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A HIDDEN MARKOV MODEL FOR TRANSIT DETECTION IN COROT'S DATA

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The CoRoT (COnvection ROtation and planetary Transits) satellite has provided the scientists with photometric time-series data of thousands of stars since early 2007. One of the main goals of the CoRot' related research is to detect exoplanets using the method of the "planetary transits" which consists in detecting a planet by the small periodic drop of brightness on the disc of the star as it orbits around. In this work we consider the use of hidden Markov models (HMM) to detect light curve patterns related with transits. The development of the detector starts by applying the Exoplanetary Pixalization Transit Model (EPTM) to simulate light curves of a planetary transit. This step demands the assumption of some elements about the object we intend to examine. The basic parameters are the stellar and planet radius in pixels ($r_\star$ and $r_\odot$) and the transit duration T. The data generated by the EPTM is then added by a Gaussian additive noise. In sequence the light curve is decomposed in k segments of duration $t_1 \ldots t_k$. The signal in each period is processed with a number of filters to extract attributes as the linear correlation r between time and relative amplitude of the signal, the mean μ and the standard deviation σ of the signal and n modal frequencies of the Fourier periodogram. The states of the HMM are symbolized by $s_1 \ldots, s_k$. Every s_i influences directly every variable of the set of attributes $\mathbf{A}=\{r,a,\sigma,\omega_1,\ldots\omega_n\}$, these attributes are assumed be uncorrelated. The numeric parameters of the model are defined by the next probabilities: (a) $p(s_1)$; (b) $p(r \mid s_i) \ldots, p(\omega_n \mid s_i)$; (c) $p(s_{i+1} \mid s_i)$ (the transition matrix); and (d) $p(t \mid s_i)$ (the beliefs about the state duration). All these parameters are obtained from the simulated data. The likelihood of the most probable state sequence **s** given the data gathered from a window of the curve under analysis can be computed by the MLSS algorithm. Once the model is built it is possible to use the MLSS to verify if the likelihood of the intended sequence is larger than a threshold. If it is the case for a window, an alert is emited to highlight the possibility of a transit. An experimental test on pre-processed data is showed.

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CHROMOSPHERIC ACTIVITY INDUCED BY EXTRASOLAR GIANT PLANETS?

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In the present work, we have analyzed the behavior of the chromospheric activity of stars with planets, as a function of different planetary parameters, searching possible effects of planets on the chromosphere of the hosting star. For this study we have selected a sample of 73 main sequence stars with planets, of spectral types F, G and K, with CaII emission flux available in the literature. Our analysis shows that among stars with planets presenting semi-major axis smaller than 0.15 AU, a few ones present enhanced CaII emission flux, paralleling recent results found in the literature for coronal x-ray flux. Nevertheless, in contrast to Kashyap et al. (2008), who claim that enhanced X-ray flux in stars with planets is associated to massive close-in planetary companions, we suggest that such an aspect, at least in the context of CaII emission flux is rather an effect of stellar sample selection. We have also studied the behavior of the CaII emission as a function of orbital parameters such as orbital period and eccentricity, and no clear trend was found, reinforcing our present suggestion that enhanced chromospheric activity in stars with planets is an intrinsic stellar phenomenon.

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ALGORITMOS GENÉTICOS E ESTRUTURA DE DISCOS PROTO-PLANETÁRIOS

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A estrutura vertical e radial de discos protoplanetários são tradicionalmente modeladas por um sistema de equações diferenciais acopladas, em geral, solucionáveis por meio do método numérico de Runge-Kutta aperfeiçoado. Contudo, o uso deste método numérico clássico ocasiona alto custo computacional devido ao grande número de tentativas oriundas de estimativas iniciais, necessárias ao

início da integração das equações, em geral, distantes do espaço de busca da solução quase-ótima. Portanto, é perceptível a dificuldade em se estimar o valor inicial da altura vertical do disco, artefato crucial para se obter soluções numéricas das características físicas dos discos. Neste contexto, desenvolvemos um algoritmo genético que resolve o problema de estimativa, descrito como segue. Dado um conjunto de agentes, cada agente resolve o conjunto de equações independentemente. Ao final desta operação, os agentes são avaliados para verificar a qualidade de suas soluções. Um esquema de seleção elitista é aplicado para escolher os melhores agentes. Estes, por sua vez, devem trocam informações entre si a fim de produzir valores de estimativa mais próximos do desejado. Este processo iterativo é terminado após uma condição de adequação ser satisfeita. Como resultados, conseguimos i) automatizar o processo de busca por bons valores de estimativa; ii) atenuar o custo computacional por um fator de eficiência superior à versão paralelizada; e resultados comparáveis aos da literatura. As perspectivas de utilização deste código, no contexto de formação planetária em discos de acresção, serão apresentadas.

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THE STABILITY AND DYNAMIC OF A CIRCUMBINARY DISK IN TRIPLE STELLAR SYSTEMS

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There is a special interest to know under what kind of conditions an inclined protoplanetary disk remains stable. The mean inclination of a disk might also have implications for the stability region of system for which large bodies disturb the disk, producing dust through collisional events. In this study we have concentrated on triple stellar systems, in which an inner binary is orbited by a more distant third star. Our main goal is to infer the possible stable regions around the inner binary. We have chosen the quadruple stellar system HD98800 as an example of close companions, and then it was modelled as a triple stellar system. We considered three possible fits given by Tokovinin (1999) for the third star, suggesting eccentricities 0.3, 0.5 and 0.6. The particle disk's initial inclination was assumed from 0 to 90 degree with Δi=10° with respect to the inner binary plane. The numerical simulations were made for an interval of 1 Myr. In case of a high initial inclination (i>40 degree) between particles disk and that of the third star orbital plane, the dynamical evolution seems to be complex. The orbital evolution of the particles disk seems to have been affected by the nodal libration due to the inner binary, the Kozai effect and several mean motion resonances, but it is not dominated by a particular one. Unlike the expected, some particles remained stable for high values of initial inclination. The nodal libration seems to be suppressing the Kozai mechanism caused by the third star. From a broader point of view, the effect of a third star on particles disk may have important consequences on the confinement process of a disk, if the period of the Kozai cicles is shorter than that of the nodal libration. ACKNOWLEDGMENTS: R. C. Domingos acknowledges financial support from the FAPESP (Processo 2008/08679-4).

Reference: Tokovinin, A., 1999, Astron. Lett., 25, 669

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O SISTEMA COROT 7

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O projeto Corot já obteve êxitos na detecção de exoplanetas, porém estes foram descobertos por técnica de trânsito, que possui efeito seletivo bastante expressivo. Estes sistemas também possuem medidas de velocidades radiais disponíveis e o estudo destas é de fundamental importância se quisermos encontrar outras informações relevantes. Um destes sistemas é Corot-7, com 106 medidas no intervalo 775-890 (JD245400000), que nos permite concluir a existência de 2 corpos,em órbitas circulares e curtos-períodos, os planetas Corot-7b e Corot-7c. Todavia, este é um caso singular pois as medidas que dispomos estão fortemente contaminadas por efeitos de atividade estelar, o que torna incerta e discutível qualquer resolução orbital deste sistema. O grande desafio que se impõe é separar de forma correta, nas velocidades radiais,os efeitos da atividade estelar daqueles causados por planetas. Nesta comunicação apresentamos uma análise e aplicamos um filtro harmônico, já proposto por Queloz

(2009), e que, aparentemente elimina as contaminações indesejadas. Porém demonstraremos que os elementos orbitais deduzidos, em especial as massas, são bastante incertos e discordam de forma significativa daqueles calculados por outros autores.