The syllabus is divided in two Modules, Basic and Advanced. BASIC MODULE: Water and the Origin of Life - theories and experimentation; The new Solar System, the Galaxy and the Universe; Nucleosynthesis, star formation and evolution; ISM, molecular clouds and planet formation; Planetary atmospheres; Miller-Urey's experiment; Habitability Zone; Rare earth arguments; Evolution of complexity on Earth; Mars, from Vikings to ALH84001 and beyond. ADVANCED MODULE: Exoplanets: profile, detection and the search for reliable biosignatures; extremophiles and the limits of life on earth; Meteorites and Comets; Mass Extinctions is earth's life history; Mars, our greatest exobiological lab; Europe, Titan and other potential niches in the Solar System; SETI: Drake's equation, Kardashev's Civilizations and the fermi Paradox; Between facts and desire: UFOs, science fiction and public opinion. RESULTS: Attending public is steadily growing over the years (at least 68 students have attended the course until this year, and 24 are enrolled for this year). It includes students from biology, physics, astronomy, geology and chemistry, and there are evidence of some future careers already on the run.

(19)

STUDY OF ABSORPTION OF AMINO ACIDS ON CLAYS IN SEAWATER AT SEVERAL PHs

Luís Otávio de Brito Benetoli, Cláudio Mendes Dias de Souza, Henrique de Santana, Dimas Augusto Morozin Zaia.DQ/UEL

Bernal (The physical basis of life; Routledge and Kegan Paul Ltd.; London; 1951), first suggested that mineral clays could have played an important role as pre concentrators of biomonomers for their subsequent condensation to form biopolymers. Numerous studies have been shown that amino acids with positively or negatively charged R groups adsorb more than amino acids no charged R groups. Thus, Zaia et al. (J. Braz. Chem. Soc. 13, 678-681, 2002) and Zaia (Amino Acids 27, 113-118, 2004) raised some questions about the role of minerals in providing a concentration mechanism for amino acids, since 74% of the amino acids of today's proteins are comprised of amino acids with non charged R groups. The present work describes the utilization of caulin and bentonite for the study of adsorption on clays (mg of amino acids/500 mg of clay) of several L-amino acids in seawater at different pHs. The following results were obtained: Caulin {pH=(2.45- 3.35) [Met (149.3±22.7 N=6); Lys (219.1±46.1 N=5); Asp (370.3±73.2 N=6); Cys (1184.4±9.9 N=4)]; pH=(5.32 -7.25) [Met (31.7±13.3 N=7); Lys (453.9±19.7 N=4); Asp (268.5±13.4 N=5); Cys (1172.0±10.3 N=4)]; pH=(7.80-8.52) [Met (235.7±17.1 N=5); Lys (318.0±13.4 N=4); Asp (321.5±56.5 N=8); Cys (1200±0.0 N=4)]}. Bentonite {pH=(2.65-3.12) [Met (521.3±59.4 N=7); Lys (785.4±39.4 N=6); Asp (607.2±38.6 N=4) Cys (1200.0±0.0 N=3)]; pH=(5.90-6.95) [Met (293.1±32.7 N=6); Lys (806.0±35.5 N=5); Asp (468.2±42.6 N=4); Cys (1160.7±9.9 N=5)]; pH=(7.95-8.48) [Met (672.9±43.4 N=5); Lys (1007.4±12.2 N=4); Asp (477.1±44.8 N=6); Cys (1176.0±16.85 N=5)]}. Bentonite adsorbs more than caulin probably due to its bigger surface area. Cys was much adsorbed at

all pHs studied here in, probably the sulfur of its side chain is bonding to metals of the clays. These results show that the adsorption of amino acids on clays depends on several factors

(20)

STUDY OF REACTION BETWEEN AMMONIUM AND THIOCYANATE IN SEA WATER BY IRRADIATION OF UV LIGHT

Leidimara Pelisson, Cláudio M. D. de Souza, Luís O. de Brito Benetoli, Henrique de Santana e Dimas A. M. Zaia. DQ/UJEL

Ammonium and thiocyanate have been synthesized in experiments under prebiotic chemistry conditions or have been found in places that resembling these environments. The reaction between ammonium and thiocyanate have been studied in several media. In this paper, it was studied the reaction between ammonium and thiocyanate in seawater at two pHs (5.3 and 7.2) and different irradiation times (0-15 h). It was observed the formation of red precipitate whose composition is under studies. The decomposition of thiocyanate depends on the time of irradiation, after 15 h of irradiation about 60% of thiocyanate was decomposed in both pHs. However, the results of decomposition of ammonium are not understood completely. The samples with 7.2 of pH did not change during the irradiation time, however the samples with pH 5.3 increased until 7.0. This increasing could be due to formation of ammonium. After irradiation, the samples were lyophilized, the FTIR spectra were recorded using pressed KBr discs. The spectra showed a decreasing of the bands at 2065 and 3127 cm^{-1} due to stretchings C-N and NH₄ of ammonium thiocyanate, and two new bands were observed in the region 1113 and 3426 cm^{-1} . The FT-IR spectra show that the decomposition of ammonium thiocyanate occurred and new compound was formed.

(21)

STUDY OF DIFFUSION OF THIOCOMPOUNDS THROUGH OF SEMI PERMEABLE INORGANIC MEMBRANE

João Paulo Sacchetto, Cássia Thaís B. V. Zaia, Henrique de Santana e Dimas A. M. Zaia. DQ/UJEL

Spontaneous formation of a cellular structure with a semipermeable membrane is a crucial step for the study of origin of life. Maselko and Strizhak (J. Phys. Chem. B 108, 4937-4939, 2004), obtained that a pellet of calcium chloride with copper chloride immersed in a solution containing sodium carbonate, potassium iodate and hydrogen peroxide, produces a cell surrounded by a semipermeable membrane for iodine that diffuses out of cell. In the present, it was studied the diffusion of thiocompounds into the inorganic cell of calcium chloride. The results showed that did not occur the diffusion of thiocyanate into the cell. The following procedures were tested: immersion of the pellet in a solution of 1.5 mol L⁻¹ of sodium carbonate, cell growing for 1 hour and after thiocyanate (0.1 mol L⁻¹, final volume 98 mL) was added, and waiting time for 2 and 24 hours; pellet and thiocyanate were added the same time and waiting time for 2 and 24 hours and pellet with 1% m/m of Fe³⁺ using the two procedures described before. The diffusion of thiocyanate into the cell did not occur and cause are under studies, but we can suggest that thiocyanate molecule is negatively charged, by the other hand the iodine molecule studied by Maselko and Strizhak is not charged.

(22)

COMMENTING CONVERGENT EVOLUTION ON AURELIA & THE BLUE MOON.

Ruy J. V. Alves. Museu Nacional/UFRJ

Simulations in this case were based on assumptions, most importantly that alien life would be carbon-based such as that on earth. The model exaggerates in extrapolating earthly biological phenomena into every proposed organism. Some of the "rules" explicit in the Aurelia model must be questioned by assumption-free scientific approach: 1- Life could be silicabased instead of carbon based, for instance; 2- The primary energy source for life on Earth is light from a star, but other alternatives such as chemical reactions or electric energy could be explored; 3- While water as a key compound seems a fair assumption, other liquefied gases could be the solvents for extraterrestrial life processes, under different environmental situations; 4- Viral particles and cells are common building-blocks of life on earth, but this may differ on other life-supporting worlds; 5- Even if we admit that cells, the species-richness of microorganisms on Earth, greatly outnumbering that of multi-cellular organisms suggests that size and complexity are by far not an evolutionary advantage. 6- Circumscription of kingdoms of living beings on Earth are still an object of quite intense debate, and the traditional "animal, plant etc." concept is only one of many possibilities. 7- The bilateral symmetry of Gulphogs, Skywhales and other proposed animals is reminiscent of earth creatures. Must that be so in another world? 8- As to earthly organs (wings, legs,

eyes paired horizontally), other technical solutions with simpler or distinct design seem possible.

(23)

ENDOLITHIC CYANOBACTERIA: EXTREMOPHILES IN QUARTZITE OUTCROPS

Valéria Lima Marques de Sousa, Mariângela Menezes e Ruy José Válka Alves

A considerable amount of papers is currently being published about extreme environments, many of which include experiments aimed at evaluating the capacity to filter UV radiation, tolerate drought, fixation of Carbon and Nitrogen and alteration of the chemical composition of rocks through secretion of oxalic acid, among others. These attributes have led to the inclusion of these microorganisms in experiments conducted aboard spacecraft. The endolithic communities are the most resistant extremophiles, yet remain largely unknown due to the difficulties in identifying their species composition. The determination of species from natural populations is difficult, and must be assisted by long and painstaking cultivation experiments aimed at establishing the life cycles of each species. This study is aimed at establishing the species composition of endolithic cyanobacteria found in quartzite outcrops of the São José range in Minas Gerais, Brazil ((21°05S and 44°10W). To date the endolithic species of Chroococcales identified without cultivation were: *Gloeocapsa punctata*, *Chroococciopsis* sp., *Chroococcus varius* and *Chroococcus* cf. *helveticus*. Different species of these same three genera have previously been found in South African sandstone outcrops.

(24)

**A SIMPLE MODEL ESTIMATING SURVIVENCE ON EARTH-LIKE PLANETS UNDER NEARBY
GAMMA RAY BURSTS.**

Rolando Cardenas

The current understanding of supernova and gamma-ray burst events suggests important effects on the biosphere if one or more of them happened to strike the Earth in the past. In this work we evaluate the possibility that life extinctions which probably occurred due to excess of radiation in the geologic past might have left a genetic signature on surviving species. We emphasize the signatures of these extinctions, proposing a quantitative model to evaluate the surviving probability of the species, based on kinetic aspects of the frequency of mutations and the DNA repair rate.

(25)

A FIRST STEP TOWARD A GENERAL THEORY OF LIVING SYSTEMS AT CELLULAR LEVEL

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Most biologists are usually not concerned with the definition of life. Life is taken for granted and the biologist's task is simply to study it. However a definition of life has gained increasing practical importance, mainly now that astrobiology has emerged, but as pointed out by Cleland and Chyba (*Origin of Life and Evolution of Biospheres* 32, 387-93, 2002) "...insights gained from philosophical investigations into language and logic strongly suggest that the seemingly interminable nature of the controversy over life's definition is inescapable as long as we lack a general theory of the nature of living systems and their emergence from the physical world." Here we report on the possibility that such a theory may be constructed at the cellular level. The most striking difference between ordinary chemistry and the chemistry of living entities is concerned with the reagents system structure. While ordinary chemical reactions involve randomly distributed molecules, the reactions in living systems strictly require a structured collection of macromolecules both in space and time - that is to say, the cellular chemical reactions occur across a macromolecular network. So, a theory on living systems at cellular level is indeed a theory of such networks. There is another important issue: the very great diversity of living systems points to the development of a "theory schema" instead of a "closed" theory. We now show the limitations of the mathematical systems as formal tools for the achievement of our aim due to the absence of ontological "creativity." This fact imposes the use of a computer program for the formal statement of the theory - a program with behavioral reflection. Here we present a first version of this program written in Lisp and discuss some issues of its topology.

(26)

THE SCIENTIFIC MEANING OF ASTROBIOLOGY

Ivan G. P. Lima. Universidade Estadual de Londrina

The possible existence of extraterrestrial life has been discussed along the whole history, and today we can examine this question using the scientific method. We are now able to look at and measure phenomena that not only were not observed before, but could not have been measured or observed because the means to do so were not available. Astrobiology is concerned with life as a planetary phenomenon. It is the study of the origin, evolution, distribution, and future of life on Earth and in the Universe. Some conceptual and theoretical adjustments must be tested but, whether astrobiology cannot be a scientific revolution yet, it is at least a remarkable movement that represents a change of view for the question of life in the Universe. This poster aims to explain some features of this scientific movement and presents reasons that support astrobiology as a genuine science.

(27)

BIOLOGICALLY-EFFECTIVE SOLAR RADIATION BY SPORES DOSIMETER AND UVB RADIATION BY BREWER SPECTROPHOTOMETER AND SPECTRORADIOMETER AT SOUTHERN SPACE OBSERVATORY FOR 2004-2005

*Pabulo H. Rampelotto, Ana Paula S. Lima, André P. Schuch, Nobuo Munakata,
Damaris K. Pinheiro, Nelson J. Schuch
UFSM*

The incidence of the solar radiation on the terrestrial surface becomes important to accurately measure due to its effects on living organisms. The harmful effect caused by UVB Solar Radiation in DNA is the key process of the damages caused in the human health and aquatic and terrestrial ecosystems. Therefore, the use of a biosensor based on the damage caused in DNA for the biologically effective solar radiation has a great relevance. The Partnership between Southern Regional Space Research Center (CRSPE/INPE-MCT), Space Science Laboratory of Santa Maria (LACESM/CT/UFSM), from Brazil, and Rikkyo University, from Japan, has been monitoring the biologically-effective solar radiation using a spore dosimeter since 2000. In this work, it is compared spore monthly exposition of *Bacillus Subtilis* TKJ 6312 (uvr spl), in the form of Spore Inactivation Dose (SID), with total UVB radiation intensity measured by Brewer Spectrophotometer and Spectoradiometer. The instruments are installed at Southern Space Observatory (29.4°S, 53.8°W) in the South of Brazil and the period of analysis in this work was from January 2004 to June 2005. A model to calculate total UVB radiation using SID was obtained which provided a correlation of 0.93. The resulting equation permits the monitoring and study of the impact of biologically-effective solar radiation on locals where it is impossible to install a physical sensor like Brewer Spectrophotometer or Spectoradiometer.

(28)

CRITERIA FOR EVALUATING VERY ANCIENT TERRESTRIAL AND EXTRATERRESTRIAL MICROFOSSILS

Eduardo M Redoschi. Ciências Moleculares -USP

Extraordinary claims that microscopic objects in Earth rocks as old as 3.5 Gyr and even in some extraterrestrial materials, such as the Martian meteorite ALH84001, may be microfossils require much more rigorous evaluation than do similar objects from younger rocks well within the mainstream of earthly paleontology in order to distinguish them from contaminants and pseudomicrofossils and corroborate their biological origin. Criteria for judging possible extraterrestrial microfossils have been developed based on studies of possible microbial microfossils from Archean rocks (>2.5 Ga). Such criteria focus upon identification of terrestrial contaminants, taphonomic and paleobiological assessment of organic remains, and analysis of the geological context of the possible microfossils.

(29)

POLYPHASIC STUDY OF METHANOGENIC COMMUNITIES IN SEDIMENT FROM ADMIRALTY BAY, KING GEORGE ISLAND, ANTARCTICA.

C.R.Nakayama, E.Kuhn, A.C.V.Araújo, F.Nastasi, V.H.Pellizari, R.F.Vazoller. ICB, USP

In this work, a polyphasic approach was used to study methanogenic communities in sediment samples from Admiralty Bay, Antarctica. Sediment was sampled near Comandante Ferraz Brazilian Station (CF) and Botany Point (BP), Martel Inlet. The samples were enriched in saline mineral medium containing 20mM acetate, 20mM formate and 1g/L glucose, and incubated at 4 and 25°C. Methane production was monitored by GC/FID. Both sediment and culture samples were submitted to rDNA 16S-DGGE analysis, using the primers 1100f and 1400r, specific for Archaea. Enrichment results showed that in both CF and

BP cultures the highest methane values were obtained at 25°C, indicating that psychrotolerant archaea are common in the sediments. DGGE analysis revealed that all the bands observed in the BP sediment were also present in the culture at 25°C, which also contained some additional bands. On the other hand, cultures inoculated with CF sediment at both temperatures contained only a few bands, in contrast with a more diverse pattern found in the environmental sample. A control flask containing CF sediment and medium with no organic sources showed a richer profile than the environmental sample, as observed for BP sediments. These results show that the experimental conditions were adequate for the enrichment of the main groups of archaea present in the BP sediment, but addition of organic sources was highly selective for the CF community. Sequencing of the main bands will be carried out to characterize the communities in more detail. Financial support: Proantar-CNPq / SECIRM / MMA.

(30)

CRYOBIOSPHERES: A MODEL FOR ASTROBIOLOGY

Rubens Duarte. ICB/USP

Low temperature environments are a common feature in the Universe, including the interstellar space, space dust, asteroids, meteors, comets and most of the planets and their satellites. Earth is not an exception, since the majority of its surface is below 5°C. The terrestrial cold biosphere occurs mostly as ice and permafrost and these act as a depository of ancient biosignatures, like biogases, biominerals, pigments, lipids, enzymes, proteins, RNA/DNA fragments and viable cells. From an astrobiological point of view, the terrestrial permafrost and ice, inhabited by cold adapted microbes, can be considered as an extraterrestrial model. The cells and their metabolic end-products found in the Earth's cryobiosphere provide a range of analogues that could be used in the search for possible ecosystems and potential inhabitants on extraterrestrial bodies. In the Solar System, two candidates are the planet Mars and the moon Europa, one of the greatest moons of Jupiter, since recent discoveries suggests the occurrence of water (ice) in these environments.

(31)

LEVANTAMENTO DAS CONCEPÇÕES DE ALUNOS DE GRADUAÇÃO DA UEL A RESPEITO DOS TEMAS ORIGEM E EVOLUÇÃO DA VIDA

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O ensino dos temas origem e evolução da vida são muito complexos, exigindo dos professores de Educação Científica uma sólida formação na temática. No entanto, atualmente, a complexidade destes temas não é o único problema enfrentado por esses professores. Principalmente nos Estados Unidos da América um movimento de cunho fortemente religioso chamado de criacionismo tem orquestrado diversos passos na tentativa de impor ao sistema público de ensino uma visão religiosa da origem e evolução da vida. Podemos dizer de um modo geral que os criacionistas são aqueles que rejeitam a evolução em favor de algum criador sobrenatural. Os resultados obtidos do presente estudo fornecerão uma idéia se existe ou não um problema na aceitação da teoria da evolução pelos futuros professores, visto que o questionário será aplicado somente aos alunos dos cursos de licenciatura. Os resultados também fornecerão subsídios para propostas de mudanças curriculares no ensino de origem e evolução da vida em diversos cursos de graduação assim como de pós-graduação. Temos como objetivo deste trabalho, levantar as concepções prévias dos alunos de graduação dos cursos de Licenciatura de Ciências Biológicas, Física, Química, História, Filosofia e Geografia, a respeito do tema Origem e Evolução da Vida. Nos meses de novembro/dezembro 2005 os questionários foram aplicados aos alunos de 1 e 4 anos dos cursos acima citados. Uma análise preliminar dos resultados mostra que existe um número baixo de alunos que rejeitam a evolução biológica. No entanto parece existir um conflito na compreensão do método científico. Observamos também uma forte correlação entre religiosidade e dificuldade na aceitação/compreensão dos temas origem e evolução.

(32)

USE OF ASTRONOMY IN THE PHYSICS TEACHING WITH EMPHASIS IN ASTROBIOLOGY

Clifford Neitzel. Universidade Federal do Rio Grande do Sul

This project's goal is to introduce and stimulate junior High School students to the Astronomy field,

making use preacquired knowledge from the previous series, and with emphasis in a current theme undergoing rapid growth: Astrobiology. The project development was meant to lead to learning of new concepts and areas of Physics areas, not studied previously. The project has started with the History of Astronomy, passed through a broad view of contemporary Astronomy, stressing its relation with other disciplines, such as Physical and Chemical sciences and Biology and always using Astrobiology as a defining axis. In these contexts basic concepts of different areas of Physics are introduced, including those that are taught during the two last years of High School. This project has led to the production of a CD, which contains the multimedia material applied in the classroom, in "PowerPoint" format. The CD includes full explanations about each class to interested teachers; these lecture notes are in the more usual "Microsoft Word" format. Thus, teachers will have in hands an easy access script to guide themselves through their lectures. The results we obtained with the application of this project are significant. They are shown as tables and graphs throughout the text. The very satisfactory outcome of the project clearly shows the need for an updated and innovative way of learning and teaching Physics. We hope this work may have stimulated the curiosity and creativity of students towards learning such an important theme.

(33)

INTRODUCCION DE LA ASIGNATURA ASTROQUIMICA Y ASTROBIOLOGIA EN EL CURRICULO DE ESTUDIANTES DE CIENCIAS.

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En este trabajo se presenta la experiencia de introduccion de los temas de astrobiologia y astroquimica en el currículo optativo para estudiantes de Ciencias. Se propone un programa para la asignatura y se discute un modelo pedagógico centrado en el estudiante, para su impartición.

(34)

SOLAR TWIN STARS: ASTROBIOLOGICAL TARGETS

Leandro di Bartolo, Gustavo F. Porto de Mello, Licio da Silva. OV/UFRJ e ON

Solar twins are defined as stars with the same mass, temperature, gravity, luminosity, chemical composition, age, evolutionary state and chromospheric activity as the Sun. Such objects are presumably privileged candidates to possess planetary systems similar to our own, besides being natural places to look for telluric planets harboring life forms based on carbon chain chemistry and water oceans. Upon identification of HD146233 as the best ever solar twin (Porto de Mello & da Silva 1997), a following survey (da Silva 2000) identified a number of further candidates to solar twin status among the Gtype stars within 50 parsecs of the Sun. In this work, we present a detailed analysis of such best candidates. We determine their chemical composition, surface gravities, effective temperatures, evolutionary state, masses and ages. We also gauge their ages by their degree of chromospheric activity as judged by the absolute flux of H α and Ca II HK spectra. These data are massed into a complete analysis of their properties compared to the solar ones. We thereby produce a list of the stars within 50 parsecs which can be regarded as true solar twins to a very fine level of detail.

(35)

ASTROBIOLOGICALLY INTERESTING STARS.

Leandro di Bartolo, Gustavo F. Porto de Mello. OV/UFRJ

The existence of life relies upon planetary properties, chiefly climate stability, and stellar ones, such as mass, age and chemical composition. The latter can be well constrained with present knowledge. We discuss the state-of-the-art criteria for selecting astrobiologically interesting stars, and apply them to the stellar sample within 20 pc from the Sun, determining their masses, ages and galactic orbits. We produce an optimized list of candidates that merit serious consideration by the planned space-based interferometry probes, aimed at detecting Earth-like extrasolar planets and seeking spectroscopic infrared

biomarkers as evidence of photosynthetic life. We show that approximately 7% of the nearby stars are optimally interesting targets for exobiology, and present the stars Zeta Tucanae, Beta Canum Venaticorum and 61 Virginis as the nearest best targets.

(36)

PREFERENTIAL PATHWAY FOR GLYCINE FORMATION IN STAR-FORMING REGIONS

Pilling S., Baptista L., Boechat-Roberty H. M., Santos A. C. F. OV/UFRJ e IQ/UFRJ

Interstellar clouds, similar to that from which the solar system was formed, contain many organic molecules including aldehydes, acids, ketones, and sugars Ehrenfreund & Charnley (2000). Those organic compounds have important functions in terrestrial biochemistry and could also have been important in prebiotic synthesis. The simplest amino acid, glycine ($\text{NH}_2\text{CH}_2\text{COOH}$), was recently detected in the hot molecular cores Sgr B2(N-LMH), Orion KL, and W51 e1/e2 Kuan et al. (2003). The formic acid (HCOOH) and acetic acid (CH_3COOH) have also been detected in those regions Liu et al. (2002), Remijan et al. (2004). The goal of this work is to study experimentally photoionization and photodissociation processes of glycine precursor molecules, acetic acid and formic acid to elucidate a possible preferential pathway in the glycine synthesis between ice and gas phase. The measurements were taken at the Brazilian Synchrotron Light Laboratory (LNLS), employing soft X-ray photons from a toroidal grating monochromator TGM beamline (100 - 310 eV). The experimental set up consists of a high vacuum chamber with a Time-Of-Flight Mass Spectrometer (TOF-MS). Mass spectra were obtained using PhotoElectron PhotoIon Coincidence (PEPICO) technique. Kinetic energy distributions and abundances for each ionic fragment have been obtained from the analysis of the corresponding peak shapes in the mass spectra. Dissociative and non-dissociative photoionization cross sections for both molecules were also determined Boechat-Roberty, Pilling & Santos (2005). Due to the high photodissociation cross section of formic acid it is possible that in PDRs regions, just after molecules evaporation from the grains surface, it is almost destroyed by soft X-rays, justifying the observed low abundance of HCOOH in gaseous phase Ehrenfreund et al. (2001). Acetic acid have shown to be more stable to the ionizing field, and its main outcomes from dissociation process were the reactive ionic fragments COOH^+ and CH_3CO^+ . To complete our research we performed ab initio calculation of some potential pathway to glycine formation involving mainly COOH^+ , HCOOH^+ and CH_3COOH^+ in both gas and ice phase. Our Enthalpy reaction calculation confirm that even acetic and formic acids could lead to glycine products, perhaps it may be some preferential pathway for the glycine formation. We expected that reactions involving acetic acid (and its photodissociation ionic fragments) to form glycine and its precursors might occur preferentially at gas phase. On the other hand reactions via formic acid could be more effective at ice phase, before mantle evaporation.

(37)

INTERACTION BETWEEN SOLAR WIND ELECTRONS AND PRE-BIOTIC MOLECULES IN COMETS

Diana P Andrade-Pilling. OV/UFRJ

It is now accepted that comets have brought to the Earth a certain amount of volatile compounds such as water, and other inorganic and organic compounds, which may have contributed to the starting of the Chemical evolution that allowed the appearance of life on the Earth. So, the investigation of comets, how much dust particles and ice accreted in comets have been altered is a very important study. The irregular grain surface in a comet act as a catalyst to form other molecules and radical in presence of solar radiation field and charged particles flux. Therefore, new molecules can be formed which will be evaporated, returning to the gas phase. We present preliminary experimental simulation results of molecular formation in comets. The experimental setup consists in condensed CO_2 and H_2O molecules onto a cold (90 K) brass substrate mounted inside a high-vacuum chamber, to simulate an icy mantle. The icy solid sample is exposed to electrons, producing several ions from ionization, dissociation and desorption processes. Subsequently the ions are analysed by a Time of Flight mass spectrometer (TOF - MS). We have found the expected products of CO_2 dissociation such as C^+ , O^+ , CO^+ , CO_2^+ . However, we observed new molecular ions CH^+ , OH^+ , H_2O^+ , HCO^+ , H_2CO^+ .

(38)

UV RADIATION AS A CONSTRAINT IN THE ORIGIN AND DEVELOPMENT OF LIFE IN EXTRASOLAR PLANETS

Andrea P. Buccino. Instituto de Astronomia y Fisica del Espacio (IAFE)

We displayed a new biological criterion that restricts the traditional habitable zone. We set the internal

boundary of this new UV habitable zone from the maximum radiation that tolerates the DNA and its external boundary from the levels of UV radiation needed in the biogenesis processes. We also analyzed the evolution of the habitable zones according to the variation of the stellar luminosity throughout the main sequence stage.

(39)

MILLI-MAGNITUDE IR TRANSIT DETECTION: OGLE-TR-113

Sebastian Ramirez. Universidad Católica de Chile

We present high precision infrared and visual transit for an extrasolar planetary candidate, for an OGLE catalogue star. We monitored a series of OGLE stars, which are candidates of harbour planets, during May, 2005, using the New Technology Telescope (NTT), located at La Silla (Chile). During that week, we observed 3 candidates through Infrared filters, obtaining after the data reduction process, millimagnitude precision transit curve. The small depth in this curve is a strong feature for a planetary transit

(40)

A POSSIBLE EUROPA EXOBIOLGY

Antonio de Morais. CBPF

The Near Infrared Mapping Spectrometer (NIMS) of the NASA's Jet Propulsion Laboratory's Galileo spacecraft was used to study the atmospheric and surface composition of Jupiter and its moons, as Galileo orbited that planet. The NIMS covered the wavelength range 0.7 to 5.2 μm with up to 408 spectral channels and a resolving power of 40 to 200. The European surface spectra were calibrated to units of reflectance at the specific geometry of the observation compared with the reflectance of a perfectly diffusing (Lambert) surface with the use of the solar spectrum and a combination of ground and in-flight NIMS measurements of calibration targets. In this paper I propose a biogeochemical model for a possible biomolecular activity inside icy gravitationally-thermal Europa, in a state analogous to the pre-Archaean period on the Earth.

(41)

HABITABLE MOONS AROUND EXTRASOLAR GIANT PLANETS

O.C. Winter, R.C. Domingos and T. Yokoyama. UNESP

At the moment more than a hundred extrasolar planets have been found. In general, they are giant planets of Jupiter's size. In the present work we study the dynamics of hypothetical moons around such planets in order to identify orbital parameters of extrasolar planets that could have habitable moons candidates. Therefore, we explore the satellite stability regions around such planets. This work is done through numerical simulations. In many cases, the results impose constraints on the size of the satellites. That will depend on how close to the planet is the stable satellite region. For regions that are inside the Roche limit, the satellite will have to be significantly small. Therefore, we discuss the constraints imposed by the size and location of the stable satellite regions of extrasolar planets on the existence of habitable moons candidates.

(42)

RESPONSE OF BIOLOGICAL POPULATIONS TO LARGE PERTURBATIONS: TOWARDS MATHEMATICAL MODELS OF SPECIATION

Jorge Ernesto Horvath. IAG/USP

The response of coupled populations to a large external perturbation is addressed. We attempt to construct solutions for the evolution by combining a "microscopic" (Montecarlo) approach with features of a "continuum" (i.e. Volterra type) formulation, identifying the essential ingredients to describe the response to a sudden catastrophe such as a nearby supernova or Gamma-Ray Burst.

(43)

PREBIOTIC MOLECULES IN STELLAR RADIATION FIELDS: A LABORATORY STUDY

Ana Mónica Ferreira-Rodrigues. IQ/UFRJ

Nitriles (or CN compounds) are among the most commonly reported interstellar gas-phase organic molecules and are much more abundant than acids (COOH molecules) in interstellar environments (Bernstein, M.P. et al, ApJ 601, 365, 2004). We have shown that acid formic HCOOH is almost totally destroyed by soft x-rays (Boechat & Roberty, H.M. et al, A&A, 2005 accept). These molecules are of relevance to astrobiology because they are intermediates from which prebiologically important molecules, such as amino acids are formed. In this work we present laboratory data for the acetonitrile (CH₃CN) and acetone ((CH₃)₂CO) molecules, both present in star forming regions. Two different experimental techniques were employed. Electron energy loss spectroscopy (EELS) and time-of-flight light mass spectrometry (TOF MS) studies were performed at the Federal University of Rio de Janeiro (UFRJ) and at the Brazilian Synchrotron Light Laboratory (LNLS) respectively. Photoabsorption, photoionization and photodissociation cross-sections were determined for the molecules excited in the Ultraviolet (UV) and X-rays regions. The experimental results suggest that, due to the high photodissociation cross-sections, the acetone molecule would be easily destroyed in the stellar radiation field as evidenced by its relative low abundance.

(44)

DETECTABILITY OF EXOPLANETS

Eder Martioli. DAS/INPE

In this work we present a study of the capability of the current astronomical instrumentation and of the near-future space missions in detecting exoplanets. We estimate the ranges in size, mass, period and distance for exoplanets that are detectable by these instruments, making use of proved detection methods like radial velocity, transits, microlensing, astrometry and direct imaging. This kind of estimation is important to lead future research works in planetary formation and related topics that are expecting data for the next few years. Finally we conclude what kind of detectable exoplanets we are already able to find and whether it includes other worlds that are most suitable laboratories for astrobiology research.

(45)

THE END OF ACCRETION IN YOUNG LOW MASS STARS

Giovanni Pinzon. ON

The evolution of discs around low mass stars is still an open issue in star formation. The disc produced during the first stages of the formation, evolves along the time through complex physical processes. The loss of the disc gas mainly by accretion tunneled to the surface of the central star is followed by aggregation of the dust particles leaving to the formation of planetesimals and cores of giant planets. Most of the preceding work has focused on stars of a relatively narrow range of masses and ages. We observed stars in young open clusters of the north hemisphere as part of a program to understand the evolution of accretion discs at the ages of disc dissipation and planet formation. Photometric observations in the U-band (spectral types K-M) permit us to study the presence and characteristics of their accretion disks, finding evidences of disk evolution. Using high resolution optical spectroscopy of some of these members, we have measured accretion rates using veiling determination in some cases and line emission analysis in others. Accretion rates are in the order of 10^{-8} MSUN/yr. We have not found any accreting members in stars with ages greater than 10 Myr, suggesting that disk accretion generally ends before, which is consistent with results from other populations.

(46)

SEST AND MOPRA SURVEYS OF MOLECULAR CLOUDS: IMPLICATIONS TO ASTROBIOLOGY

Everton Ludke, Rogemar Riffel, Nadiane Cristina Cassol,
Alcides Gilberto da Rosa Adornes
UFSM, UFRGS, UNESP

The potential role of the molecular cloud survey in CO and HCN molecular lines with the decommissioned SEST telescope and the available ATCA telescopes are useful tools to aid astrobiology research by

tracing the chemical evolution of gas and dust from interstellar clouds to planetary systems. We report our most recent observational studies of molecules in low- and high-mass young stellar objects by the means of millimetre line surveys using single-dish (sub)millimeter-wave telescopes to develop cold gas models and the availability of quasi-organic matter. We also propose that scenarios can only be tested with high spatial and spectral resolution observations, and current progress toward this goal will be described. In particular, we intend to pursue further radio observations with the APEX telescope at the ALMA site for further exploratory observations of the excitation and distribution of molecules in star-forming regions, which are suitable tools to identify possible sites dense organic matter.

(47)

DETERMINATION OF THE SPIRAL PATTERN ROTATION SPEED AND THE COROTATION RADIUS OF THE MILKY WAY

Wilton Dias, UNIVAP

We determined the rotation velocity of the spiral pattern of the Galaxy, by direct observation of the birthplaces of open clusters of stars in the galactic disk as a function of their age. Our measurement does not depend on any specific model of the spiral structure, like the existence of a given number of spiral arms, or the presence of a bar in the central regions. The results first confirm that a dominant fraction of the open clusters are formed in spiral arms, a question which has been a subject of controversy. We find that the spiral arms rotate like a rigid body, as predicted by the classical theory of spiral waves, and show that the corotation radius is close to the solar galactic orbit. This proximity has many interesting consequences, like the preservation of life on the Earth, and a new understanding of the history of star formation in the solar neighbourhood, and of the evolution of the abundance of elements in the galactic disk.

(48)

TRIGONOMETRIC PARALLAX MEASUREMENT OF EXTRA-SOLAR PLANETARY SYSTEM

R. Teixeira and C. Ducourant, IAG/USP

We started in January 2006 an observational program aiming at the determination of the trigonometric parallax of the brown dwarf 2M1207XXX that hosts a planet, the first to be directly imaged (VLT/NACO, Chauvin et al. 2005). Its mass is about 5MJ and its semi major axis is 55U.A and its photometric distance estimations vary from 53pc to 71pc (Chauvin et al. 2004, Mamajek et 2005). The trigonometric parallax is essential to determine the physical parameters of this planetary system and understand the formation mechanism of planetary systems. Observations are being performed at ESO-La Silla with the NTT/SUSI2 telescope. In this program we will have 8 observational runs spread over two years in order to well separate proper motion and parallax and to determine the parallax with an accuracy of about 1 mas. We present here the observational program as well as some preliminaries astrometric results.

(49)

OLIGARCHIC GROWTH OF TERRESTRIAL PROTOPLANETS AND WATER DELIVERY

Karla de Souza Torres, DMC/INPE

While considerable progress has been made in the past 20 years in understanding the formation and evolution of Terrestrial Planets, there is a paradox in the definition of the habitable zone with respect to the presence of liquid water. While little is known about their formation and evolution, there is a consensus that research to study the necessary conditions to obtain and retain liquid water is important. We have investigated late stage of planetary accretion using 3-D Nbody simulations, focusing on the delivery of volatiles (primarily water) to the terrestrial planets. The distribution of water content versus semimajor axis used for the planetesimals is based on the meteorite data for our own Solar System. We seek to understand how frequently habitable worlds can be formed.

(50)

A PROPOSAL FOR A BRAZILIAN SETI PROGRAM FROM THE RADIO OBSERVATORIO DO ITAPETINGA

*Carlos Guillermo Giménez de Castro, Guillermo Andrés Lemarchand,
Eduardo Sergio Santini CRAAM/UPM, CNEN/CBPF e FCEN/UBA*

The Search for Extraterrestrial Intelligence (SETI) has long evolved during the last 40 years developing new technologies and search strategies to improve more than ten orders of magnitude their sensitivity and sky coverage. The interest will grow in the future as more sensitive instruments will be built, like the Square Kilometer Array (SKA). In this work we discuss a two-fold program that could be undertaken with the available local facilities. Astronomical unsaturated masers could work as natural amplifiers for the transmission of artificial narrowband signals with maser gains around 10^{11} . In this way, two hypothetical galactic technological civilizations could simultaneously coordinate a position in the sky (location of astronomical maser), with a specific frequency (maser frequency) with the advantage of a high gain. Here we propose to search for artificial signals using the 13.7 m single dish radome enclosed antenna of the Radio Observatorio do Itapetinga with a cryogenic receiver at 22 GHz with 50 KHz spectral resolution that could achieve sensitivities better than 1 Jy for 60 s integration. As a second astronomical goal this program will look for rapid (< 1 hour) flux variability. Water masers are known to vary in time scales of the order of days to months. In recent years, theoretical works predict variability time scales as short as 1000 s. In our proposal we can perform a survey of Southern water masers to look for its temporal variations and test present theoretical models.

(51)

A SEARCH FOR SUB-STELLAR COMPANIONS IN NEARBY YOUNG ASSOCIATIONS

*Carlos A. O. Torres, C. H. F. Melo, M. Sterzik, N. Huelamo, G. Quast,
R. de la Reza. LNA, ESO, Lisbon Observatory, ON*

The recent detection of brown dwarfs and Jupiter mass companions around 2MASSW J1207334 393254, GQ Lup and AB Pic have confirmed that it is possible to find sub-stellar companions by direct imaging from ground based observatories. In a system, age and distance may be known and this is crucial to test theoretical models of sub-stellar formation. As the brightness of the sub-stellar objects decreases rapidly with time, it will be easier to detect them near young stars. The SACY project furnished new young nearby associations. In April we will start high-angular resolution observations with the NACO/VLT of 80 selected SACY stars. The contrast in the K band will allow us detection of some Jupiter mass object at a few arcsecs.

(52)

UMA VISÃO CRÍTICA SOBRE O AQUECIMENTO GLOBAL: CAUSAS NATURAIS OU INFLUÊNCIA HUMANA?

Gabriel Hickel. UNIVAP

Neste trabalho faço uma análise sobre a questão do aquecimento global nos últimos séculos, levando em conta não só aspectos das atividades humanas, mas também os fatores naturais que moldam o clima em nosso planeta. São também consideradas as variações da atividade solar, o acoplamento entre esta e a atmosfera terrestre, a história geológica e a evolução da vida em nosso planeta e os processos químicos envolvidos na evolução do clima. São feitas comparações com outras atividades atmosféricas em outros planetas do Sistema Solar. Minhas conclusões são de que não existem evidências concretas para vincular as atividades humanas como sendo causa única do aquecimento global.

(53)

THE SIMILARITY PRINCIPLE AS A WEAK ANTHROPIC PRINCIPLE APPROACH TO ASTROBIOLOGY

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There have been multiple definitions and versions of the Cosmological Anthropic Principle since its former explicit enunciation by Carter in 1974. We can apply the Strong ones to discuss the fundamental physical laws and obtain an overview of how specific are habitable universes, those in which very complex structures can exist, persist and suffer temporal changes. The Weak Anthropic Principle, in turn, discusses observable parameters of this, our, Universe, as the Dicke postvision of the most probable

epoch of its observation. On the other hand, astrobiological investigations need, circularly but not tautologically, as a starting point mapping answers to its own questions as what life is, how singular can environments that contain some kind of life be, and how differently from us complex and/or intelligent and/or technological life can evolve. These pre-answers conduct its investigations, data interpretations and presuppose an additional, implicit, Similarity Principle the renounce to particular features of something to comprehend it in a deeper perspective and in unexpected contexts. I will discuss these topics first showing that astrobiological conclusions lead to weak anthropic $(C_{po}(B_{st-dictions}(D a(B_{nd}$ then that this version of the Anthropic Principle, combined to a Similarity Principle, can be converted in a useful instrument to guide astrobiological investigations. In doing this, we can trespass the frontier of the anthropic pos-dictions to astrobiological formulations and obtain the cosmic scale of structures.

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REEVALUATION OF SOME BIOLOGICAL EXTINCTION RISKS

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In this work we propose to: Verify how the periodic positioning far from the galactic disc affects extinction probabilities for generic disc stars; Verify how the extinction probability due to core-collapse supernovas is affected by the space and time clustering, implied by their origin on star clusters and short timelives; Consider several frequencies of occurrence and models of Gamma-Ray Bursts and Supernovas, to estimate the degree of uncertainty about the extinction probabilities for a generic disc star; Examine the contribution to the extinction probabilities caused by Type Ia Supernovas.

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ORGANIC MOLECULES FORMATION IN COMETS

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In this work we present recent results from laboratory experiments of atomic collisions with surfaces with astrophysical interest. Such collisions can cause, besides chemical reactions, the ejection of ions and molecules from the ice surface. Secondary ion mass spectrometry, using MeV projectiles are used to induce ejection of secondary ions and clusters from thin films of H₂O and CO₂ ices with different partial concentrations. The ice temperature can be varied from 80 K to room temperature. The general behaviour for all cluster series is an exponential decay of corresponding yield with the cluster mass. One aim of the work is to study the formation of organic molecules in the bombarded ice mixture. The most intense positive molecular hybrid ions are COH⁺, COOH⁺, CH_n⁺, HCOOH⁺ and cluster series. The most intense negative hybrid ions are (CO₂)OH⁻, CO₄Hm⁻ and the cluster series. By far, most of the measured molecular ions have been formed by one-step reactions.

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EXPERIMENTAL SIMULATION OF SOLAR WIND AND COSMIC RAYS EFFECTS ON COMETARY ICE

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Two important solid surface effects are due to the solar wind and cosmic rays on interplanetary ice: i) their sputtering rates are comparable with the effect of sublimation of bodies whose distance to Sun is larger than the radius of Mars $(B o(B_{rbit}$; and ii) new chemical species are produced. We have employed a time-of-flight mass spectrometer to measure the sputtering yield of ion species formed when MeV particles impinge on H₂O, NH₃, CO₂ and CO ice. Temperature was varied from 20 K to complete sublimation. The common characteristic in all these mass spectra is the formation of positive and negative ion clusters and the formation of hybrid molecular compounds. A quadrupole mass spectrometer was setup to monitor the residual gas simultaneously with the TOF measurements. Increasing the ice

temperature, trapped gases are released either by ice structural relaxation or by sublimation.

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PHOTODESTRUCTION OF ORGANIC MOLECULES IN PLANETARY NEBULAE

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It is known that polycyclic aromatic hydrocarbons (PAHs) are mainly formed in the dust shells of late stages of AGB type carbon rich stars. After the ejection of H-rich envelope those stars become the proto-planetary nebulae (PPNs). The chemistry in PPNs has been strongly modified by the UV photons coming from the hot central star and by the X rays associated with its high-velocity winds. Benzene (C₆H₆) and Anthracene (C₁₄H₁₀) were effectively detected in the PPNs CRL 618 (Cernicharo et al. 2001) and Red Rectangle (Vijh, Witt & Gordon 2004) respectively. The goal of this work is to experimentally study photoabsorption, photoionization and photodissociation processes of the benzene and methyl anthracene (C₁₄H₉(CH₃)). The measurements were taken at the Brazilian Synchrotron Light Laboratory (LNLS), using soft X-ray and UV photons from a toroidal grating monochromator TGM beamline (12-310 eV). The experimental set up consists of a high vacuum chamber with a Time-Of-Flight Mass Spectrometer (TOF-MS). Mass spectra were obtained using PhotoElectron Photolon Coincidence technique. Kinetic energy distributions and abundances for each ionic fragment have been obtained from the analysis of the corresponding peak shapes in the mass spectra. Dissociative and non dissociative photoionization cross sections for some molecules were also determined. We have observed that PAHs molecules are extreme resistant to UV photons, confirming that PAHs absorb the UV photons and after some internal energetic rearrangements, they can emit in the IR range. However, these molecules are destroyed by soft X-rays photons producing several ionic fragments, some of them with great kinetic energy. In the mass spectra of the Benzene and methyl-anthracene molecules, the observed ionic fragments C₄H₂⁺, C₆H₂⁺, C₄HCH₃ and C₂HCH₃, could correspond to the same ions and radicals detected in the CRL 618 (Cernicharo et al. 2001). This result also points out the possibility of PAHs and PAHs methylated can be actively present in those environments.

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ESTABILIDADE DE SISTEMAS PLANETARIOS

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Este trabalho relata os recentes resultados obtidos sobre a dinâmica de um sistema de planetas e mostra a grande quantidade de situações em que o ângulo entre os dois semi-eixos maiores oscila ao redor de um valor constante. Ressonâncias seculares e Ressonâncias de movimentos médios agem nestes sistemas de modo tal que os planetas não podem se aproximar muito e deste modo asseguram a estabilidade do sistema. O trabalho é concluído com uma discussão dos sistemas capturados em ressonância e de sua evolução para soluções estacionárias de corrotação apsidal simétricas e assimétricas. Os critérios de estabilidade são usados para introduzir uma classificação dos tipos de sistemas existentes.

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