

A SOLAR CYCLE LENGTHWISE SERIES OF SOLAR DIAMETER MEASUREMENTS

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The measurements of the solar photospheric diameter rank among the most difficult astronomic observations. Reasons for this are the fuzzy definition of the limb, the S/N excess, and the adverse daytime seeing condition. As a consequence there are very few lengthy and consistent time series of such measurements. Using modern techniques, just the series from the IAG/USP and from Calern/OCA span more than one solar cycle. The Rio de Janeiro Group observations started in 1997, and therefore in 2008 one complete solar cycle time span can be analyzed. The series shares common principles of observation and analysis with the ones former mentioned, and it is complementary on time to them. Other distinctive features are the larger number of individual points and the improved precision. The series contains about 25,000 single observations, evenly distributed on a day-by-day basis. The typical error of a single observation is half an arc-second, enabling thus to investigate variations at the expected level of tens of arc-second on a weekly basis. These features prompted to develop a new methodology for the investigation of the heliophysical scenarios leading to the observed variations, both on time and on heliolatitude. The algorithms rely on running averages and time shifts to derive the correlation and statistic incertitude for the comparison of the long term and major episodes variations of the solar diameter against activity markers. The results bring support to the correlation between the diameter variation and the solar activity, but evidentiating two different regimens for the long term trend and the major solar events.

CAMPO MAGNÉTICO DE MANCHAS ESTELARES

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As manchas solares são importantes assinaturas do ciclo do campo magnético global do Sol. Acredita-se que em outras estrelas esses fenômenos também existam. Contudo, atualmente não é possível observar diretamente tais manchas devido aos seus pequenos tamanhos. O método proposto por Silva (2003) para estudar essas manchas consiste em detectar variações na intensidade de luz dessas estrelas durante um trânsito planetário. Quando o planeta passa na frente de sua estrela hospedeira, há a possibilidade de ele ocultar, pelo menos parcialmente, uma mancha. Isso possibilita determinar suas características físicas, como tamanho, temperatura e localização na superfície da estrela. Este projeto visa estimar o campo magnético de manchas estelares. O objetivo é obter uma função fenomenológica entre o campo magnético e a intensidade da mancha, tomando como base o Sol, para então aplicá-la às demais estrelas. Através dos dados obtidos pelo instrumento MDI a bordo do satélite SOHO (Solar and Heliospheric Observatory) mediu-se a componente do campo magnético na direção da linha de visada (máximo e mínimo) e a intensidade em relação à intensidade máxima no centro do disco para várias manchas solares. Para uma melhor precisão nos dados, foram utilizadas apenas as manchas localizadas entre -40° e 40° de longitude do disco solar. A temperatura das manchas foi calculada a partir de sua intensidade relativa considerando-se radiação de corpo negro tanto para as manchas quanto para a fotosfera ao redor. Nota-se que os campos magnéticos B máximo e mínimo das manchas decrescem com a sua temperatura T de acordo com a função $T/T_e = aB^2 + c$, sendo T_e a temperatura efetiva da estrela, a e c constantes. Isso era esperado, pois um campo magnético muito intenso atrapalha a transmissão de energia das células convectivas, tornando a região mais fria do que o resto do disco solar. Para o campo magnético máximo os valores das constantes obtidas do ajuste por mínimos quadrados foram: $(a,c) = (-6,25 \times 10^8, 0,929)$, e para o campo magnético mínimo foram: $(a,c) = (-7,38 \times 10^8, 0,949)$. Usando essa função estimou-se o campo magnético de manchas da estrela HD 209458b a partir de suas intensidades calculadas por Silva (2003),

$I_m/I_s=0,4-0,7$, sendo I_m a intensidade da mancha e I_s a intensidade máxima da estrela. Os valores obtidos para o campo magnético foram: $B=800$ a 1600 Gauss, para o campo magnético máximo, e $B=-1600$ a -900 Gauss, para o campo magnético mínimo.

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**A WEAK SOLAR BURST SUBMILLIMETER ONLY SPECTRAL COMPONENT DURING A GOES
M CLASS FLARE: IMPLICATIONS
FOR ITS EMISSION MECHANISMS**

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Since the installation of the Solar Submillimeter Telescope (SST), a new spectral burst component was discovered at frequencies above 100 GHz, creating the THz bursts category. In all the reported cases, the events were X class flares and the THz component increases with frequency. We report for the first time an M class flare which shows a submillimeter radio spectral component different from the one at microwaves. Two successive flares of 2 minute duration occurred in active region NOAA 10226 with 2 minutes delay. They started at around 13:15 UT and had an M 6.8 maximum intensity in soft X-rays. The submillimeter flux densities from the SST are used in addition to microwave total Sun patrol telescope observations. The submillimeter component is observed at 212 GHz only. We have upper limits for the emission at 89.4 and 405 GHz which are smaller than the observed 212 GHz flux density. An extensive analysis of the magnetic topology evolution derived from magnetograms reveals that AR 10226 evolved from a single bipole whose polarities grew in size and separated from each other, indication of a flux tube emergence. Later on, a second oppositely oriented bipole emerged and formed a quadropolar configuration, their polarities rotated around each other until they aligned with the original bipole. Finally, on the morning of 20 December a third emergence occurred in its close vicinity with the orientation reversed. H α and EUV kernels are associated with the two emegergences and with the zone where most of the activity takes place. Reconnections during the emergence of the third bipole with the second one on 20 December are the origin of the energy released during the flares. From soft X-ray and H α observations we deduce that the flaring area is compact ($A\sim 10^{17} \text{ cm}^2$) and dense ($n\sim 10^{12} \text{ cm}^{-3}$). The multiwavelength analysis reveals that neither positron synchrotron nor free-free emission could produce the submillimeter component. We explain the complex spectrum with a double synchrotron source created by the assymetry of the magnetic field. The first source produces the microwave emission and is composed of 10^{35} accelerated electrons with power law index $\delta\sim 3.4$ embedded in a $n_e\sim 10^{12} \text{ cm}^{-3}$ plasma, with magnetic field $B\sim 200$ G and projected area $A\sim 9''$. The second source produces the submillimeter enhancement and might be located in the opposite $\sim 0.2''$ size, $B\sim 2000$ G magnetic field footpoint, where $\sim 10^{30}$ electrons with $\delta\sim 2.1$ precipitate.