PAINEL 159

TÉCNICA DE LENTES FRACAS POR SIMULAÇÃO

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As lentes gravitacionais fracas são uma das principais ferramentas para o estudo da distribuição de massa em aglomerados. Um aglomerado–lente distorce as imagens das galáxias de fundo e o mapeamento deste padrão de distorção torna possível determinar a distribuição de massa total do aglomerado. O objetivo principal deste trabalho é o estudo desta técnica através de simulação. Nosso grupo desenvolveu um software, o SimWL, que cria um catálogo de objetos de fundo e é capaz de simular as deformações que seriam sofridas por tais objetos ao serem "lenteados" por um modelo conhecido de distribuição de massa, considerando o regime de lentes fracas. O programa LensEnt, desenvolvido por Bridle et.al(1998), é, então, utilizado para reconstrução da massa. Neste trabalho são apresentados os resultados das simulações obtidas para quatro perfis de lentes gravitacionais: NFW, Sérsic, SIE e PIEMD. Para cada caso foram feitas simulações com o SimWL variando seus parâmetros observacionais e físicos. Os resultados obtidos pelo LensEnt foram comparados com os perfis teóricos. Para tal foram determinados os perfis simulados e teóricos da densidade superficial de massa em função da distância ao centro do aglomerado-lente. A comparação, em cada caso, mostra grande similaridade entre os resultados teóricos e simulados. Através deste método é possível verificar qual a confiabilidade de uma análise de lentes fracas de um aglomerado de galáxias.

PAINEL 160

PHYSICAL PROPERTIES OF A SAMPLE OF PECULIAR AND INTERACTING GALAXIES

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For a long time it has been known that galaxy interactions and mergers are of fundamental importance for the evolution of galaxies, clusters of galaxies and the intergalactic medium. This became evident when the first deep survey images from HST were analyzed (Abraham et al. 1996, MNRAS, 279, L47). Peculiar galaxies often result from galaxy interactions or galaxy mergers, or may shown some other distinctive feature such as jets emerging from the nucleus, unusual amounts of dust, or low surface brightness. In this work we have used long-slit spectroscopic data to investigate the physical properties of five peculiar and interacting galaxies observed at the Observatório do Pico dos Dias (LNA/MCT). No detailed optical spectroscopy for these objects has been published yet. For each galaxy in our sample, we have chosen one extranuclear region located as far as possible from the nucleus, but at the same time showing a sufficient number of emission lines (in particular Hβ) to allow estimate of its ionization parameter. In all objects discussed, the line intensity rations have been corrected for reddening using the Hα/Hβ line intensity ratio. The intrinsic value Hα/Hβ was taken to be 3.1 in all nuclear regions and 2.85 in extranuclear zones. Ionization mechanisms are discussed through a comparison of dereddened emission line ratios to published photoionization and shock ionization models. Detailed physical properties, such as the ionization parameter, density and filling factor, are derived for a number of extranuclear regions, showing that the gas is always clumpy, with typical filling factors of a few 10^{-2}.

PAINEL 161

FUNÇÃO DE LUMINOSIDADE DE GALÁXIAS EM RXJ 2114 E NGC 4936

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Grupos fósseis exibem um halo extenso em raio-X, com luminosidade, massa total e massa do gás similares aos de aglomerados pobres e grupos ricos, mas são opticamente dominados por uma única galáxia elíptica luminosa, cercada por companheiras fracas. Nós obtivemos dados fotométricos e espectroscópicos para vários candidatos a grupos fósseis com o Blanco, do Cerro Tololo, em 2005 e 2006. Nesse trabalho iremos mostrar os resultados das funções de luminosidade das galáxias em dois dos grupos estudados. Encontramos que para ambos o final fraco é plano, similar ao do Grupo Local, em contraste com as funções de luminosidade encontradas para outros grupos fósseis mais ricos. De fato, RXJ 2114 e NGC 4936 são grupos de baixa massa e esperava-se uma função de luminosidade como foi observada (com um final fraco plano).

PAINEL 162

ABUNDANCE OF GIANT ARCS IN CLUSTERS: REDSHIFT EVOLUTION AND SCALINGS OF THE CROSS SECTION

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We study the abundance of gravitational arcs in galaxy clusters, focusing in particular on its variation with respect to the cluster redshift (z_L). We present a method to include observational effects, such as the seeing and the signal to noise ratio (s/n) of the images, in semi-analytic calculations of arc statistics. Since the magnification (μ) enhances the s/n of the arcs, we must obtain the cross section as a function of μ, for arbitrary length to width ratios (L/W) of the images. The cross section (σ) for arc formation is computed by mapping circular sources and with a semi-analytic method based on the eigenvalue ratio of the magnification tensor. Using this last approach we obtained the scaling of σ with respect to μ, L/W, and other parameters, which allows for a fast computation of the cross section. We apply this method to evaluate the expected number of arcs per cluster (f_{arcs}) using an elliptical Navarro-Frenk-White matter distribution, explicitly including the effect of magnification. We find that f_{arcs} increases with cluster redshift for low z_L and then has a turnover, decaying for higher z_L. The behavior of cluster abundance at higher z_L as well as the turnover redshift are sensitive to the high redshift source distribution and limiting magnitude of the image. This stresses the importance of the magnification, which effectively increases the limiting magnitude in strongly lensed regions. For a survey with similar depth as the Red Cluster Sequence Survey (RCS) we predict that the number of arcs increases substantially up to z_L~0.6, which is consistent with the excess of arcs found in this survey for clusters at higher redshifts. The overall arc abundance is much lower for the Sloan Digital Sky Survey (SDSS) depths and f_{arcs} has an expressive drop below z_L~0.3, which is also consistent with an arc search in SDSS.

PAINEL 163

COMO ACHAR UMA SEYFERT 1 EM STARBURST: OS CASOS DE NGC 7582 E NGC 6221

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Galáxias de Seyfert 1 são objetos relativamente fáceis de serem identificados: suas linhas são intensas e largas e estão centradas nas galáxias. No entanto quando se trata de galáxias "starbursts", a questão pode ser bem complexa. Por um lado a poeira extingue a emissão da região central e por outro, a emissão da região HII gigante se superpõem a emissão central. As galáxias NGC 7582 e NGC 6221 foram identificadas como fontes luminosas de raio-x duros, típicas de Seyfert 1. Seus espectros ópticos, no entanto, revelam características típicas de starburst. Desenvolvemos um método capaz de separar a componente de espectro de região HII da componente de AGN: PCA de cubo de dados. As galáxias foram observadas com o GMOS-IFU no Gemini Sul. Aplicado o PCA, mostramos que os autovetores principais caracterizam a emissão e rotação do starburst. Porém em autovetores de ordem mais alta identificamos de

forma inequívoca a emissão de asas largas em Hα, confirmando os alvos como galáxias de Seyfert 1. No caso de NGC 6221, o AGN está localizado no centro da galáxia. Já em NGC 7582, é mostrado uma emissão espalhada na vizinhança do centro da galáxia. Este caso mostra semelhanças com a clássica NGC 1068. Não podemos descartar a hipótese de que parte da emissão em Hα largo de NGC 7582 venha de restos de uma supernova.

PAINEL 164

THE NEAR-INFRARED STELLAR POPULATIONS IN SEYFERT GALAXIES

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The stellar populations of Seyfert galaxies have been mostly studied in the optical bands, while in the near-infrared (NIR) region they are poorly known. However, there are several reasons to study them in the NIR. Among others things spectral range is indeed the most suitable to unveil the stellar population in highly obscured sources like the circumnuclear regions of AGN and ultra-luminous infrared galaxies. As part of an ongoing project aimed to study the stellar populations of the Seyfert galaxies, through the NIR, we perform the stellar population synthesis of 25 Seyfert galaxies. The near-infrared spectra used were obtained at the NASA 3 m Infrared Telescope Facility (IRTF) from 04/2002 to 06/2004. The SpeX spectrograph in the short cross-dispersed mode (SXD, 0.8-2.4 μ m) was used. In all cases, the detector employed consisted of a 1024x 1024 ALADDIN 3 InSb array with a spatial scale of 0.15"/ pixel. A 0.8" x 15" slit, giving a spectral resolution of 360 km s^{-1}, was employed. In order to determine the stellar populations which dominate the light in the NIR we have identified the brightest absorption lines like the molecular bands of CO around 1.6 and 2.3 μ m and CN at 1.1 μ m. The latter band is a recent star formation tracer, being particularly strong in carbon stars. Prominent atomic absorption lines of Si I 1.2112 and 1.5905 μ m; Mg I 1.5028, 1.5775 μ m Na I 1.1387, 2.2042, Ca I 2.2645 μ m, Ca II 0.8498, 0.8542, 0.8662 μ m (CaT) and Al I 1.1258 μ m, were detected in almost all the sources. The stellar population synthesis was done by comparing the equivalent widths of the above lines and the continuum at selected regions free from absorption/emission lines of the galaxy spectra which those of Simple Stellar Population models. The presence of the ~1.1μ m CN band in the spectrum of a galaxy is an unambiguous evidence of stellar populations with ages between ~ 0.3 and ~2 Gyr. A non-thermal continuum (Power Law- PL, $F_\lambda \propto \lambda^{-1.5}$) is observed in all Sy 1 and in 60% of the Sy 2. In a significant fraction of the objects, the sum of the stellar and non-thermal continua is not capable of describing the continuum in the *K* band. The excess observed in this band is due to hot dust near its sublimation temperature, composed by graphite grains, located at ~1 pc from the central source and with a mean mass of $M_{HD} \approx 0.3\ M_\odot$.

PAINEL 165

3D SIMULATION OF EXTRAGALACTIC RADIO SOURCES: THE SEARCH FOR A SCALE FACTOR BETWEEN BOW SHOCK AND COCOON VOLUME

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In classical doubles radio galaxies the AGNs central object ejects a pair of jets that advances in the interstellar medium with supersonic speeds to form a double shock structure. The front shock formed in the ambient gas is called the bow shock. A second shock originates from the jet material and forms a cocoon. The cocoon is responsible for the radio emission of the source while the front shock heats up the ambient gas. XMM observations of the CSS radio galaxies show possible evidence for X-ray emission from a hot shocked gas component. In the process of analysis of the observations one needs to estimate the volume of the shocked ambient gas between the cocoon and the bow shock. On the other hand, radio observations measure just the volume of the radio-emitting cocoon. In this work, we present a way to scale the cocoon volume to get the shocked gas volume. In a previous work, we used results of 2-dimensional simulations to find the ratio f_{bc} between the two volumes. Here, we extend this work by using fully 3D numerical simulations. These represent a more realistic scenario and confirm the trend already

found in the previous work. The results show that, after a transient period, the ratio between the two volumes tends to almost a constant value that depends on the jet parameters allowing us to find the desired scale factor. We find that, for a given jet Mach number (M), f_{bc} increases almost linearly with the jet density contrast (η), whereas for a fixed η, it decreases with increasing M. For typical values of M=6 and η=0.1 the scale factor is approximately f_{bc}~15.

PAINEL 166

STACKED SPECTRA ANALYSIS OF WEAK-LINE GALAXIES IN THE SLOAN DIGITAL SKY SURVEY

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Emission lines are the most conspicuous and easy-to-detect features in galaxy spectra, and thus play a central role in classification schemes. Baldwin, Phillips & Terlevich (1981) were the first to devise a classification scheme based on the four strongest optical lines: Hβ, [OIII]λ5007, Hα and [NII]λ6584. Their [OIII]/Hβ versus [NII]/Hα diagram became the standard tool to separate AGN from Star Forming (SF) galaxies, and Seyferts from LINERs. However, large scale surveys like the SDSS contain huge numbers of galaxies which do not have all 4 BPT lines detected with enough confidence to ensure an unambiguous classification. Hβ and (to a lesser extent) [OIII], in particular, are often undetected (S/N<3), even when [NII] and Hα are. We have devised ways to rescue these galaxies from their classification limbo by estimating Hβ/Hα and (when needed) [OIII]/Hβ from correlations of these line ratios with a large suite of observed (e.g., colors, magnitudes, etc.) and physical (e.g., stellar extinction, stellar mass, star-formation rate, etc.), properties from our STARLIGHT-SDSS database (www.starlight.ufsc.br). In principle, this allows us to place these weak-line galaxies in the BPT diagram, and thus classify them, increasing the statistics by a substantial factor, and, more importantly, including a population of galaxies which would otherwise be left out of the analysis and mistakenly counted as passive systems. In this contribution we test whether this method actually works by constructing stacked spectra of galaxies in different boxes in the reconstructed BPT diagram. Stacking spectra increases the signal of weak emission lines to a detectable level, thus allowing a direct measurement of line ratios, which can then be compared to the indirectly estimated ones. This test shows that our Hβ/Hα and [OIII]/Hβ estimation method works with very good accuracy.

PAINEL 167

PHYSICAL PROPERTIES OF THE CORONAL LINE REGION IN NEARBY ACTIVE GALACTIC NUCLEI

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The relationship between emission of coronal lines (CLs) and type of active galactic nucleus (AGN) is analyzed based on the near infrared (0.8-2.3 μm) spectra of 54 active galaxies. We detected CLs in 65% of the sample (35 AGNs). The remaining objects do not show any evidence of these features. The frequency of CLs is 10-15% higher in Type 2 than in Type 1 AGNs. The expected correlation between FWHM and ionization potential (IP) is only observed in a few objects, most of them narrow line Seyfert 1s (NLS1). For the large majority of sources, high ionization lines tend to have FWHM comparable to those from IP ≤ 30 eV. The presence or absence of CLs in a given object is independent on the luminosity and photon index of the soft (0.1-2.4 keV) and hard (2-10 keV) X-rays continuum. Yet, when present, the coronal line luminosity tends to increase as the 0.2-2.4 keV continuum luminosity increases or becomes steeper, confirming the role of X-rays in the intensity of CLs. Overall, NLS1 galaxies tend to produce the most luminous CLs, followed by classical Seyfert 1s and Seyfert 2s, the latter ones displaying the less luminous lines. Our work reinforces the importance of studying NIR CLs as they provide additional constraints to the understanding of this important emission region of AGNs.

PAINEL 168

MAPPING OF EXTRAGALACTIC STAR FORMING REGIONS IN INTERACTING SYSTEMS

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The galaxy environment plays a key role on the evolution of galaxies. It has a fundamental role in the definition of the evolution stages followed by galaxies. One of the most interesting effect of environment is the star-formation outside of the galaxy triggered by the interaction of the system of galaxies. We present a study of 4 young star-forming regions in the intragroup medium, located in intergalactic HI-clouds of galaxies with apparent interaction, which extend to over tens kpc away from the main galaxy. The HI regions were obtained from the HI maps on the “Rogues Gallery". The star-forming regions have different sizes and masses, being identified as young clusters, intergalactic HI regions or dwarf galaxy formed in tidal interaction. We use multi-wavelength data, NUV and FUV obtained from the GALEX survey to search for evidence of star formation in the intergalactic regions. For the 4 galaxy systems we found several star-forming regions with ages ranging from 5 to 150 Myr and masses from 10^4 to 10^6 $M_\odot$ and located in the intergalactic HI cloud over the tail. In this poster we present colors (FUV-NUV), ages, luminosities and star-formation rates for the intragalactic starburst regions.

PAINEL 169

THE GLOBULAR CLUSTER SYSTEM OF NGC 1600

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NGC 1600 is a very luminous elliptical galaxy located in a group at about 62 Mpc distance. We obtained deep images of the group, which also contains two other early-type galaxies, NGC 1601 and NGC 1603, with the SOAR Optical Imager (SOI) in B an d I filters. A clear excess of faint point sources is detected in both filters around NGC 1600 and NGC 1603, revealing a large population of clusters. From our photometry and completeness tests we derived luminosity functions which are perfectly consistent with a Gaussian with average absolute magnitude M_V=-7.4 and dispersion σ=1.4. Adding the contribution of different annuli around NGC 1600, we estimate its total cluster system size as N_{GC} = 2500 clusters. The specific frequency is $S_N \simeq 1.5$. The colour distribution ranges from $1.0<(B\text{-}I)<3.0$, with a hint of bimodality, especially at larger galactocentric regions. We also cross-checked our clusters sample with x-ray point sources detected with Chandra and found a total of 15 coincidences, representing about 40% of the total x-ray point sources close to NGC 1600.

PAINEL 170

PREVISÃO DE PROPRIEDADES ESPECTRAIS DE GALÁXIAS A PARTIR DE FOTOMETRIA

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Neste trabalho, verificamos a possibilidade de predizer características de linhas de emissão em espectros de galáxias usando apenas dados fotométricos. Sabemos que muitas propriedades de galáxias, como taxas de formação estelar e redshifts, podem ser inferidas através das cores, que se relacionam com características espectrais como a quebra em 4000Å. Assim, em princípio, deve ser possível também usar

cores para se inferir propriedades de linhas espectrais. De fato, mostramos aqui que tal técnica pode ser útil na análise de linhas de emissão em objetos extragalácticos e pode tornar mais rápidos os futuros surveys de redshifts de galáxias, assumindo que estes tenham como alvo objetos com linhas de emissão. Nós usamos dois métodos empíricos independentes, Redes Neurais Artificiais e Regressão Ponderada Localmente para determinar correlações entre o espaço de cores, determinado por fotometria, e as larguras equivalentes de linhas presentes em espectros. Para essa análise, utilizamos dados dos surveys SDSS (*Sloan Digital Sky Survey - Data Release 2*) e *DEEP2*, a partir dos quais foram medidas as seguintes linhas de emissão: Hα, Hβ, [O II]λ3727, [O III]λ5007, [O I]λ6300 e [N II]λ6584. Os resultados indicam que, como esperado, as linhas de recombinação podem ser estimadas satisfatoriamente a partir apenas de fotometria, com uma dispersão rms da ordem de 0.35 quando se considera o logaritmo da largura equivalente. Para as linhas colisionais, as correlações são mais fracas e nota-se um significativo bias no diagrama de comparação entre as medidas de linha espectral e as estimadas. Investigamos também até que ponto nossas técnicas podem estimar informações contidas em diagramas de diagnóstico espectrais, a partir apenas de fotometria. Descobrimos que é possível classificar relativamente bem tanto AGNs quanto objetos de formação estelar, usando apenas cores, embora tal classificação não seja tão precisa quanto, por exemplo, a classificação obtida com o diagrama BPT, com as larguras equivalentes das linhas sendo medidas por espectroscopia. Sugerimos que esta técnica, de estimar linhas espectrais por fotometria, pode ser utilizada para aperfeiçoar surveys de redshifts como o survey FMOS (*Fibre Multi Object Spectrograph*) e o planejado survey WFMOS (*Wide-Field Multi-Object Spectrograph*).

PAINEL 171

TRACERS OF STAR FORMATION IN THE NEAR-IR

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Starburst features in the optical are nowadays well known, but the use of this knowledge is not always possible (e.g. objects heavily obscured). In this case the near-IR is of unprecedented value. Recent models show that TP-AGB stars should dominate the NIR spectra of populations 0.3 to 2 Gyr old. These stars are among the most luminous cool stars and can be detected sometimes even individually in galaxies. While the optical spectra is insensitive to their presence, the near-IR changes dramatically. Not only does the absolute flux in the near-IR is affected, but also peculiar absorption features appear. These features can be unambiguously used as indicators of ~ 1 Gyr stellar population in the integrated spectra of stellar systems. In this work we used the IRTF Spex to create the first empirical database of NIR spectra of carefully selected starbursts, to test for the first time and in a consistent way the new stellar population models that account for the TP-AGB. The methodology used is to do stellar population synthesis in the optical and in the NIR, and compare the predictions of both spectral regions. We also compare the strength of important features of the TP-AGB stars, like the CN (1.1 microns) and CO (2.3 microns) bands with optical diagnostics. For example, we find that the equivalent width of the CN band increases for lager fractions of younger stellar populations. These preliminary results show that the NIR can be used as a robust tracer of young/intermediate stellar populations.