SOLAR ACTIVITY INFLUENCE UPON THE PHOTOMETRICAL EVOLUTION OF COMETS: NEW PHENOMENA. V. S. Filonenko[1], K. I. Churyumov[2] and L. S. Chubko[3], [1]Institute of Astronomy, V. N. Karazin Kharkiv National University (Sumskaja str., 35, Kharkov-22, Ukraine, filonenko@astron.kharkov.ua), [2]Astronomical Observatory of T. G. Shevchenko Kiev National University (Observatornaja str., 3, Kiev, Ukraine, klim.churyumov@observ.univ.kiev.ua), [3]Kiev National Aviation University (Cosmonaut Komarov avenue, 1, Kiev, Ukraine, larisa_ch@inbox.ru).

Introduction: The relation between comet brightness and the level of solar activity were found for the first time at the beginning of 19th century. But despite more than a century and a half of exploration, a mechanism of solar-comet interactions is unknown until now. In general the brightness of comets is correlated with the phase of the solar cycle, but the brightness variations of individual comets are not good correlated with solar activity level. Therefore, explorations of the relation between comet brightness (especially for new comets) and solar activity are important.

We are presented here the results of our long-term investigations of relation between the solar activity and the photometrical behavior of comets.

Influence of Solar Activity on the Light Curves of Some Comets: For the first time we found a significant correlation between total brightness variations of comet 1P/Halley and 67P/Churyumov-Gerasimenko and variations of solar activity indexes and velocity of solar wind [1]. Also we have found that the light curves of six new bright comets (C/1999 S4 (LINEAR), C/2001 Q4 (NEAT), C/2002 T7 (LINEAR), C/2002 V1 (NEAT), C/2004 Q2 (Machholz) and 153P/2002 C1 (Ikeya-Zhang)) very well correspond to the variations of Wolf number (with correlation coefficients 0.62÷1).

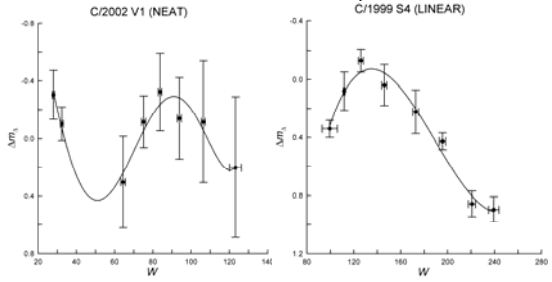

Fig. 1. The comets magnitude vs Wolf numbers.

We have found a new peculiarity (Fig. 1): for all explored comets the cometary brightness is increased with solar activity when the Wolf numbers are increased from ~ 40 to ~ 120; when Wolf numbers are less or more than these values the cometary brightness is decreased with increment of solar activity [2].

Influence of Secular 90-year Solar Cycle on the Brightness Secular Variations of Short-period Comets: We explored secular variations of 17 short-period comets [3]. For all these comets had been calculated the normalized deviations of absolute magnitude:

$$\Delta H_{10} = (H_{10}^{i} - \overline{H_{10}}) / A,$$

were H_{10}^{i} is the comet's absolute magnitude in i appearance, $\overline{H_{10}}$ is mean magnitude calculated from all comet's appearances, A is amplitude of comet's secular variations. A dependence between values of ΔH_{10}, averaged from 10 points for all 17 comets, and a phase of Gleissberg solar cycle is presented in Fig. 2.

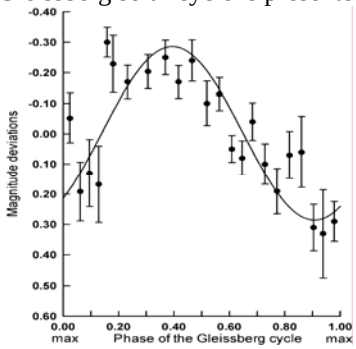

Fig.2. The values of ΔH_{10} vs phase of the Gleissberg cycle

This phase had been calculated as:

$$\Phi = \frac{t - T_0}{T},$$

were t is the moment of comet's appearance, T_0 is the moment of previous maximum of Gleissberg cycle, T is the length of the respective Gleissberg solar cycle (the yearly average Wolf numbers were smoothed by Gleissberg's method [4]). This dependence had been approximated by sinusoid:

$$\Delta H_{10} = [\sin(1.95\pi\Phi + 2.3)] / 3.5$$

with correlation coefficient $R = 0.81 \pm 0.07$ ($R_{crit}(0.05) = 0.41$).

This phenomenon can explain the observational fact that the secular fading of short-period comets is not monotone.

References:

[1] Churyumov K. I. and Filonenko V. S. (1992) *ACM,* 121–124. [2] Filonenko V. S. et al. (2008) *LPS XXXIX,* Abstract #1590. [3] Filonenko V. S. (2006) *LPS XXXVII,* Abstract #1597. [4] Gleissberg W. (1967) *Solar Physics, 2,* 231.