COSMOLOGIA, RELATIVIDADE & GRAVITAÇÃO

PAINEL 4

LOOKING FOR THE SHAPE OF THE UNIVERSE

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Recent results from the satellite WMAP contains information not only about matter and radiation of the primordial universe, but also contain the imprints of its glogal (or topological) properties, that is about its shape. One way to discover them is through the Pair Angular-Separation Histograms of cosmic point-like sources, which show slight -but noticeable- differences when performed for simulated sources in simple and in multiply connected spaces. From the observational point of view, an excellent cosmic source candidate for these histograms -due to its extremely accuracy never before achieved- are the maps of equal temperature of the recent measured cosmic microwave background radiation, coming not only from WMAP satellite but also from the BEAST project. However, these data are not full-sky surveys mainly due to the interference of our galaxy. For this reason the histograms analysis has to be prepared to deal with these type of data. We analyze the Pair Angular-Separation Histograms for data contained around the celestial poles, and show the imprints that multiply connected properties of the space leave in these histograms. This study led us to use the temperature maps of the CMBR maps -from the WMAP satellite- to look for the shape of the Universe.

PAINEL 5

ON THE EXISTENCE OF A TURNING POINT INSIDE A Λ - BLACK HOLE

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The motion of a test particle in a spherically symmetric and static space-time with positive cosmological constant (Λ) is rediscussed. In such space-time, besides the physical singularity at r=0, there are two coordinate singularities at two finite radii (say, r_1 and r_2) which depend on the values of M and Λ. It is shown that whether a particle follows a radial geodesic motion, it will met a turning point located between r_1 and r_2, and, consequently, the particle cannot reach the internal physical singularity. This phenomenon can be better understood using the corresponding Carter-Penrose diagram.

PAINEL 6

COSMOLOGIES WITH VARYING SPEED OF LIGHT: KINEMATIC TESTS

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In the last few years, there have appeared in the literature several models with variation of the fundamental constants of Nature, such as the speed of light (c), the elementary electric charge (e) and the Planck constant (h). The two main motivations for such interest are: (i) observations related to quasars that seem to indicate the fine structure constant is changing with time and (ii) the possibility that these models may solve some long standing problems of the standard cosmological model, without the need for inflation. In the present work, we obtain the expressions for lookback time, age of the universe, luminosity distance, angular diameter, and galaxy number counts versus redshift for the cosmological models with a power law dependence of the speed of light on the scale factor and the Hubble parameter. The Lorentz invariance and the principle of the general covariance are violated and the gravitational field equations have the same form as Einstein field equations with cosmological constant in a preferred reference frame postulated by the theory. We analyse the closed, open and flat Friedmann-Robertson-Walker (FRW) geometries. We have also obtained the limits imposed by the kinematic tests for the exponents m and n of the power laws of these models.

PAINEL 7

TAXAS DE EVENTOS PARA AS FONTES ASTROFÍSICAS DO DETECTOR MARIO SCHENBERG

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O detector de ondas gravitacionais Mario Schenberg será sensível a sinais que cheguem à Terra com amplitude h~10^{-21} e dentro da faixa em frequências que varia de 3,0 a 3,4 kHz. As principais fontes astrofísicas em condições de gerar um sinal detectável pela antena Schenberg são: colapsos estelares que produzam eventos do tipo supernova; instabilidades hidrodinâmicas em estrelas de nêutrons; excitação dos modos fluído (modos f) de estrelas de nêutrons; excitação dos primeiros modos quadrupolares de buracos negros com massa ~ 3,8 $M_{\odot}$; coalescências de estrelas de nêutrons e buracos negros em sistemas binários e, ainda, espiralações de mini-buracos negros. Neste trabalho nós determinamos as taxas de eventos para o Schenberg associadas a dois tipos de fontes: através da de-excitação dos modos f de estrelas de nêutrons e através da coalescência de mini-buracos negros de 0,5 $M_{\odot}$ (que atualmente têm sido colocados como possíveis candidatos a objetos massivos do halo Galáctico). Nós mostramos que esses tipos de fontes poderão produzir sinais em ondas gravitacionais com uma taxa em torno de um evento por ano dentro da banda do Schenberg.

PAINEL 8

LOCAL APPROXIMATIONS IN THE WEAKLY NONLINEAR REGIME AND THE DENSITY-VELOCITY RELATION

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We develop a perturbative study of a set of approximations aimed to the description of the nonlinear evolution of large-scale structure. We include in our analysis all four local approximations know to be exact for planar, cylindrical, and spherical symmetries (Makler et al. 2001). We have shown that they are exact up to second order in the density contrast. They are also extremely accurate at third order, in the region of initial conditions that can be parameterized by a homogeneous ellipsoid. By means these approximations, we derive a local expression relating the density with the velocity divergence up to third order. This relation is useful for comparisons between the cosmic density and peculiar velocity fields, and could be readily incorporated into reconstruction methods of the matter distribution such as POTENT. Our expression includes a new shear term that was absent in previous approaches. Omitting such a term produces a systematic effect leading to an underestimation of the density. Finally, we compute the higher order moments of the density distribution and use the result to show that no diagonal local approximation can be exact beyond second order. This work motivates further tests of the accuracy of the local approximations with generic initial conditions, and in particular of the newly proposed density-velocity relation.

PAINEL 9

ON THE THERMODYNAMICAL BEHAVIOR OF COSMOLOGIES WITH TIME-VARYING SPEED OF LIGHT AND GRAVITATIONAL CONSTANT

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A manifestly covariant thermodynamic formulation is proposed for cosmologies with time-varying speed of light and gravitational constant. In a general relativistic framework, the variation of these fundamental constants lead to the creation of matter and energy, thereby altering the basic standard behavior of FRW cosmologies. Particular attention is given for the temperature evolution law, and some physical consequences are addressed to the case of "adiabatic" creation. The possibility of an accelerated universe in accordance with the recent Supernovae type Ia experiments is also discussed.